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Factors affecting complementary and alternative medicine (CAM) use in adult diabetic patients: A systematic review using the theoretical domains framework

Background

Current evidence-based recommendations for the management of diabetes include prescribed medicines including oral hypoglycaemic agents such as metformin and pioglitazone as well as insulin therapy. When used in appropriate patients following individual tailored made treatment these medicines are beneficial for controlling blood glucose levels and preventing future complications.¹ In addition to these recommendations, patients often use additional self-care measures which include the use of complementary and alternative medicines (CAM).² The World Health Organization (WHO) defines CAM as a "broad set of health care practices that are not part of that country's own tradition or conventional medicine and are not fully integrated into the dominant health-care system".³ A recent systematic review showed that up to 51% of diabetic patients worldwide use CAM either in conjunction with or as a replacement for orthodox treatments.⁴

The evidence base in relation to the effectiveness of CAM in diabetes is limited. Herbal and Dietary Supplements (HDS) such as fenugreek and ginseng have been identified to decrease carbohydrate absorption and increased insulin secretion and to lower blood glucose levels by acting similarly to insulin or by altering hepatic glucose metabolism respectively.⁵ CAM also includes the application of non-HDS products and practices such as Yoga, Homeopathy, Acupuncture and Ayurveda. Yoga has been shown to improve glycaemic control in adults with type 2 diabetes mellitus.⁶ However, currently there is a lack of research in relation to effectiveness and safety (particularly in relation to drug-CAM and CAM disease interactions) of over 35 CAM types reported to be used by diabetic patients.⁴

It is important for healthcare professionals to be familiar with the factors that influence diabetic patients to use CAM in order to understand patient perspectives on its use. This will enable healthcare professionals to better advice patients, support adherence to their prescribed medicines and identify the risks of interactions and adverse effects with prescribed treatments. Current international guidelines around diabetes management do not explicitly recommend that healthcare professionals should discuss CAM use with patients.^{1, 7} Consideration of wider self-care measures in clinical consultations allows shared decision making, promotes patient involvement as partners in their care and avoids adverse outcomes from the treatments.⁷

The Theoretical Domains Framework (TDF) is an integrative framework that was developed for the purpose of implementing new practices that requires changes in the behaviour of the parties involved. Currently, there is a lack of theory based research that aims to identify factors related to CAM use by diabetic patients. Theoretical perspectives are important for identifying determinants of a behaviour and developing effective behaviour change interventions. The TDF has been previously used in systematic reviews to synthesise data from primary research to apply theoretical perspectives into understanding factors associated with a particular behaviour. For example, in a recent systematic review, authors used TDF to understand the constructs that influence referral of people with chronic obstructive pulmonary disease (COPD) to pulmonary rehabilitation.⁸ In another recent review, TDF was used to identify the barriers and enablers for a triage, treatment, and transfer of clinical intervention to manage acute stroke patients in the emergency department.⁹

A previous systematic review and meta-analysis of CAM use in diabetes suggested that up to 67% of patients do not disclose their CAM use to healthcare professionals.⁴ Healthcare professionals' awareness of diabetic patients' CAM use

and associated factors can inform effective counselling and communication practices during clinical consultations. For example, addressing patient fears, concerns about prescribed treatments which can be important factors in regards to patient use of CAM can enable promotion of treatment optimisation and adherence to prescribed treatments, and patient safety through avoidance of any drug-CAM interactions. The aim of this systematic review was to identify factors reported in the published literature in regards to CAM use by diabetic patients using the TDF.

Method

This systematic review was informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and checklist.¹⁰ A protocol was developed as per the PRISMA protocol guideline (protocol ID CRD42019125036).

Data Sources and Searches

Cochrane Library, MEDLINE, Embase, CINAHL, AMED, Web of Science, and Google Scholar databases were searched from the year 2010 to March 2021. Open Grey was searched for grey literature. Search terms are listed in Supplementary Table 1. The review was restricted to studies published in English.

Study Selection

Screening and selection was performed independently by two review authors (AA, VP) and was carried out in three phases. Titles and abstracts were screened for inclusion of possible relevant studies followed by assessment of full texts for eligibility. Reference lists of included studies were screened. If a title was considered relevant; the study was manually searched and the abstract examined.

Studies which included data on factors that influence CAM usage by adult diabetic patients 18 years of age and older were included. The review included studies that discussed partially or exclusively the factors that influence diabetic patients to use CAM. We included studies conducted with patients as well as healthcare professionals. In the latter case, factors associated with patient use of CAM from healthcare professionals' perspectives were included. All study designs were considered for inclusion.

Data Extraction and Quality Assessment

Data on study characteristics, influencing factors for CAM use as well as types of CAM used by diabetic patients were extracted. Two review authors (AA, VP) independently assessed the quality of included studies using the critical appraisal tool from the Joanna Briggs Institute (JBI) checklist.¹¹ The quality assessment for included studies was focused on three fields: clarity of participants' inclusion criteria, study setting and sampling, appropriateness of data collection and analysis methods. Included studies were judged to be of 'high quality' if quality criteria were satisfied by at least 7 items, 'moderate quality' for scores of 3-6 and 'low quality' for scores $\leq 2.^{12}$ All studies were included regardless of their quality (table 1).

