Complementary and Alternative Medicine in Association with Type 2 Diabetes Mellitus

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ABSTRACT

Background: Type 2 Diabetes Mellitus is a clinical condition that is associated with energy metabolism, particularly carbohydrate and fat management in the organism. An increase in the prevalence of diabetic population and the association of decreasing patient compliance and medication adherence leads to prefer a new concept for the management of disease complications. The use of complementary and alternative medicine (CAM) has proved to be effective for controlling diabetes.

Objectives: The purpose of this review is to perform an overview of CAM use, to emphasize its importance for managing diabetic complications and to get outfits of CAM.

Discussion: A literature survey was done by using various articles related to CAM and Diabetes mellitus. The focus was kept on the frequency of CAM use, the methods they use, the factors related to the use of CAM, the sources of information about CAM treatment, and the effect of the method used for disease management.

Conclusion: This review concluded that CAM therapy found to have adept at reducing blood glucose, maintaining a healthy body, and relieving symptoms of DM. From the study, the relevance of CAM for managing Diabetic complications was verified and the future need to perform scientific researches on CAM use was analyzed.

Key Words: Complementary And Alternative Medicine, Type 2 Diabetes Mellitus, Neutraceuticals, Mind-body interventions, Health

INTRODUCTION

Type 2 Diabetes Mellitus is a disease condition that is linked to energy metabolism, particularly carbohydrate and fat management in the organism. In the last decades, there was an explosive increase in the number of people diagnosed with diabetes worldwide due to ageing as well as the increasing prevalence of obesity and physical inactivity. The total number of people with diabetes is projected to rise from 347 million in 2008 to 552 million in 2030 as per data.

Along with total energy intake macroelements as well as microelements are playing a role to show various types of serious effects of diabetes mellitus. From clinical findings data is suggestive of individual vitamins e.g. A, B1, B3, C, D, E, minerals e.g. calcium, magnesium and trace elements e.g. zinc, chrome beneficially affect the complications of diabetes mellitus.

Although medical advancements are there, therapeutic outcomes are often unreachable. An unsatisfied population can shift to nontraditional medicine or further alternatives. Many professionals considered Complementary and alternative medicine as the best option for minimizing diabetic complications. Therefore, this study focuses mainly on complementary and alternative medicine utilization in diabetic complication management.

Complementary and alternative medicine

Complementary and alternative medicine (CAM) can be defined as an alternative health-care approaches besides mainstream Western, or conventional medicine. It reflects two words, “complementary” meaning used together with, and “alternative” meaning used in place of conventional medicine. As per the guidelines from National Center for Complementary and Alternative Medicine (NCCAM),

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tional Institutes of Health defines complementary and alternative medicine as “health care approaches with a history of use or origins outside of mainstream medicine.”

**Objectives**

The purpose of this review is

A) To present an overview of the use of complementary and alternative therapies in association with diabetes.

B) To emphasize the importance of CAM for the management of diabetes and reducing its complications.

C) To obtain the benefits of various therapies involved in CAM approaches.

**Categories**

As per the National Center for Complementary and Alternative Medicine, CAM therapies are broadly categorized into two main categories like I) Natural therapies and II) Mind-body intervention1-3.

**Natural therapy or biological-based therapies**

Certain conditions like infections, microvascular and macrovascular complications of diabetes may occur due to deficiencies of the microelements, vitamins, and nutrients. Such events can be minimized by the administration of these essentials. Vitamins and minerals proved helpful for the enhancement of the immune status of patients so they can easily overcome the clinical conditions. Biologically based therapies indicate substances coming from nature that includes herbs, essential oils, typical diet, nutritional and food supplements, and other products such as cartilage20.

The following are some findings obtained from natural therapy utilization for CAM significance and outcomes obtained from them as mentioned in table no.1.

