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Ameliorative Review on Exploration of Spices in Aspects of Phytochemical Screening for their Antidiabetic Action

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Abstract:- Diabetes is a diverse group of disorder characterized by hyperglycemia due to an deficiency in insulin production. Diabetes mellitus's chronic hyperglycemia is linked to end organ damage, dysfunction, and failure, including blood vessel, kidney, retina, and nervous system. With over 62 million cases of diabetes being identified in India, the disease is rapidly turning into a true epidemic. The majority of synthetic oral hypoglycemic medications available for the disease's treatment are costly, have significant adverse effects, and/or cannot be used while pregnant. As a result, a growing number of people worldwide are turning to traditional herbal remedies to prevent and treat diabetes. Spices having antioxidant, hypoglycemic, and hypolipidemic characteristics may be effective in the therapy of diabetes. As a result, these spices are growing in popularity due to their potential efficacy, little to nonexistent adverse effects, and synergistic effects. Spices are compounds used in food as coloring, flavoring, or preservation. They might be fresh or dried seeds, bark, roots, fruits, or even vegetables. This paper includes phytochemical screening of spices which have crucial role in the treatment of diabetis mellitus.

Keywords:- *Hyperglycemia, Traditional, Ingredients, Phytochemical Screening.*

I. INTRODUCTION

➢ *Diabetes and Herbal Treatment*

Diabetes is a diverse group of disorder characterized by hyperglycemia due to an deficiency in insulin production. Diabetes mellitus's chronic hyperglycemia is linked to end organ damage, dysfunction, and failure, including blood vessel, kidney, retina, and nervous system.[1] Diabetes is gradually becoming an epidemic in India, with over 62 million individuals diagnosed. In 2000, India (31.7 million) led the globe in the number of persons with diabetes mellitus, followed by China (20.8 million) and the United States (17.7 million).Wild et al. forecast that the global prevalence of diabetes will double from 171 million in 2000 to 366 million in 2030, with India suffering the highest increase. Diabetes mellitus is anticipated to affect up to 79.4 million people in India by 2030, while China (42.3 million) and the United States (30.3 million) will also witness significant increases in those affected by the condition.[2] The American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD) currently prescribe hypoglycemic medications in addition to diet and exercise as first-line treatments. Biguanides, sulfonylureas, meglitinides, thiazolidinediones, α-glucosidase inhibitors, incretinimetics, and DPP-4 inhibitors are the seven distinct types of hypoglycemic medicines.[3]

Diabetes and its complexity remain a major medical challenge, despite noticeable advancements in the use of conventional medications and management techniques to control the disease. The majority of synthetic oral hypoglycemic medications available for the disease's treatment are costly, have significant adverse effects, and/or cannot be used while pregnant. As a result, a growing number of people worldwide are turning to traditional herbal remedies to prevent and treat diabetes. Thus, the demand to find more effective antidiabetic medications with minimal to no side effects is growing. Spices with antioxidant, hypoglycemic, and hypolipidemic properties may be useful in the management of diabetes. [4]

As a result, these spices are growing in popularity due to their potential efficacy, little to nonexistent adverse effects, and synergistic effects.[5] Spices are fresh or dried seeds, roots, bark, fruit, or even vegetable materials that are used as flavoring, coloring, or preservatives in food. It is a challenging task to trace the history of Indian medicinal spices. The use of plants, spices, and herbal remedies as dietary prescriptions has a long history—possibly dating back to the prehistory of Vedic culture.[6] India is home to an enormous variety of plants, herbs, and spices, many of which are said to have therapeutic qualities. Diabetes has traditionally been treated with more than 800 herbs.[7] Spices have a number of positive physiological and pharmacological benefits, including hypoglycemia.[8] Numerous studies have highlighted the benefits of spices, including their productivity, unique liquid-based extracts, active ingredients or phytochemical components from pre-clinical animal research and/or clinical human trials of diabetic treatments. It has been scientifically demonstrated that several spices, including black pepper, ginger, fenugreek, turmeric, mustard, and garlic and onion, may