Data Synthesis and Analysis

The factors reported to be relevant to participants' use of CAM in diabetes were extracted from the included studies as reported by the study authors and listed. These factors could relate to those that positively or negatively influence a diabetic patients' use of CAM. Each of the extracted factors were then classified according to the Theoretical Domain Framework (TDF) into one of its 14 domains. TDF was developed

through a collaboration of behavioural scientists and new health practices implementation researchers identified theories related to behaviours and includes 14 domains related to goals, intentions, social and environmental influences on behaviour .¹³ The use of the TDF can help to restructure and simplify data concerning a certain behaviour into a set of theoretical domains which would make it more useful for further applications. In order to achieve this, information relating to a specific behavioural determinant is categorised into any relevant domain(s) of TDF. Descriptions of TDF domains are provided in (supplementary table 2).

Results

A total of 3554 unique titles were screened of which 43 articles met the inclusion criteria (figure 1).¹⁴⁻⁵⁶ Table 3 shows that included studies were conducted between 2010 and March 2021 and originated from 28 different countries. Participants were mostly recruited from healthcare centres. Eighteen of the included studies enrolled participants either with type 1 diabetes (T1D) or type 2 diabetes and twenty-four studies included only patients with T2D, one also included traditional healers, and another study also enrolled doctors (Table 3).^{19, 25} One of the included studies enrolled only healthcare professionals. Out of the 43 studies included, 40 were cross-sectional surveys (39 on diabetic patients and 1 on healthcare professionals) and two studies were qualitative interviews, one used mixed methods and one analysed data from a cohort study. Studies utilising a survey design mainly aimed to identify the prevalence of use with factors associated with use reported as secondary outcomes. Questionnaire administration methods for cross-sectional studies varied between self-administration, interviewer assisted administration and telephone administration (Table 3).

The two qualitative studies included in the review used in-depth interviews with patients.^{21, 31} One study was conducted in Akhuwat Diabetes Clinic Lahore and Awan Medical Complex Lahore Pakistan ³¹. The participants were interviewed using semi-structured and open-ended interviews. The study was focused on spiritual practices and homeopathic, herbal and home remedies for diabetes management, side effects and poor control. The second qualitative study was conducted in Edinburgh, United Kingdom.²¹ It consisted of an ethnographic study conducted among Indian and Pakistani migrants living in Edinburgh. The study was conducted using unstructured interviews and was focused on the use of CAM for diabetes control.

Only one study investigated the perspectives of healthcare professionals regarding their patients' use of CAM. This study was conducted in Uganda and was qualitative in design, in addition to another study that enrolled both T2D patients and physicians and this study was cross-sectional in design.^{25, 43} One of the studies that enrolled patients with both T1D and T2D also enrolled local herbalists and another study enrolled health promoters and traditional healers in addition to T2D patients, both were cross-sectional studies.^{19, 52}

Factors affecting the use of CAM among diabetic patients

A total of 84 factors in relation to patient use of CAM were identified and extracted from the included studies. Domains were arranged in descending order based on the number of studies which reported factors associated with each domain (Table 2).

Intentions

Factors related to intentions either with stability or stages of change in intention fall under this domain.¹³ Treating diabetes, or other medical problems, lowering blood glucose levels, prevention or management of diabetic complications, relieving

symptoms of the diabetes as well as preventing progression of diabetes by using CAM were the intentions described in the included literature.^{14-18, 21-29, 33, 34, 36-38, 41, 42, 47-53} Other factors included potentiating the effect of conventional treatments, treating side effects of prescribed diabetic medications and non-diabetic medications, and perceived positive effects on general health and well-being.^{14, 16-18, 21-29, 33, 34, 36-38, 41, 42, 47, 48, 50, 51}

Beliefs about consequences

Beliefs about consequences, outcome expectancies and anticipated regret played an important role in influencing diabetic patients to use CAM as reported in 21 studies.^{16, 19, 23-26, 30, 32-45} Study participants were aware of the consequences of unmanaged diabetes and that awareness was a motivation to use CAM. Study participants in these studies chose CAM because they believed that CAM was more effective and safer than conventional medicines with fewer side effects and was free from adverse effects.

Optimism

Optimism was perceived as important in 13 studies.^{17, 18, 21, 24-31} For example, study participants in some of the studies were optimistic that CAM could completely cure diabetes. They were also optimistic that CAM could slow diabetes progression as well as being able to cure the cause of the diabetes. Diabetic patients perceived conventional treatments as an approach that only focused on treating symptoms and not treating the disease itself. Moreover, patients were optimistic that they would not have to use conventional medicine if they use CAM, therefore patients rejected orthodox treatment and used CAM instead.^{14, 17, 18, 21, 23-29, 31}

Environmental context and resources

Factors in this domain played an important role in influencing diabetic patients to use CAM. Long waiting times between clinic appointments and lack of access to and effective communication with doctors were among the reported factors.^{30, 31, 34} Moreover, studies reported that patients living in villages use CAM more often than patients living in urban areas due to limited access to healthcare services in the former areas.^{14, 25, 46} In general, participants said they used CAM as it is more accessible and affordable.^{17, 24-27, 29, 30, 33, 34, 36, 37, 40, 45, 46, 49, 52-54}

Memory and decision processes

Memory, attention, decision making, cognitive overload or tiredness contributed to diabetic patients' use of CAM as reported in 12 studies.^{19, 21, 25, 26, 30, 34, 35, 37, 40, 41, 44, 52} Many diabetic patients described using CAM due to lack of trust in conventional medicine.^{34, 40} Many study participants deemed that plants that tasted bitter like medications were effective.¹⁹ For some study participants the decision making process leading to CAM use was mostly about experimenting with new approaches for diabetes management or as a break from conventional medicine.^{25, 26, 44} Experience of discomfort or poor glycaemic control when taking diabetes medications also led to some patients actively seeking and using CAM.^{21, 25, 35, 37, 41}

Social influences

Factors under this domain were reported by 29 studies.^{14, 16-19, 21, 23-29, 33-40, 44-46, 48, 50, 54-56} These factors could be categorized into four subgroups including a) cultural and religious beliefs, b) healthcare professionals' encouragement including pharmacists, herbalists or dieticians, c) family members, friends and d) media and internet advertisements.