**Table 1: Clinical trials showing CAM significance and outcomes**

<table>
<thead>
<tr>
<th>Neutropceuticals</th>
<th>Clinical findings</th>
</tr>
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<tbody>
<tr>
<td>Vitamin A</td>
<td>Type 2 diabetics of elderly age group showed low plasma concentrations of vitamin A and carotenoids2, with lower carotene and higher RBP than controls, the study done by administering retinoic acid in diabetic mice has been shown to reduce RBP4 (Retinol binding protein 4), as well as the reduction in retinol to RBP4 ratio, and found to improve insulin sensitivity39.</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>The expression of calbindin-D28K has demonstrated a protective effect on beta cells from cytokine-mediated cell death, reducing the risk of T2DM.</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>The effect of vitamin E on risk of diabetes and its complications is most probably due to its role as an antioxidant; a decrease in plasma tocopherol was noted in diabetic patients with chronic state relates to total cholesterol, central type obesity, lipid peroxidation, and cardiovascular complications.</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>Vitamin K affects insulin sensitivity, glucose metabolism in diabetes.</td>
</tr>
<tr>
<td>Multivitamin</td>
<td>In the study of multivitamin effect in type 2 diabetes patients, the study population was administered with multivitamins and minerals for one year resulted in reduced incidence of infections in patients with subclinical micronutrient deficiency4.</td>
</tr>
</tbody>
</table>

Data was obtained from articles showing Clinical trials conducted on herbs like Cinnamon [Cinnamomum verum],...
bitter gourd [Momordica charantia], fenugreek [Trigonella foenum-graecum], Crepe Ginger [Costus speciosus] and ivy gourd [Coccinia grandis]. Clinical outcomes and mechanisms of the antidiabetic effect of these herbs were summarized and mentioned in table no.2.

Table 2: Clinical outcomes and mechanisms of the antidiabetic effect of herbs

<table>
<thead>
<tr>
<th>Herb</th>
<th>The mechanism utilized in diabetics</th>
</tr>
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<tbody>
<tr>
<td>Cinnamomum Verum Cinnamon</td>
<td>Cinnamon facilitates glucose entry into cells by increasing the amount of GLUT4 [Glucose transporter type 4] receptors, Insulin Receptor (IR), and Insulin Receptor substrate. Cinnamon increases the expression of PPAR [ Peroxisome proliferator-activated receptors] (alpha) and PPAR (gamma), that help to improve insulin sensitivity.</td>
</tr>
<tr>
<td>Momordica charantia (MC) (Bitter gourd or bitter melon)</td>
<td>MC extract increases cellular glucose uptake by enhancing cellular insulin signalling pathways through up-regulation of GLUT 4 [Glucose transporter type 4] and P13K [Phosphoinositide 3-kinase], as well as up-regulating PPAR [ Peroxisome proliferator-activated receptors] gamma, MC preserves islet beta cells and has shown to stimulate glycogen storage by liver and insulin secretion by islets of Langerhans.</td>
</tr>
<tr>
<td>Trigonella foenum-graecum (Fenugreek)</td>
<td>Fenugreek helps diabetic patients by enhancing glucose uptake into the cells and also by stimulating the tyrosine phosphorylation of the insulin receptor.</td>
</tr>
<tr>
<td>Costus speciosus (Crepe Ginger)</td>
<td>The Hypoglycemic effect was accompanied by an increased hepatic hexokinase activity and liver glycogen content in diabetic rats.</td>
</tr>
<tr>
<td>Coccinia grandis (Ivy gourd)</td>
<td>Pectin, isolated from the fruit of Coccinia grandis has hypoglycemic properties in rats by correcting elevated levels of glucose-6-phosphatase and lactate dehydrogenase. The plant extract found to increase activation of peroxisome proliferator-activated receptor-gamma activity. Triterpenes, isolated from Coccinia spp may have the ability to reverse beta-cell damage induced by Alloxan in experimental diabetic rats.</td>
</tr>
</tbody>
</table>

**Mind-body therapies**

The therapies including holistic perspectives or mind body spirit evaluation techniques to enhance the mind’s ability to affect body functions and symptoms are known as mind-body therapies. Its broad category approach to be considered to include various therapies like visualization, guided imagination, progressive muscle relaxation, meditation, prayer, music therapy, light therapy, art therapy, journaling, storytelling, biofeedback, hypnosis, humour, animal-assisted therapy, tai chi, qigong, and yoga.

**Manipulative and body-based therapies**

Application of pressure for manipulation or movement of one or more body parts can be considered in this therapy. The following are some examples that can interpret the idea of manipulative and body-based therapies as chiropractic medicine, osteopathic manipulative medicine, movement therapy, and Rolfing i.e. a form of soft-tissue manipulation.