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have hypoglycemic effects.[9,10,11,12,13] Curry leaves, cumin seeds, coriander, and sumac have also been linked to anti-hyperglycemic effects. [14]

➢ *Diabetes and Insulin*

Most of the food we eat is broken down into the basic sugar glucose. The body uses this glucose as its main fuel source to produce energy. Glucose is absorbed into the bloodstream and utilised as an energy source by bodily cells.However, insulin is required for glucose to enter cells.The pancreas secretes the hormone insulin, which is responsible for transferring glucose from the blood into the body's cells. Glucose cannot enter body cells if the pancreas produces insufficient insulin or if the insulin that is generated does not function properly. As a result, glucose remains in blood cells, raising blood sugar levels. The initial hallmark of diabetes is a disruption in glucose homeostasis. The primary actions of insulin on glucose, fatty acid, and amino acid metabolism as well as on ion flux are initiated when the insulin molecule binds to a specific insulin receptor on the cell surface.The insulin molecule is not chemically altered during its reversible interaction with the hormone receptor.The insulin receptor is eventually recycled back into the membrane for further use when the insulin molecule is degraded. As a result, the organism loses its main source of energy even while the blood's glucose content is high. Since the cells are unable to oxidize glucose there, the cell membrane is the main location of insulin resistance. Because glucose is not digested, the blood has higher than normal levels of glucose. The kidney removes excess sugar from the blood and excretes it in the urine in order to maintain the proper quantity of glucose in the blood. Because the body does not use glucose, diabetes causes the body to always feel hungry, leading to polyphagia, or an increased desire to eat. Reduced stimulation of muscle glycogen synthesis, abnormalities in glycogen synthesis activity, hexokinase activity, and glucose absorption are indicators of insulin resistance.

➢ *Diagnostic Criteria for Diabetes:*

A healthy man's blood glucose levels range from 80 mg/dL during a fast to 160 mg/dL after a meal. Diabetes mellitus is characterized by recurrent or chronic hyperglycemia, which can be identified by one of the following: a fasting plasma glucose level of 126 mg/dL or greater (7.0 mmol/l).After ingesting a 75 g oral glucose load, participants in a glucose endurance test must have plasma glucose at or above 200 mg/dL or 11.1 mmol/L, or random plasma glucose of at least 200 mg/dL. Diabetes mellitus is diagnosed when two fasting glucose tests surpass 126 mg/dL (7.0 mmol/l) or two random blood sugar measurements reach 200 mg/dL. Individuals with plasma glucose levels at or above 140 mg/dL or 7.8 mmol/L two hours after a 75 g oral glucose load are assumed to have impaired glucose tolerance, whereas patients with fasting sugars between 6.1 and 7.0 mmol/L (110 and 125 mg/dL) are thought to have impaired fasting glucose.

➢ *Classification of Diabetes*

- **Type I** diabetes (diabetes reliant on insulin), Absolute insulin insufficiency is typically the result of islet β-cell loss, a condition that affects 10% of diabetes individuals. Patients cannot survive without exogenous insulin to keep them from going into ketosis.
- **Type 2 diabetes** (Non insulin-dependent diabetes), Represents more than 85% of cases globally. It can take many different forms, ranging from insulin resistance to insufficiency. Furthermore, type 2 diabetes (T2D) is a multifactorial disease with both hereditary and substantial non-genetic components.

- *Other Distinct Variants, such as:*

Genetic deficiencies in β-cell activity, such as MODY syndromes Genetic flaws in the way insulin functions, such as leprechaunism Exocrine pancreatic diseases, such as pancreatitis Correlated with endocrinopathies, such as acromegaly Induced by drugs or chemicals, such as glucocorticoids Infections, such as rubella congenital Seldom occurring immune-mediated diabetes types, such as "Stiff Man" syndrome Additional hereditary conditions linked to diabetes, such as Down syndrome. [12]

- *Gestational Diabetes:*

Diabetes identified during pregnancy, encompassing both pre-existing and newly developed diabetes.