Reinforcement

Patients might use CAM due to a positive influence by religious scholars on their CAM use; healthcare professionals' recommendations and the portrayal of a positive experience of CAM use by other users were reported as factors influencing diabetic patients to use CAM.^{17, 21, 25, 29, 31, 33, 35, 37, 43, 44, 46}

Emotion

Emotions such as anxiety, fear, stress, depression, or burn-out have been associated with diabetic patients' CAM use. Factors related to this domain were reported in 12 studies.^{15, 16, 19, 21, 25, 26, 29, 31, 33, 35, 40, 47} For example, participants in one study reported that CAM use made patients feel more in control over their health and made it easier to cope and made them feel better emotionally.⁴⁷ Dissatisfaction and 'loss of hope' with conventional therapy, satisfaction with the use of CAM, and patients' unwillingness to accept their illness and its treatment were reported.

Goals

The main goals of using CAM by diabetic patients were either to cure diabetes or to manage diabetes.^{14, 16-18, 21-27, 33, 34, 37, 38, 42, 47-51}

Behavioural regulation

Factors in this domain were associated with self-monitoring, breaking habits or action planning.¹³ These factors were reported in 6 studies.^{21, 25, 31, 33, 39, 56} Diabetic patients turned to using CAM as a result of being exhausted by insulin therapy or a too frequent daily dosage of diabetic medications because they perceived CAM as 'user friendly'. The included studies also reported that diabetic patients who are unable to keep up with regular follow-up with their healthcare professionals usually resort to traditional healers, spiritual healers and home-self-medication.

Knowledge

Patient knowledge about CAM was a key factor associated with CAM use in five studies (Table 2). One study reported that herbal medicine use was popular because patients were aware of the uses of the existing various natural flora in their local environment.¹⁸ Level of knowledge about interaction between conventional medicine and CAM was reported as a reason for using or not using CAM by patients with diabetes in two studies.^{16, 17}

Social/professional role and identity

One study reported that there was a relationship between profession and CAM use. Occupation was shown to be an important factor in CAM use. For example, the unemployed and housewives were more likely to use CAM than other occupations, followed by farmers or retired people.²⁰

Beliefs about capabilities

One study reported that patients perceived themselves to be capable of weighing up effectiveness with side effects in their decision making process around their use of CAM.²¹

Skills

Health promoters, individuals who work to treat diabetic patients in rural areas in Guatemala without undertaking any medical education or training, used skills in relation to CAM use for treating their diabetic patients as they learned about the most popular plants used for diabetes from working with people with diabetes.¹⁹

Discussion

Factors most commonly reported across the included studies related to the optimism, beliefs about consequences and social influences domains of the TDF. Key factors were related to the domains of TDF intentions and goals which were to treat and relieve symptoms. The environmental context and resources domain was populated by factors related to accessibility and affordability of CAM compared to physician visits and conventional medicines, factors such as influences by family members, friends, religious and spiritual scholars fell under the social influences domain of the TDF.

Behavioural interventions could be a helpful tool for healthcare professionals including pharmacists to help integrate CAM with prescribed medicines to guide patients through their diabetes management routine to ensure treatment optimization and medication adherence. Some of the factors identified in this review such as those related to the behavioural regulations domain including the factor of discontinuation of insulin therapy due to exhaustion or the factor of too frequent daily dosage of diabetic medications. Exhaustion that diabetic patients experience as a result of these factors could be mitigated by dose simplification.⁵⁷

Diabetic patients seek information from pharmacists in diverse settings. Recent COVID-19 pandemic has also shown pharmacy staff increasing involvement in CAM related advice and support to patients.⁵⁸ Awareness of the factors as reported in this study that influence diabetic patients to use CAM would assist pharmacists to offer evidence based advice around the use of CAM along with prescribed treatments, promote medicines adherence and consider CAM-drug interactions where applicable. For example, patients' emotions such as frustrations or tiredness resulting from lack

of treatment optimisation that in turn lead to patients resorting to CAM use instead of prescribed medicines could be addressed as part of medication reviews.

Barriers to accessibility and affordability of modern treatments led many participants in the included studies to resort to CAM. Improving access to diabetes care and treatment could address some of the barriers to access or use of evidencedbased treatment approaches.

Most of the included studies in this review used a survey as a data collection tool often restricting participants in relation to the range of potential influences they could mention. Moreover, participants' answers to interview questions might be influenced by social desirability bias i.e. when participants answer questions in a way they think acceptable to others.⁵⁹

Implications for practice and research

A previous systematic review has shown that up to 51% of diabetic patients use some forms of CAM for the management of diabetes and approximately 2/3rd of diabetic patients using CAM do not disclose their use to their healthcare providers.⁴ Therefore, CAM use should be proactively explored as part of diabetes communication and counselling. Healthcare professionals should take into consideration the factors that increase the likelihood of CAM use by diabetic patients. The more of these factors that apply to a patient the more likely it is that the patient might resort to CAM use. By anticipating diabetic patients might use CAM, healthcare professionals could help to minimise any possible interactions between CAM and other medications. Moreover, it could also help healthcare professionals to address medication adherence by encouraging their patient to discuss their CAM use and offers the opportunity to provide better advice for them. Many CAM products are supplied through pharmacy

alongside many over-the-counter products.⁵⁸ It is imperative that education of healthcare professionals should include CAM use by patients with long term health conditions.^{60, 61}