**Energy therapies**

This kind of complementary and alternative medicine works on the belief that a vital energy flows through the human body. They aimed to balance the energy flow in the patient by modification, manipulation, enhancement, and supporting the energy fields for reducing stress, anxiety, and promotion of well being.

**Traditional Chinese Medicine**

Traditional Chinese medicine work as a holistic system consisting of a combination of natural medicines, massage therapy, diet changes, acupuncture, and some practices like breathing exercises, movement therapies, and mind stabilizing therapies.

**Systems of Care**

There are some categories of treatment which become distinct from other approaches of disease management that shows their work based on systems of care like homeopathy, Ayurveda, Chinese medicine, a folk system of medicine and can be proved to be effective for improving the health status of the patients.

**Yoga**

Yoga consists of various exercises, asanas, and meditation. Yoga harmonizes the body with our mind and breath. It identifies one with different levels of consciousness and understanding resulting in gaining perspective and peace. Yoga interns proved to obtain a healthy mind and a healthy body. In the case of the diabetic population some studies on yoga
for reducing complications type 2 diabetes showed better effects of controlling glycemic levels, regulation of lipid and BP profile, again to reduce A1C, fasting, and postprandial glucose values19.

**DISCUSSION**

An article among Non-Hispanic White, Mexican American, and Vietnamese American Type 2 Diabetic Patients on Complementary and Alternative Medicine (CAM) Use concluded that CAM use may result in improved diabetes management with long-term health outcomes as per race and ethnicity. It also reflected low levels of thiamine and increased renal clearance in both Type 1 and Type 2 diabetic patients. Better clinical outcomes found to be obtained on thiamine supplementation among those patients.

The association between diabetes and bacterial infection has been recognized for many years25, 26. A prospective study showed a higher incidence of bacteremia in diabetic patients compared to non-diabetics. Surgical wound infection may also be associated with diabetes mellitus. In a study calculating rate of wound infection for total hip replacement surgeries among diabetic and nondiabetic populations with similar circumstances found to obtain a higher percentage for diabetic people and a very low fraction for non-diabetics. In the study i.e. Effect of Antioxidants and B-Group Vitamins on Risk of Infections in Patients with Type 2 Diabetes Mellitus, the provision of nutrient supplementation to diabetic subjects was done and improvement in the disease-related complications was noted27. In some studies relating to vitamin D and chronic inflammatory status of T2DM patients, outcomes helped to conclude that vitamin D acts on inflammatory mediators and modulates the effects of mediators like cytokines and nuclear transcription factors such as NF-κB. This results in improving insulin sensitivity and promoting pancreatic β-cell survival28.

Studies on Systems like yoga, tai chi showed an effect on glycemic control in people with type 2 diabetes and in lowering A1C levels19.

In a preclinical study for outcomes of nutrient therapy for the management of diabetes, it was reported that external supplementation like Calcium, zinc, chromium, magnesium, vitamins found to increase insulin sensitivity, reduced vascular resistance and induced partial regurgitation, increased HbA1c, fasting glucose and insulin level, decreased lipid peroxidation, reduction in serum triglycerides, and VLDL reduction in type 1 and type 2 diabetes.

**CONCLUSION**

Total of 18 articles relating to complementary and alternative medicine was included in the study, out of which 4 reviews found to be showing the significance of CAM for the reduction of blood glucose level, improving insulin utility, and minimizing diabetic complications. One preclinical study on diabetic rats indicates Diagnostic parameters improved in MVT treated male rats but not in streptozocin treated female rats. In another prospective observational study, varying rates of CAM use were analyzed. A descriptive cross-sectional study containing differential statistical questionnaires came with outcomes as Herbs proved to be effective for reducing blood glucose, maintaining a healthy body, and relieving symptoms of DM. As such numbers of studies were taken into consideration for finding the beneficial outcomes for utilization as well as finding safety parameters of CAM for managing diabetic complications. Some of which are shown in table no 3.