➢ *Antidiabetic Indian Spices:*

In our daily lives, we use herbs and spices extensively as vital food flavorings and seasonings. Their antioxidant, anti-inflammatory, anticancer, anti-diabetic, neuroprotective, and cardiovascular actions are among their other well-known health benefits. [16,17,18,19,20,21]

Due to their complex combinations of various chemicals, which have the ability to collaboratively influence the activity of several dysregulated and interrelated disease targets, they constitute promising therapeutic approaches. With the possible exception of saffron, they are likewise reasonably priced and readily accessible. While several research studies have been undertaken on the potential anti-diabetic effects of specific herbs and spices, and in select instances, comprehensive scientific assessments have been carried out, the majority of these studies remain unexplored in the scientific community. [22]

Fig 1 Antidiabetic Indian Spices

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➢ *Health Benefits of Spices:*

- *Improve Digestion:*

The capacity of spices to improve digestion is one of their main characteristics. The digestion of dietary lipids and carbohydrates is improved by the addition of ginger, coriander, cumin, turmeric, chili, and peppercorn, which also increase bile volume, bile acid secretion, and pancreatic lipase and amylase activity. Pancreatic trypsin is elevated by peppercorn, ginger, and chili, improving protein digestion.[23,24] Spices can reduce the length of time food takes to move through the digestive tract, which offers some protection against cancers of the gastrointestinal tract. Herbs that reduce gas and bloating are known as carminatives; they are mainly used in culinary or spice applications. The classic examples are peppermint, fennel seed, cinnamon, and anise. Limited research has indicated that fennel alone itself.[25] or in combination with lemon balm and chamomile.[26] Cinnamon is recognized by the German health authorities as a treatment for dyspepsia, bloating, gas, and appetite loss. While herbal liqueurs (digestifs) like anisette and crème de menthe are a traditional method of "taking your medicine," herbal teas (tisanes) also fulfill this function. After a meal, one tablespoon is typically given either by itself or diluted in water to aid in digestion and reduce gas and bloating. Spices and culinary herbs may be quite helpful, given the prevalence of functional dyspepsia in the general population.Ginger (Zingiberofficinale Rosc.) has been used for at least 2,000 years, and its digestive and antiemetic qualities are widely acknowledged in popular culture.Hyperemesis gravidarum, chemotherapy-induced nausea and vomiting, and travel sickness have all been treated with ginger, a common home remedyA analysis of six randomized controlled trials revealed that 1.0 to 1.5 g/day of dried ginger is effective for treating pregnancy-related nausea and vomiting, with little risk of side effects, although inconsistent results for the latter two conditions.[27]

- *Mediate Inflammation and Pain:*

As opposed to their pharmaceutical equivalent, various plants control swelling through a variety of mechanisms as opposed to only one enzyme at a time during the inflammatory cataract. For example, ginger inhibits 5-lipoxygenase (5-LOX) and cyclooxygenase (COX) 1 and 2, but it also inhibits inducible genes that code for chemokines and inflammatory cytokines.[28] Turmeric (Curcuma longa L.) and ginger have been used for arthritis since ancient times.Clinical trials using ginger as a stand-alone treatment for osteoarthritis have produced mixed results; two small studies suggest that combining ginger, turmeric, ashwaganda, and boswellia may reduce inflammation associated with rheumatoid arthritis.[29] Capsicum frutescens L., or chili peppers, were employed as a topical analgesic in traditional medicine. Today, it's common to discover ointments containing the active capsaicinoids that are intended to relieve the pain of muscle strain, arthritis, and neuropathy. [30] When capsaicin binds to the vanilloid receptor subtype 1 (VR1), which is expressed in vagal nerves and primary sensory neurons, it triggers the release of substance P, a molecule that is responsible for transmitting pain from nerve terminals. After sustained treatment, substance P eventually drains from the nerve terminals, causing the desensitization of sensory neurons and the loss of pain perception.[31] In dentistry, clove (Eugenia caryophyllata THUMB) bud essential oil is well-known; a recent study found that it is just as efficient in reducing dental pain as benzocaine.[32]