In light of this, research that provides evidence-based information about CAM is crucial because of the large number of factors that increase the likelihood of CAM use amongst diabetic patients. Safety and efficacy studies as well as studies on herbdrug interactions, the mechanism and impact on patients of commonly used CAM as identified in our previous prevalence systematic review are vital to ensure patients benefit the most from both prescribed drugs and CAM.⁴

Included studies did not distinguish between different types of CAM such as HDS and non-HDS. Further qualitative studies that focused on specific types of CAM would be helpful to examine HDS or non-HDS specific patient perspectives.

Study limitation

This review only included studies which are published in English language. In recent years, the term 'integrative medicine' is being increasingly used to refer to CAM which was not captured in the search strategy used by this systematic review. Views expressed by patients other than in formal research settings such as in patient online forums have not been captured in this study. Such forums can also offer valuable data.

Conclusion

Decisions to use CAM in diabetes can be multifactorial. Healthcare professionals' awareness of diabetic patients' use of CAM can inform effective advice to promote optimisation of and adherence to prescribed treatments, and promotion of patient safety through avoidance of drug-CAM interactions. Alleviating patients'

concerns, and reluctance to use prescribed treatments are imperative to achieve therapeutic goals.

Declaration

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: All data generated or analysed during this study are included in this published article [and its supplementary information files].

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| No. | Author and date | Study design | Number that we | iber of critical appraisal tool questions it were answered Yes, No, Unclear, or Not applicable (N/A) | | | | |
|-----|-------------------------------------|-----------------|-------------------|---|---------|-----|--|--|
| | | 8 | Yes | No | Unclear | N/A | | |
| 1 | Yildirim & Marakoglu, 2018 | CS | 6 | 0 | 2 | 0 | | |
| 2 | Rhee, Westberg, & Harris, 2018 | CS | 7 | 0 | 1 | 0 | | |
| 3 | Mekuria et al., 2018 | CS | 7 | 1 | 0 | 0 | | |
| 4 | Karaman et al., 2018 | CS | 6 | 1 | 0 | 1 | | |
| 5 | Bukhsh et al., 2018 | Q | 8 | 1 | 1 | 0 | | |
| 6 | Avci., 2018 | CS | 6 | 1 | 1 | 0 | | |
| 7 | Andrews, Wyne, & Svenson, 2018 | CS | 5 | 2 | 1 | 0 | | |
| 8 | Amaeze et al., 2018 | CS | 5 | 2 | 1 | 0 | | |
| 9 | Mohamed Ali, & Mahfouz, 2014 | CS | 5 | 2 | 1 | 0 | | |
| 10 | Vishnu, Mini & Thankappan, 2017 | CS | 5 | 2 | 1 | 0 | | |
| 11 | Putthapiban, et.al., 2017 | CS | 6 | 1 | 1 | 0 | | |
| 12 | Kamel et al., 2017 | CS | 4 | 3 | 1 | 0 | | |
| 13 | Porqueddu, 2017 | Q | 8 | 1 | 1 | 0 | | |
| 14 | Atwine & Hjelm, 2018 | CS | 5 | 1 | 0 | 2 | | |
| 15 | Wanchai & Phrompayak, 2016 | CS | 5 | 2 | 1 | 0 | | |
| 16 | Lunyera et al., 2016 | CS | 5 | 2 | 1 | 0 | | |
| 17 | Bahroom, Shamsul & Rotina, 2016 | CS | 7 | 1 | 0 | 0 | | |
| 18 | Azizi-Fini, et. al, 2016 | CS | 7 | 1 | 0 | 0 | | |
| 19 | Al-Eidi et al., 2016 | CS | 6 | 2 | 0 | 0 | | |
| 20 | Koren et al., 2015 | CS | 5 | 2 | 1 | 0 | | |
| 21 | Hashempur et al., 2015 | CS | 7 | 1 | 0 | 0 | | |
| 22 | Devi et al., 2015 | CS | 5 | 2 | 1 | 0 | | |
| 23 | Damnianovic et al., 2015 | CS | 5 | 2 | 1 | 0 | | |
| 24 | Alami et al., 2015 | CS | 6 | 2 | 0 | 0 | | |
| 25 | Nguyen et al., 2014 | CS | 6 | 2 | 0 | 0 | | |
| 26 | Naja et al., 2014 | CS | 7 | 1 | 0 | 0 | | |
| 27 | Khalil et al., 2013 | CS | 3 | 2 | 3 | 0 | | |
| 28 | Fan et al., 2013 | CS | 6 | 0 | 2 | 0 | | |
| 29 | Ching et al., 2013 | CS | 7 | 1 | 0 | 0 | | |
| 30 | Lui et al., 2012 | DC | 6 | 0 | 5 | 0 | | |
| 31 | Ali-Shtayehet et al., 2012 | CS | 5 | 2 | 1 | 0 | | |
| 32 | Wazaify et al., 2011 | CS | 6 | 2 | 0 | 0 | | |
| 33 | Sethi, Srivastava & Madhu, 2011 | CS | 5 | 2 | 1 | 0 | | |
| 34 | Fabian et al., 2011 | CS | 7 | 1 | 0 | 0 | | |
| 35 | Bradley et al., 2011 | CS | 6 | 1 | 1 | 0 | | |
| 36 | Khalaf & Whitford, 2010 | CS | 5 | 1 | 2 | 0 | | |
| 37 | Algathama et al., 2020 | CS | 5 | 1 | 2 | 0 | | |
| 38 | Cengiz & Budak, 2019 | CS | 5 | 0 | 3 | 0 | | |
| 39 | Kasole & Kimiywe, 2019 | CS | 5 | 0 | 3 | 0 | | |
| 40 | Meshesha, Gebretekle, & Fenta, 2020 | CS | 4 | 1 | 3 | 0 | | |
| 41 | Owusu et al., 2020 | CS | 6 | 0 | 2 | 0 | | |
| 42 | Radwan et al., 2020 | CS | 5 | 0 | 3 | 0 | | |
| 43 | Raja et al., 2019 | CS | 3 | 2 | 3 | 0 | | |

