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Anti–Diabetic Activity of Cinnamon: A Review

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Abstract*—Diabetes mellitus (DM) is the most common of the endocrine illnesses. It is a significant human disorder, affecting numerous, from several pieces of life in diverse countries. In spite of improvements in drug controlling of diabetes, the adverse drug effects have made experts to look towards hypoglycemic agents of natural source, particularly in the developing nations. Cinnamon is one medicinal universal plant which has been used daily by people all over the world, which has the probable to decrease the growth of diabetes and its problem. It also does not have much notable side effects. The current mini reviews present the outstanding ability of cinnamon, to control diabetes by enhancing insulin release and insulin receptor signaling. It also points to the areas of prospect research regarding of the pathological mechanisms that cause diabetes*.

***Keywords*—** *Cinnamon, Diabetes mellitus (DM), Fasting blood glucose, Hyperglycemia*.

I. INTRODUCTION

Conferring to the International Diabetes Federation Atlas guideline report, presently, there are 352 million adults with impaired glucose tolerance who are at high threat of developing diabetes in the future. In 2017, it was expected that 425 million people (20–79 years of age) suffered from Diabetes mellitus (DM), and the number is expected to rise to 629 million by2045[1].DM with its effect on health, the healthcare system expenses of individuals represents a severe international health burden [1,2].

II. COMPLICATIONS OF DIABETES

DM is a severe, chronic disease that occurs either when the pancreas does not secrete sufficient insulin, or when the body cannot effectively use the insulin it produces[3]. Atypically extraordinary blood glucose can have a serious impact if it triggers conditions such as diabetic ketoacidosis (DKA) in type's 1 and 2, and hyperosmolar coma in type2[4].

III. TREATMENTS:

Pharmacological therapy is intended at keeping the glycaemia and reducing the long term problems of Diabetes. Drug classes used for the treatment of type 2 diabetes comprise the following:
(1) Insulin sensitizers: (a) Biguanides; (b) Thiazolidinediones (TZDs); (2) Insulin secretagogues:
(a) Sulfonylureas; (b) Meglitinide derivatives; (3) Alpha-glucosidase inhibitors; (4) Glucagonlike peptide–1 (GLP-1) agonists; (5) Dipeptidyl peptidase IV (DPP-4) inhibitors; (6) Selective sodium-glucose transporter-2 (SGLT-2) inhibitors (7) Insulin; (8)Amylinomimetic[5].

IV. ANTI-DIABETIC MEDICINAL PLANTS

The global use of medicinal plants for the management of diseases like diabetes has promptly increased over the last decade. It is stated that up to 72.8% of people with diabetes used herbal medicine[6].

Moreover, a large number of medicinal plants are believed to possess anti-diabetic activities and have been utilized to control diabetes[6]. One of the medicinal plants that is emerging as a possible therapeutic agent for the management of DM is cinnamon[6].

V. CINNAMON

Cinnamon is generally used in the aroma and industries due to its smell, which can be combined into diverse varieties of foodstuffs, perfumes, and medicinal products7. Overall, around 250 species have been recognized among the cinnamon genus, with trees being scattered all over the world[7].

VI. BOTANICAL DESCRIPTION

Cinnamon is an evergreen tree belongs to *Lauraceae* family, which grows from 20 to 30 feet; the leaves are dark green on top and lighter green underneath. Fruits are black, pulpy, and aromatic. A flower is small, yellow. The diverse, spicy aroma of cinnamon inner bark, *Cinnamomum cassia*, is the spice sold as cinnamon in the United States Fig.1. Ceylon cinnamon, *Cinnamomumzeylanicum*, which is stated to as true or sweetcinnamon[8,9] Fig. 2.

Fig. 1. CInnamomum cassia.

Fig. 2. Cinnamomumzeylanicum.

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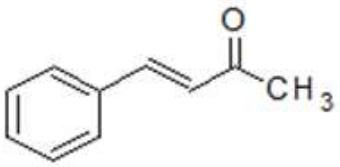

Fig. 3. Cinnamaldehyde.

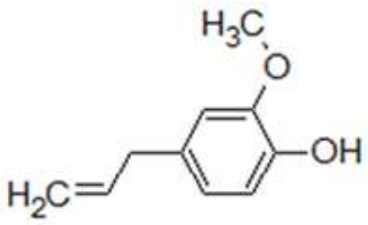

Fig. 4. Eugenol.

VII. Chemical Constituents

The main constituents of cinnamon are cinnamaldehyde, cinnamate, cinnamic acid, and numerous essential oils[10]. They all contribute to the odor and to the several biological activities observed with cinnamon. It also contains procyanidins tannins, mucilage, and a bit amounts of coumarin[11, 12]. Cinnamaldehyde (trans-cinnamaldehyde) is the foremost constituent in cinnamon barkoil Fig. 3. However, the principal component of leaf oil is eugenol[13] Fig. 4.