- *Antimicrobial:*

For many years, antibiotic resistance has been an increasing issue. Many components found in plants, such as phenols, quinones, flavones, tannins, terpenoids, and alkaloids, have antibacterial properties.[33] A few culinary herbs and spices also have antiadhesive qualities, which are compounds that stop microbes from adhering to host tissue and so stopping the initial point of infection. Some, like garlic, may increase the activity of immune cells. To some extent, all culinary herbs and spices possess antibacterial properties. There are just too many to mention here, but here are a couple. In 1858, Louis Pasteur established that garlic (Allium sativum L.) possessed antibacterial properties. According to Albert Schweitzer, it works well to treat amoebic dysentery. Garlic has been shown to have antimicrobial activity by modern research. It works well against a number of illnesses, including Giardia intestinalistrophozoites and Salmonella and Escherichia coli O15, [34] which can also cause quite severe diarrhea. The latter is still a leading global cause of gastrointestinal tract infections.[35] Garlic is a common, inexpensive, and safe spice that may have implications for public health in areas where infectious diarrhea is common. In the United States, basil (Ocimum basilicum L., O. sanctum L.) is not often seen in herbal ointments and creams, but it has long been utilized for a variety of issues, including wound care.Its effectiveness as an antibacterial and vulnerary (wound-healing) agent has been confirmed by research. Staphylococcus aureus is a common skin infection that is extremely susceptible to the essential oil fraction's bactericidal effects. [36] Additionally, holy basil leaf ethanolic extracts significantly promote wound healing, even in animals when dexamethasone suppression is present.[37] When it comes to treating decubitus ulcers, this could be especially relevant. A lot of cough drops and mouthwashes are commercially manufactured with thyme essential oil. Thyme is a strong antifungal that is especially helpful in treating oral candidiasis. It is also a potent antibacterial that exhibits broad spectrum effectiveness against forms of bacteria resistant to antibiotics. [38,39] The need for novel antifungal medications is increasing due to the emergence of strains resistant to fluconazole and nystatin. Diluted thyme tincture works well for newborn thrush and vaginal yeast infections, in my experience. Additionally, models of vaginal candidiasis have demonstrated the effectiveness of clove bud essential oil.[40]

- *Chemoprevention:*

A wide range of compounds found in culinary and spices herbs may lower the chance of developing certain malignancies.A meta-analysis encompassing seven epidemiological studies revealed an inverse correlation

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between the consumption of raw and cooked garlic and the incidence of colorectal cancer. [41] The results of a population-based study were published in the Journal of the National Cancer Institute in 2002. Regardless of other dietary considerations, the study indicated that men who ingested large amounts of Allium, particularly garlic and scallions, had a decreased risk of prostate cancer.[42] An increasing body of research indicates that turmeric may lower the incidence of skin, prostate, and colorectal cancers.[43] Turmeric, ginger, chili, and cumin have bactericidal properties against Helicobacter pylori, the world's most common cause of stomach cancer and a bacterium that raises the risk of gastrointestinal ulcers.Turmeric not only has immediate antibacterial effects, but also diminishes the bacterium's attachment to the stomach lining, showing great potential for further research.[44] Although triple therapy, which consists of two antibiotics and a proton pump inhibitor, is now the advised course of treatment, other methods are being investigated due to the rise in antibiotic resistance.

- *Respiratory Health:*

Numerous aromatic herbs have been utilized to treat both acute and long-term respiratory conditions. German health authorities have approved thyme, including Thymus vulgaris L. and other species, for the treatment of bronchitis and respiratory infections because it is widely used in traditional medicine to treat bronchitis and asthma. Thorne syrup has been shown in small trials to alleviate bronchitis symptoms when combined with ivy and/or primrose[45,46]. Additionally, fundamental science has shown thyme to be a strong inhibitor of 5-LOX.[47] This may account for some of its positive effects on inflammation in the respiratory system. Ayurvedic medicine has employed holy basil, which likewise inhibits 5-LOX, to treat a wide range of conditions, including asthma and bronchitis.[48] My personal favorite and a traditional cure for a sore throat and cough is sage tea. In a recent phase II/III experiment, a sage spray (15% Salvia officinalis fluid extract) was found to be more effective than a placebo spray for relieving acute viral pharyngitis; the sage spray showed statistically significant improvement over the placebo within the first two hours after treatment.[49]