Table 1: Critical Appraisal Summary using Joanna Briggs Institute Critical Appraisal tools (JBI) for quality assessment.

CS= Cross-Sectional

DC= data obtained from cohort study

Q= Qualitative

Table 2: Factors for using CAM distributed to the TDF domains

| TDF domains and descriptions | Factors | Studies citing the domain | | | | | |
|--|--|---------------------------|--|--|--|--|--|
| | CAM user's knowledge about CAM benefits including the effect on blood glucose | 14, 15 | | | | | |
| 1. Knowledge | Patients' unfamiliarity with interaction between conventional medicine and herbs | 16, 17 | | | | | |
| | Herbal medicine use is popular because of the existence of various natural flora for which patients are aware of its uses. | | | | | | |
| 2. Skills | Health promoters learned the most popular plants used from working with people with diabetes. | 19 | | | | | |
| 3. Social/ Professional Role and Identity | There is a relationship between occupation and CAM use. Unemployed and housewives are more likely to use CAM followed by farmers, retired and lastly officers. | 20 | | | | | |
| | Patients' belief that herbal products are natural | 21 | | | | | |
| 4. Beliefs about Capabilities | Patients tried several treatments by weighing out effectiveness with side effects, as they belief that they are capable to find the best treatment | 21 | | | | | |
| | Patients thought that they are able to improve the control of blood glucose levels. | 22 | | | | | |
| | Patients' belief in benefits of CAM including that CAM can treat diabetes, help the diabetes control and slow | 14, 17, 18, 23, 29, 30 | | | | | |
| | diabetes progression Patients' belief CAM can cures all kinds of illnesses including diabetes | 24-28 | | | | | |
| 5. Optimism | Patients' belief CAM cure the cause of diabetes not like conventional treatments that focused on | 21 | | | | | |
| | 'manifestations and symptoms' | 21 | | | | | |
| | Patients' belief in God and use prayers for good health | 31 | | | | | |
| | Patients rejected first treatment and used CAM instead | 21 | | | | | |
| | Patient lack of knowledge about long-term consequence of diabetes | 19 | | | | | |
| | Herbal medicines are safe because they are natural | 24, 32 | | | | | |
| | Patients' belief conventional treatment was not effective and are harmful | 33 | | | | | |
| C. Dellafe also | Patients perceived threat of their illness | 25, 34, 35 | | | | | |
| 6. Bellets about | Patient's belief that CAM is more effective than conventional medicines | 26, 32-34, 36-38 | | | | | |
| | Patients' belief that they have obtained the wanted result from CAM | 17, 41-43 | | | | | |
| | Patients aware of the importance of self-care | 23 | | | | | |
| | High motivation to self-care including CAM use | 44 | | | | | |
| | Patients' belief that CAM is safer with fewer side effects | 16, 30, 36, 43, 45 | | | | | |
| | Patients' belief that CAM is free from adverse effects | 33 | | | | | |
| 7. Reinforcement | Influence of religious scholar/spiritual person. | 31 | | | | | |
| | Experience of CAM use considered positive by others | 46 | | | | | |

| | Patients who used CAM recommended CAM for someone with diabetes. | 17, 33, 44 |
|-----------------------|---|-------------------------------------|
| | Family and friends made patients try CAM. | 21, 31, 43 |
| | Healthcare providers stated giving recommendations for using CAM therapies but to a limited extent | 25 |
| | Patients knew someone who uses / practice this CAM | 37 |
| | CAM use was suggested by other CAM users | 35 |
| | Having good example from the other user of CAM | 29 |
| | | 17, 23, 27, 30, 33-35, 43, 44, 50, |
| | CAM recommendations by healthcare professionals | 55 |
| | Patients received information about CAM from pharmacist | 23, 27, 34, 38, 44, 55 |
| | Patients received information about CAM from Herbalist | 27, 34 |
| | Patients received information about CAM from Dietician | 34, 44 |
| | Patients received information about CAM from Traditional healers | 17, 34 |
| | | 16, 18, 21, 23, 24, 27, 29, 33, 34, |
| | Treating diabetes | 36-38, 41, 42, 47-49 |
| | | 16, 18, 24, 29, 36, 37, 41, 47, 50, |
| | Treating other medical problems | 51 |
| | Lowering blood glucose level | 22, 28, 48, 50-52 |
| 8. Intentions | General health and well-heing | 16, 26, 36, 37, 50 |
| | Treating side effects of prescribed diabetic medications | 21, 23, 25, 27 |
| | Patients' use of CAM to control the side effects of non-diabetic medications | 21, 25, 53 |
| | Prevent or manage diabetic complications | 17, 25, 48, 50 |
| | Increase the drug's effect | 17 |
| | Prevent progression of diabetes | 15, 23, 26, 27 |
| | Relieving symptoms of diabetes | 14, 15, 23, 27, 49 |
| | Cure of Diabetes | 15, 23, 27, 32, 53 |
| 9. Goals | | 14, 16-18, 21, 22, 24-26, 33, 34, |
| | Management of Diabetes | 37, 38, 42, 47-51 |
| | Patients think that plants that tasted bitter like medications do were effective | 19 |
| | Patients experienced discomfort when taking diabetes medications | 21, 37 |
| 10. Memory, Attention | | 25 |
| Processes | Patients use home-self-medication or traditional healers before they turn to conventional treatments | 25 |
| | Patients know CAM therapist with good reputation | 25 |
| | Signs and symptoms attributed to poor glycaemic control that were not controlled by conventional medicine | 25, 35, 37, 41 |
| | led patients to try CAM. | 25 |
| | Patients used CAM to have a break from conventional medicine | 20 |