<table>
<thead>
<tr>
<th>Articles</th>
<th>Type of study</th>
<th>Study parameters</th>
<th>Clinical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uslu et al. 2018, 7:1</td>
<td>Review</td>
<td>CAM for children with T1DM</td>
<td>Use of CAM reduces diagnosis duration, lowers blood glucose level, improves insulin utility, minimizes diabetic complications</td>
</tr>
<tr>
<td>Sarkozy et al. 2014, 14:72</td>
<td>Preclinical case-control study</td>
<td>MVT administration in diabetic rats</td>
<td>Diagnostic parameters improved in MVT treated male rats but not in streptozocin treated female rats</td>
</tr>
<tr>
<td>Khalaf et al. 2010, 10:35</td>
<td>Prospective observational study</td>
<td>CAM use for Diabetes</td>
<td>High rates of CAM users for managing diabetes</td>
</tr>
<tr>
<td>Niswah et al. 2014</td>
<td>A descriptive, cross-sectional study</td>
<td>Differential statistical questionnaire for herb use</td>
<td>Herbs proved to be effective for reducing blood glucose levels, maintaining proper health, and relieving symptoms of DM</td>
</tr>
<tr>
<td>Medagama et al. 2014, 13:102</td>
<td>Review</td>
<td>Cinnamon, bitter guard, fenugreek, crepe ginger, ivy guard as a CAM</td>
<td>Effects of 5 CAM for minimizing diabetic complications</td>
</tr>
</tbody>
</table>
Table 3: (Continued)

<table>
<thead>
<tr>
<th>Articles</th>
<th>Type of study</th>
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<th>Clinical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debra Kramlich et al. 2014, 6</td>
<td>Research article</td>
<td>CAM use and significance</td>
<td>To emphasis the benefits of nonpharmacologic therapies for critically ill patients</td>
</tr>
<tr>
<td>L.D. Grossman et al. 2018, 42</td>
<td>Case-control study</td>
<td>NHP and CAM</td>
<td>Reduction of co-morbidities and complications of diabetes, including lipids and blood pressure (BP) in diabetes, as well as CVD, nephropathy, retinopathy and peripheral neuropathy</td>
</tr>
<tr>
<td>Valdes Ramos et al. 2015, 15</td>
<td>Review</td>
<td>Vitamins and Type 2 Diabetes Mellitus</td>
<td>Neutropceuticals shows effectiveness for management of C-reactive protein, HDL cholesterol, triacylglycerides, serum Homocysteine, blood pressure and incidence of diabetes</td>
</tr>
<tr>
<td>Nguyen et al. 2014, 25(4)</td>
<td>California Health Interview Survey</td>
<td>CAM</td>
<td>CAM use may influence diabetes management behaviours</td>
</tr>
<tr>
<td>Salah Gariballa et al. 2013, 5</td>
<td>Randomized trial</td>
<td>Dietary supplementation</td>
<td>Need to do more clinical studies for better clinical outcomes</td>
</tr>
<tr>
<td>Ghulam Jilany Khan et al. 2014, 21(6)</td>
<td>A cross-sectional, interview-based survey</td>
<td>CAM</td>
<td>CAM can be used for disease management</td>
</tr>
</tbody>
</table>

**CONCLUSION**

This study focuses on complementary and alternative medicine, its significance, and utilization for minimizing diabetic complications. As per the data collected from various articles CAM therapy proved beneficial for the diabetic population by various mechanisms. CAM therapies include natural therapies like Yoga, mind-body intervention, energy therapy, reiki, tai chi, behavioural therapies, and utilization of natural medicines like herbs, vitamins, minerals, nutrients for disease management. CAM therapy shows its significance not only on disease outcomes but also improves the patient’s physical, psychological, and social health. CAM utilization in type 2 diabetes was found to be associated with the reduction of plasma glucose levels, it also helps by maintaining HbA1c, improving insulin sensitivity, and again it can minimize comorbid states by maintaining biological markers and improves the health status of the patient.

This review concluded that CAM therapy found to have adopt at reducing blood glucose, maintaining a healthy body, and relieving symptoms of DM. From the study, the relevance of CAM for managing Diabetic complications was verified and the future need to perform scientific researches on CAM use was analyzed.

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**REFERENCES**


46. Vijaykumar MV, Singh S, Chhipa RR, Bhat MK. The hypoglycemic activity of fenugreek seed extract is mediated through the activation of peroxisome proliferator-activated receptors. PPAR Res 2008;581348:9.