- *Alzheimer's Dementia:*

Epidemiological research points to a potential link between older Indian populations' high turmeric (curry) consumption and a lower incidence of neurological disorders like Alzheimer's dementia (AD). Curcumin, an active polyphenol found in turmeric, has been shown to reduce the course of Alzheimer's disease (AD) in rats, according to research from the University of California, Los Angeles [50]. To further clarify its safety and efficacy, studies on AD humans are presently being conducted.[51] Given that sage has been used as medicine for such a long time, its genus name, salvia, comes from the verb salvere, which means "to save."In addition to its antibacterial, astringent, and carminative qualities, sage has also been said to have memory-improving and clarifying qualities. The term "sage" can also refer to knowledge or an experienced person. It's interesting to note that there might be some truth to the sage-mind connection. Researchers have discovered that the enzyme acetylcholinesterase, which is the target of many Alzheimer's medications, is inhibited by the essential oil portion of Salvia officinalis and Salvia lavandifolia. Sage may enhance mood and cognition in healthy persons as well as those suffering from Alzheimer's disease, according to in vitro research, animal studies, and limited human clinical trials.[52]

- *Diabetes:*

The hunt is currently underway for natural compounds that have the potential to prevent or reduce the risk of diabetes. Cinnamon is one spice that is becoming more popular.Data from both in vitro and animal models show that cinnamon either directly activates insulin-producing cells or improves the sensitivity of insulin receptors.[53] Results from small clinical trials have been inconsistent. One g/day of C. cassia (roughly 1/4 to 1/2 teaspoon) reduced serum blood glucose by 20% in a study involving 60 patients with type 2 diabetes; cholesterol and triglycerides were also lowered[54]. After four months of taking an aqueous extract of cinnamon equivalent to three g/day, 79 patients with type 2 diabetes who were in a placebo-controlled study reported a 10% reduction in serum glucose.[55] A more recent trial, however, using 25 postmenopausal women, did not show significant improvement in lipids or serum glucose levels following a six-week course of one gram per day of C. cassia.[56] It appears appropriate for people who enjoy the spice to include it in their diets given its pleasant taste and safety. In addition to adding flavor and taste to food, spices and culinary herbs have long been used as a source of dietary medicine. This is still the case today. They can add taste and turn a typical meal into a delightful treat without adding extra fat, calories, salt, or artificial flavors. They also include an abundance of phytonutrients and antioxidants that support health and lower the risk of disease.You should aim for variety in the spices and herbs you use to flavor your meal, just as you would desire variation in the foods you eat.Investing in a few quality cookbooks could be one of the best gifts you can give yourself for your health! Now go ahead and try out these fragrant treats; just keep in mind that there's a "reason to season.

II. REVIEW OF LITERATURE

A. Pimpinellaanisum l.

Pimpinellaanisum L., Among the earliest known medicinal plants is a member of the Umbelliferae family. It is an annual grassy plant that grows in the Eastern Mediterranean Region, West Asia, the Middle East, Mexico, Egypt, and Spain. It has white flowers and little green to yellow seeds. It is 30 to 50 cm high. The main purpose of P. anisum cultivation is for its fruits, or aniseeds, which are gathered in August and September.[57]

➢ *Scientific Classification of the Plant*

- Kingdom: Plantae.
- Subkingdom: Viridiplantae – green plants
- Superdivision: Embyophyta

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- Order: Apiales
- Family: Umbelliferae
- Genera:Pimpinella.
- Species: anisum.

Fig 2 *Pimpinellaanisum l.*

Aromatic herbs, like anise seed, have a wide history of usage in conventional and folk medicine, as well as the pharmaceutical sector. Anise alcohol, acetophenone, p-anisaldehyde, estragol, pinene, and limonene are among the significant components present in anise seeds. However, anethole is the most significant volatile oil responsible for imparting the seeds' distinctively sweet and aromatic flavor. Recent research has demonstrated the antiviral, analgesic, gastro-protective, antibacterial, antifungal, anticonvulsant, antioxidant, and analgesic properties of anise seeds and essential oil.