| | Patients' lack of trust on conventional medicine | 30, 34, 40 |
|---|---|-------------------------------------|
| | Trying CAM as an experiment as patients look for other solutions | 26, 44, 52 |
| | | 17, 24-27, 29, 30, 33, 34, 36, 37, |
| | CAM is more affordable | 40, 45, 49, 52-54 |
| 11. Environmental Context and Resources | | 24-27, 29, 30, 33, 34, 36, 37, 46, |
| | CAM is easily accessible | 52, 53 |
| | Patients living in villages use CAM more often than natients living in cities | 14 |
| | Long waiting time between clinics' appointments | 30, 34 |
| | Inefficient communication with doctors | 34 |
| | Limited access to remotely located healthcare services from natients | 25 |
| | Lack of qualified and specialized doctors | 31 |
| | Convenience of using CAM as neither a prescription nor a physician visit is required | 46 |
| | convenience of using of hit, as nether a preseription nor a physician visit is required. | 18, 36, 46 |
| | Cultural beliefs encourage the use of CAM. | |
| | | 17 27 45 |
| | The type of herbal products used is related to cultural beliefs | 17, 57, 45 |
| 12. Social influences | Recommendations from herbal companies selling medicinal plants in the market | 19 |
| | Recommendations from CAM practitioners or herbalists | 33, 39, 46 |
| | Used for religious reasons | 36 |
| | | 14-16, 18, 19, 21, 23-29, 33-35, |
| | Family members, friends, Internet, TV and/or advertisement | 39, 40, 43, 44, 46, 48, 50, 52, 54- |
| | | 56 |
| | CAM use made patients feel that they are in control over their health | 47 |
| | CAM made patients to feel better emotionally | 47 |
| | CAM made it easier to cope with the illness | 47 |
| 13. Emotion | Dissatisfaction with conventional therapy | 15, 47 |
| | Satisfaction with the use of CAM | 21, 25, 33, 35 |
| | Spiritual Healing | 31 |
| | Patients' unwillingness to accept their illness and its treatment | 19 |
| | Lost hope with conventional therapy | 16, 25, 26, 29, 40 |
| | Discontinuation of insulin therapy due to exhaustion | 31 |
| 14. Behavioural | CAM was user friendly | 33 |
| Regulation | Too frequent daily dosage of diabetic medications | 21 |
| | Patients fail to do regular follow-up often resort to (Traditional healers)(Spiritual healers)(Home-self- | 25 |
| | medication) | 20 |
| | / | |

| Patients who are on external insulin were 2 times less likely to use CAM compared to other diabetic patients. | 39 |
|---|----|
| Patients who performed self-monitoring blood glucose (SMBG) monthly more likely to use CAM compared to | 56 |
| patients who do not perform SMBG or do it less often than monthly. | |

Table 3: Study characteristics.

| Author and date | Country of study | Aim of the study | Research focus of the study | Study settings and recruitment of participants | Study design | Data collection method | Study participants |
|---|---------------------|--|-----------------------------------|---|---------------------|--|-------------------------|
| Yildirim & Marakoglu, 2018 14 | Turkey | Prevalence of CAM use | CAM use | Outpatient diabetes education clinic in Turkey | cross- sectional | Face-to-face interview using a structured questionnaire | T2D patients |
| Rhee, Westberg, & Harris, 2018 ⁴⁷ | USA | Prevalence of CAM use | CAM use | Data were from the 2012 NHIS, which was administrated by the National Centre for Health Statistics of the Centres for Disease Control and Prevention (CDC) | cross- sectional | Data were from the 2012 NHIS, which was administrated by the National Centre for Health Statistics of the Centres for Disease Control and Prevention (CDC) | T1D and T2D patients |
| Mekuria et al., 2018 ¹⁸ | Ethiopia | Prevalence of Herbal supplements use | Herbal supplements use | Diabetes care clinic Gondar town, north- western Ethiopia | cross- sectional | Interviewer- administered questionnaires | T1D and T2D patients |
| Karaman et al., 2018 ⁴⁸ | Turkey | Prevalence of Herbal supplements use | Herbal supplements use | Endocrinology clinics of two hospitals in Izmir | cross- sectional | Face-to-face interview using a structured questionnaire | T1D and T2D patients |
| Bukhsh et al., 2018 ³¹ | Pakistan | Patients' perspectives towards CAM | Trends in CAM use | Akhuwat Diabetes Clinic Lahore and Awan Medical Complex Lahore | Qualitative | Semi-structured one to one in- depth interviews | T2D patients |