VIII. Traditional Uses

Cinnamon is a prevalent cookery spice and is also used in candy, incense, toothpaste and perfumes. Its oil is used as a carminative, antiseptic and astringent. In traditional medicine cinnamon has been used as agent and used in treatment of sore pain and dentalharms [14].

IX. Pharmacological Activities

Cinnamon displays animated role as a spice, but its essential oils and other components also have significant activities, including antimicrobial, antifungal and antioxidant. Also, it has been used as anti-inflammatory, antitermitic, insecticidal, antimycotic, and anticancer agent[7]. The importance in cinnamon as a potentially valuable treatment for DM instigated almost 20 years ago. The aim of this mini review to provide a brief overview of anti-diabetic activity of cinnamon.

X. Cinnamon as Anti-diabetic Agent:

Established on the study of Zare, *et al* found, that cinnamon supplementation (500 mg capsules twice daily) can develop anthropometric considerations, glycemic indices, and lipid profile of patients with type 2diabetes. These benefits are considerably more prominent in patients with higher BMI (BMI≥27)[15].Shahib*et al*reported that the administration of 1 g of cinnamon powder for 12 weeks decreases fasting blood glucose level and glycosylated Hb among un-controlled type 2 diabetes patients, as well as increase the level of serum glutathione and superoxide dismutase however, reduces serum level of malondialdehyde, indicating the beneficial effect of adjuvant cinnamon as anti-diabetic and antioxidant along with conventional treatments to treat poorly controlled type 2 diabetes[16].

Also, Kim *et al*. studied the anti-diabetic activity of *cinnamomum cassia*extract in type 2 diabetic animal models. Cinnamon extract was administered at many dosages for 6 weeks. It was found that blood glucose level is significantly diminished in a dose-dependent manner ($P< 0.001$) with the most compared with thecontrol[17].

Furthermore, serum insulin levels and HDL–cholesterol levels were significantly higher ($P < 0.01$) and intestinal glycosidase activity was significantly lower after 6 weeks of the administration. These results suggest that cinnamon extract has a controlling part in blood glucose level and it may also employ a blood glucose quashing effect by improving insulin sensitivity or may be reducing the absorption of carbohydrates in the smallintestine[17].

Kumar*et al*.considered the effect of oral administration of cinnamon extract to hyperglycemia induced rats. The Study showed that oral administration of cinnamon extract produced a significant decrease in the blood glucose level in the model of induced diabetesrats[18].

Anderson *et al*. demonstrated the effects of *cinnamon cassia* 250 mg given twice a day to patients with type 2 diabetes. After, two months it was found that fasting blood glucose decreased significantly ($P< 0.001$)[19].

In addition, Al-Yasiry *et al*. proved the hypoglycemic activity of cinnamon in poorly controlled patients with type 2 diabetics. The participants were given 0.5 g of crude cinnamon 15 minutes after each meal for a total of 1.5 g daily for three months. They found that HbA1c decreased from 9.54+ 0.96 pre-treatment to 8.22 + 0.65 post treatment ($P< 0.01$)[20].

Cinnamon cassia usage in type 2 diabetes was studied by Akilen. Participants were given a total of 2g daily ingestion of 2 g of cinnamon each day was found to significantly reduce the HbA1c level, $p < 0.05$[21].

Governa *et al*., found that the consumption of supplementation with cinnamon, usually in combination with standard hypoglycemic therapies, has been related to modest effects on fasting plasma glucose and hemoglobin A1c[22].

XI. Potential Mechanisms of Cinnamon

Cinnamon hypoglycaemic activity may be recognized to numerous mechanisms of action, comprising the stimulation of insulin release and insulin receptor signaling, the activation and regulation of enzymes involved in carbohydrate metabolism, glycolysis, gluconeogenesis, stimulation of cellular glucose uptake and increased glucose transporter-4 receptorsynthesis)[23]. Another study shown that cinnamtannin B1, a proanthocyanidin isolated from the stem bark of ceylon cinnamon, stimulates the phosphorylation of the insulin receptor β-subunit on adipocytes as well as other insulin receptors[24].

XII. Recommended Cinnamon Dosage

The typical recommended dose is 1 to 4 grams daily of ground according to New York University. Cinnamon oil is generally used at a dose of 0.05 to 0.2 g daily[25].

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XIII. Specific Cinnamon Warnings and Precautions

Medicinal doses are not recommended during pregnancy because it can induce uterine contractions and in some cases even cause prematurelabor[26].

XIV. Conclusion

Cinnamon has been used as a natural traditional medicine in numerous cultures throughout the world. From the findings of various studies, it can be concluded that the oral administration of cinnamon extracts has a valuable effect on blood glucose levels. Additional studies are required to determine the effectiveness of the active principles of cinnamon and their therapeutic properties in the management of diabetes.

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