The stimulant,expectorant, carminative, vermifuge, insecticide, antirheumatic, digestive, antispasmodic, antihysteric, antiseptic, antiepileptic, culinary significance, blood pressure-controlling role that keeps the heart strong, best gas-releasing agent, relief from numerous female hormonal problems, benefits for the skin and hair, and potential reduction in depressive symptoms are some of the other significant benefits of anise seeds. Anise seed and its extract were widely utilized in savory dishes, baked goods, and other beverages in both ancient and modern times. Anise seeds are a great source of several essential B-complex vitamins, such as pyridoxine, niacin, riboflavin, and thiamin. Significant levels of minerals such as calcium, copper, potassium, iron, manganese, magnesium, and zinc can also be found in the seeds. The spices contain antioxidants like vitamins A and C as well.[58]

➢ *Studies on Antidiabetic effect of Pimpinellaanisum:*

Using in vitro methods and model systems, the antidiabetic activity, inhibitory effect, and lipid peroxidation (a sign of oxidative stress) of different aniseed (Pimpinellaanisum L.) fractions were assessed. These fractions were obtained by sequentially fractionating methanolic extract using hexane, benzene, ethyl acetate, n-butanol, and water.The ethyl acetate fraction demonstrated the strongest anti-peroxidative effect in the liver homogenate model (IC50 199µg/ml) and linoleic acid model system (IC50 185µg/ml), as well as the strongest anti-diabetic activity in terms of α-glucosidase and α-amylase inhibitory activities (IC50 0.12 mg/ml and 0.15 mg/ml, respectively). All aniseed fractions and the methanolic extract demonstrated dose-dependent anti-peroxidative and anti-diabetic activitiesThin layer chromatography (TLC) and flash chromatography revealed that the ethyl acetate fraction of aniseeds was more powerful than the other fractions. Several polyphenolic chemicals were found throughout this process, with luteolin and apigenin being more common than the others based on the analytical data produced. Therefore, the phenolic compounds included in aniseeds offer promise as a natural source of radical scavengers as well as anti-peroxidative, anti-diabetic, and other medications that may be useful in lessening the oxidative stress caused by free radicals.[59]

In a different study, patients with type 2 diabetes were evaluated for the anti-diabetic, hypolipidemic, and antioxidant qualities of aniseeds and coriander seeds. Two groups of patients with type 2 diabetes were given the seed powders (5 g/day) for sixty days. The results revealed that the type 2 diabetics treated with aniseed experienced a 36% reduction in fasting blood glucose, whereas the group treated with coriander experienced a 13% decrease. Moreover, individuals given aniseed and coriander seeds showed a significant decrease in blood triglycerides and cholesterol. Both treatment groups showed a decrease in serum protein oxidation and plasma and erythrocyte lipid peroxidation as compared to baseline values.Lipid peroxidation in RBC and plasma was significantly reduced in both groups, possibly due to an increase in serum levels of vitamin A and β-carotene. Furthermore, there was an increase in vitamin C in the groups that included anise and coriander. Consequently, both seeds have hypolipidemic, antidiabetic, and antioxidant qualities in diabetic individuals.[60]

B. Piper Nigrum

Black pepper, also called Piper nigrum, is commonly used in many traditional medical systems, including Ayurveda and Unani medicine. It is grown in several tropical countries, including Brazil, Indonesia, and India. Common names for Piper nigrum include Peppercorn, White, Green, Black, and Madagascar pepper in English; Milagu in Tamil; Pippali in Sanskrit; and Kali Mirch in Urdu and Hindi. The main pungent alkaloid present in it is piperine (1-peperoyl piperidine), which has several intriguing pharmacological properties.