| Avci., 2018 ⁵⁴ | Turkey | Prevalence of CAM use | CAM use | Van Yuzuncu Yil University, Van | cross- sectional | Semi-structured questionnaires | T1D and T2D patients |
|--|-----------|--|------------------------------|--|---------------------|--|---|
| Andrews, Wyne, & Svenson, 2018 | Guatemala | Prevalence of CAM use | CAM use | interview three groups in the San Lucas Tolimán area: people with diabetes, health promoters, and traditional healers/naturalists | cross- sectional | Semi-structured questionnaires | T2D patients Health promoters Traditional healers |
| Amaeze et al., 2018 ²⁴ | Nigeria | Prevalence of Herbal supplements use | Herbal supplements use | 5 secondary health care facilities across Lagos State | cross- sectional | Interviewer- administered questionnaires | T2D patients |
| Mohamed Ali, & Mahfouz, 2014 ⁴⁶ | Sudan | Prevalence of Herbal supplements use | Herbal supplements use | Primary health care centres in Khartoum. The total number of PHCCs is 125. The number of patients in daily attendance at each of those centres is approximately qual. Most of the patients attended for primary health care on an appointment basis | cross- sectional | Interviewer- administered questionnaires | T2D patients |
| Vishnu, Mini & Thankappan, 2017 ³³ | India | Prevalence of CAM use | CAM use | Rural Kollam district of the Indian state of Kerala (community based) | cross- sectional | Interviewer- administered structured questionnaires | T1D and T2D patients |
| Putthapiban, Sukhumthamma rat & Sriphrapradang, 2017 ¹⁶ | Thailand | Prevalence of Herbal supplements use | Herbal supplements use | At the Endocrine Clinic in Ramathibodi Hospital, Bangkok | cross- sectional | Face-to-face interview using a structured questionnaire | T2D patients |

| Porqueddu, 2017 | United Kingdom | Use of herbal supplements | Use of herbal supplements | Ethnographic study conducted among Indian and Pakistani migrants | Qualitative | unstructured Interviews | T2D patients |
|---|-------------------|--|---|---|---------------------|--|-----------------------------|
| | | | for diabetes control | living in Edinburgh. | | | |
| Kamel et al., 2017 ¹⁷ | Saudi | Prevalence of Herbal supplements use | Herbal supplements use | King Abdul-Aziz University and King Fahad General Hospitals in Jeddah | cross- sectional | Interviewer- administered structured questionnaires | T1D and T2D patients |
| Atwine & Hjelm, 2017 ²⁵ | Uganda | Professionals' perspective | Healthcare professionals ' knowledge, attitudes and practice the use of CAM among persons with diabetes | Healthcare providers working with management of diabetes in a certain region of south-western Uganda, including rural and urban areas | cross- sectional | self-administered structured questionnaire | Healthcare professionals |
| Wanchai & Phrompayak, 2016 ²⁰ | Thailand | Prevalence of CAM use | CAM use | Four primary healthcare units and two secondary hospitals in the north of Thailand | cross- sectional | Semi-structured questionnaire | T2D patients |
| Lunyera et al., 2016 ³⁶ | Tanzania | Prevalence of Herbal supplements use | Herbal supplements use | Kilimanjaro Region of Tanzania | cross- sectional | Verbally administered structured questionnaire | T1D and T2D patients |
| Bahroom, Shamsul & Rotina, 2016 ³⁷ | Malaysia | Prevalence of CAM use | CAM use | 45 government health clinics across Negeri Sembilan | cross- sectional | Interviewer- administered structured questionnaires | T2D patients |
| Azizi-Fini, Adib- Hajbaghery & Gharehboghlou, 2016 ⁵⁰ | Iran | Prevalence of Herbal supplements use | Herbal supplements use | Golabchi and Naqavi diabetes clinics in the Kashan city | cross- sectional | Interviewer- administered structured questionnaires | T2D patients |

| Al-Eidi et al., 2016 ³⁴ | Saudi | Prevalence of CAM use | CAM use | Diabetic Centre of King Salman bin Abdul-Aziz Hospital, in Riyadh city | cross- sectional | Face-to-face interview using a structured questionnaire | T2D patients |
|---|---------|--|------------------------------|---|---------------------|---|-------------------------|
| Koren et al., 2015 ⁵¹ | Israel | Prevalence of Herbal supplements use | Herbal supplements use | Internal medicine department at Assaf Harofeh Medical Centre, Zerifin | cross- sectional | Interviewer- administered structured questionnaires | T2D patients |
| Hashempur et al., 2015 ³⁹ | Iran | Prevalence of CAM use | CAM use | Two outpatient diabetes clinics affiliated with the Shiraz University of Medical Sciences, Shiraz | cross- sectional | Face-to-face interview using semi-structured questionnaire | T1D and T2D patients |
| Devi et al., 2015 35 | India | Prevalence of CAM use | CAM use | Diabetes Health camp conducted by VS micro lab, Madurai | cross- sectional | structured questionnaires | T2D patients |
| Damnjanovic et al., 2015 ⁵⁵ | Serbia | Prevalence of Herbal supplements use | Herbal supplements use | 6 Remedia Pharmacy Health Facilities in the territory of Nis | cross- sectional | structured questionnaires | T2D patients |
| Alami et al., 2015 ⁴⁰ | Morocco | Prevalence of Herbal supplements use | Herbal supplements use | Mohammad VI university hospital ,Oujda | cross- sectional | Face-to-face interview using a Semi-structured questionnaire | T1D and T2D patients |
| Nguyen et al., 2014 ⁴⁵ | USA | Prevalence of CAM use | CAM use | Patients were recruited from seven primary care or endocrinology clinics affiliated with an academic medical centre in Southern California | cross- sectional | self-administered structured questionnaire | T2D patients |
| Naja et al., 2014 26 | Lebanon | Prevalence of CAM use | CAM use | Ppatients recruited from two major referral centres in Beirut- a public hospital and a | cross- sectional | Face-to-face interview using a structured questionnaire | T2D patients |