➢ *Scientific Classification of the Plant*

- Kingdom: Plantae
- Class: Equisetopsida
- Sub class: Magnoliidae
- Order: Piperales
- Family: Piperaceae
- Genus: Piper
- Species: nigrum

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Fig 3 Piper nigrum

The woody perennial climbing vine Piper nigrum, also known as black pepper, is a flowering member of the Piperaceae family. Pepper plants can easily grow up to 13 feet (4 meters) in height on trellises, supporting trees or poles in the shade. If the vine touches the ground, roots may emerge from the leaf nodes. The plants have alternating heart-shaped leaves that are usually enormous, measuring 5-10 cm in length and 3-5 cm in width, and they contain five to seven noticeable palmate veinsThe small, monoecious flowers can be polygamous, meaning they have both male and female parts, but they also have distinct male and female components.

At the leaf nodes, tiny flowers are carried on pendulous spikes that are almost as long as the leaves themselves. Spike lengths range from 7 to 15 cm. The little, 3 to 4 mm diameter fruits of black pepper are known as drupes, whereas the dried, unripe fruits of Piper nigrum are called peppercorns. The fruits are dark crimson in color and have a diameter of around 5 mm when fully mature. A fruit has only one seed in it. The plants begin to provide fruit in their fourth or fifth year and continue to do so for up to seven years. There are twenty to thirty fruit spikes on a single stem.[61]

➢ *Studies on Antidiabetic effect of Piper Nigrum:*

On normal mice piper has hypoglycemic effect. In hyperglycemic rats, oral treatment of dried fruits from Piper longum has demonstrated strong anti-hyperglycemic, antioxidant, and antilipidperoxidative properties. In a different investigation, Atal et al. found that piper influences blood sugar levels in both acute and subacute study models in mice with alloxan-induced diabetes. Using piperine orally at 5, 10, 20, and 40 mg/kg body weight in the subacute experiment significantly reduced the blood glucose level; at high doses, however, in the acute inquiry, blood glucose increased.

Blood free and total cholesterol as well as liver total cholesterol did not significantly change in rats given a standard diet supplemented with 0.02%, 0.15%, 0.5%, 2.0%, and 5% pepper or 0.05% piperine or pepper oleoresin at 11%, 22%, and 44% levels over the course of seven to eight weeks. On the other hand, Cho and Lee found that giving rats 5% black pepper in their diet for eight weeks caused a noticeable rise in blood cholesterol. Dietary black pepper did not have an impact on hepatic cholesterol-7a-hydroxylase, the enzyme that limits the rate at which cholesterol is converted to bile acids. The amounts of cholesterol in the liver or serum were unaffected.

It is commonly known that the production of free radicals and complications related to diabetes are linked. In animal models, phenolics effectively prevent diabetes. Black pepper oil has antioxidant qualities that include radical scavenging and ferric reduction. Research has indicated that piperine possesses antioxidant properties, and that oxidative stress is the primary cause of diabetes. In their investigation, Vijayakumar et al. found that black pepper consumption has an impact on oxidative stress, enzymatic and nonenzymatic antioxidants, and membrane lipid peroxidation in rats. In alloxan-induced diabetic mice, V rosea and P nigrum were administered once daily for 4 weeks, which effectively controlled blood sugar levels and affected levels of lipid and antioxidant potential.When it comes to antioxidant capacity, Piper nigrum outperforms Zingiberofficinale and Piper longum. Diabetes is characterized by a substantial increase in serum lipid levels because of insulin resistance and altered metabolic mechanisms that lead to fat buildup. According to Nabi et al., a 200 mg/kg dose of an aq. extract of Piper longum roots dramatically lowered serum enzyme levels as well as levels of cholestrol, gulucose, triglycerides, LDL-C, and VLDL-C.[62]

C. Cuminumcyminum l.

Originating in Egypt, cumin has been grown for millennia across the Middle East, India, China, and Mediterranean nations.The plant may have come from Egypt or Syria in the Mediterranean region. These days, Palestine, Iraq, Libya, India, China, and Turkey all have large-scale cultivations of it. Iran used to be the country that sent the most cumin to the US. But as of right now, China, India, and Turkey provide substitutes.Currently; most of the cumin used worldwide is produced in India, specifically in the regions of Rajasthan and Gujarat.