| | | | | private academic medical centre | | | |
|---|-----------|--|------------------------------|---|------------------------------|--|-------------------------|
| Khalil et al., 2013 ³⁸ | Egypt | Prevalence of Herbal supplements use | Herbal supplements use | Outpatient clinics of Alexandria University Hospital, from seven health insurance centres, six hospitals, and one private healthcare facility. | cross- sectional | Questionnaires (administration method not reported) | T2D patients |
| Fan et al., 2013 ²⁹ | Singapore | Prevalence and Factors for CAM use | CAM use | Single centre study conducted in an outpatient diabetes Centre in Singapore with an average load of 2500 patients a month | cross- sectional | Self-administered questionnaires. | T2D patients |
| Ching et al., 2013 56 | Malaysia | Prevalence of CAM use | CAM use | primary health care clinic at Salak in Sepang | cross- sectional | Face-to-face interview using a structured questionnaire | T2D patients |
| Lui et al., 2012 ⁴¹ | Australia | Prevalence of CAM practitioner use | CAM practitioner use | Data reported here are taken from the Living with Diabetes Study (LWDS), a five-year, prospective cohort study being conducted in the State of Queensland | Data from cohort study | Questionnaires | T1D and T2D patients |
| Ali-Shtayehet et al., 2012 ²³ | Palestine | Prevalence of CAM use | CAM use | Patients attending outpatient departments at Governmental Hospitals in 7 towns in the Palestinian territories (Jenin, Nablus, Tulkarm, Qalqilia, Tubas, Ramalla, and Hebron) | cross- sectional | structured questionnaires | T1D and T2D patients |

| Wazaify et al., 2011 ²⁷ | Jordan | Prevalence of Herbal supplements use | Herbal supplements use | Outpatient departments at The National Centre for Diabetes, Endocrine and Genetics (NCDEG), a specialized centre in Jordan to which most DM cases are referred | cross- sectional | Face-to-face interview using a Semi-structured questionnaire | T1D and T2D patients |
|--|---------|--|------------------------------|--|---------------------|---|-------------------------|
| Sethi, Srivastava & Madhu, 2011 ²⁸ | India | Prevalence of CAM use | CAM use | Tertiary care centre in Delhi | cross- sectional | Face-to-face interview using a Semi-structured questionnaire | T1D and T2D patients |
| Fabian et al., 2011 ⁴⁴ | Austria | Prevalence of Herbal supplements use | Herbal supplements use | Diabetes Centre of the Division of Endocrinology and Metabolism, Department of Internal Medicine, Medical University of Graz | cross- sectional | Face-to-face interview using a structured questionnaire | T1D and T2D patients |
| Bradley et al., 2011 ²² | USA | Prevalence of CAM use | CAM use | Patients with moderately to poorly controlled type 2 diabetes who receive care from Group Health Cooperative (GHC), a large non-profit, integrated health care system in Washington State. | cross- sectional | Telephone- administered questionnaires. | T2D patients |
| Khalaf & Whitford, 2010 ⁴² | Bahrain | Prevalence of CAM use | CAM use | Patients attending two hospital diabetes clinics | cross- sectional | questionnaires | T1D and T2D patients |

| Alqathama et al., 2020 ⁴³ | Saudi | Prevalence of herbal supplements use | knowledge and beliefs about herbal use | 13 medical centres in Makkah | cross- sectional | Structured questionnaire | T2D patients and doctors |
|---|----------------------------|---|---|---|---|---|--|
| Cengiz & Budak, 2019 ⁴⁹ | Turkey | Prevalence of CAM use | CAM use | Patients hospitalized at endocrine clinics in university hospital in eastern region. | cross- sectional | Face-to-face interview using a structured questionnaire | T1D and T2D patients |
| Kasole & Kimiywe, 2019 ⁵² | Tanzania | Patients' and herbalists' practices and perspectives | CAM use | Kilimanjaro Christian Medical Centre (KCMC) in Kilimanjaro, and Mount Meru Hospital in Arusha | Cross- sectional | Mixed-methods design which included a quantitative and a qualitative component | T1D and T2D patients and local herbalists |
| Meshesha, Gebretekle, & Fenta, 2020 ⁵³ | Ethiopia | Prevalence of herbal supplements use | Kowledge and beliefs about herbal use | Health facility-based in Addis Ababa | Cross- sectional and qualitative | Mixed-methods design which included a quantitative and a qualitative component | T1D and T2D patients |
| Owusu et al., 2020 ³² | Jamaica | Prevalence of CAM use | CAM use | Seven chronic disease clinics in western region | cross- sectional | Investigator- administered questionnaire | T2D patients |
| Radwan et al., 2020 ¹⁵ | United Arab Emirates | Prevalence of CAM use | CAM use | Outpatient clinics in the two governmental hospitals in Dubai and Sharjah | cross- sectional | Face-to-face interviews | T2D patients |

| Raja et al., 2019 ³⁰ | Pakistan | Knowledge and attitude toward CAM | CAM use | Institute of diabetology in a tertiary care hospital | cross- sectional | Face-to-face interviews | T2D patients |
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