➢ *Scientific Classification of the Plant*

- Kingdom: Plantae
- Class: Magnoliopsida
- Sub class: Viridiplantae-green plants
- Order: Apiales
- Family: Apiaceae
- Genus: Cuminum
- Species:cyminum

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Fig 4 Cuminumcyminum

➢ *Traditional uses:*

Cumin was used in ancient medicine to cure diarrhea, dyspepsia, jaundice, and hoarseness. Its seeds were utilized because of their stomachic, diuretic, carminative, stimulant, astringent, and abortifacient properties. In addition to being used in perfumery, cumin oil was a spice in cheeses, pickles, meats, chutneys, soups, stews, and curry powders. In America, Africa, and India, the drug is used as an emmenagogue and an abortive. In Indonesia, it was applied to the forehead to alleviate bloody diarrhea and migraines. For rheumatic ailments, oral usage was also developed. In India, cumin was used as an abortifacient and to cure kidney and bladder stones, leprosy, chronic diarrhea, and eye problems. The fruits of Cuminumcyminum were utilized in the Unani medical system as an emmenagogue, carminative, and astringent to cure boils, styes, ulcers, and corneal opacities.

➢ *Studies on the Antidiabetic effect of Cuminumcyminum:*

The seed powder (2 g/kg) which is taken by oral administration decreases the level of glucose in blood in hyperglycaemicrabbits(133Rats with diabetes induced by streptozotocin were used to test the antidiabetic properties of cumin seeds. Reduced hyperglycemia and glucosuria were two signs of the remarkable benefits of an 8 week regimen (dietary) that included powder of cumin (1.25%). In addition, the diabetic animals' body weights increased. Additionally, dietary cumin reversed additional metabolic changes, as seen by decreased blood urea levels and decreased urea and creatinine excretions in diabetic mice (134). It was discovered that cuminaldehyde and cuminol were strong insulinotrophic agents. 3.34- and 3.85-fold increases in insulin secretion were seen with cuminaldehyde and cuminol (25 μg/ml), respectively. Both components had an insulinotrophic effect that was glucose-dependent and resulted from an increase in intracellular Ca2+ concentration and the closure of the ATP-sensitive K (K-ATP) channel. From the similar petroleum ether fraction, another powerful β-cell protecting agent that inhibits insulin secretion was also identified. The scientists determined that lowering blood sugar levels with cuminumcyminum did not result in hypoglycemia or β-cell burnout (135). In comparison to glibenclamide, the impact of Cuminum cyminum (CC) seed methanolic extract on oxidative stress, diabetes, and the development of advanced glycated end products (AGE) was examined.In vitro studies revealed that CC inhibited the generation of free radicals and AGEs. Treatment of streptozotocin-diabetic rats with CC and glibenclamide for 28 days led to improved levels of serum insulin and glycogen (liver and skeletal muscle) and decreased levels of blood glucose, creatinine, blood urea nitrogen, and glycosylated hemoglobinRenal oxidative stress and AGE were significantly reduced with CC in comparison to glibenclamide and diabetes control.In diabetic rats, glibenclamide and CC also enhanced the antioxidant state of the kidney and pancreas. Diabetic rats showed increased levels of glycated collagen, collagen related fluorescence, rat tail tendon collagen, and pepsin digestion (136).

In alloxan diabetic rats, the effects of supplementing with cuminumcyminum on plasma and tissue lipids were investigated. For six weeks, diabetic rats given an oral dose of 0.25 g/kg body weight of Cuminumcyminum experienced a significant decrease in blood glucose levels and an increase in both total and glycosylated hemoglobin. It also stopped the body weight from dropping. Significant fatty alterations and inflammatory cell infiltrates were seen in the diabetic rat pancreas according to histological examinations; however, the fatty alterations and inflammatory cell infiltrates were dramatically decreased in diabetic rats after supplementing with cuminumcyminum. Furthermore, it was discovered that supplementing with cuminum cyminum was superior to glibenclamide in the management of diabetes mellitus.[63]

D. Coriandrumsativum l.

The year-round cultivation of coriander (Coriandrumsativum L.), a member of the Apiaceae (Umbelliferae) family, begins with its seeds. India is the greatest producer, consumer, and exporter of coriander in the world, with an annual production of almost three lakh tons. This herbaceous annual plant is said to have therapeutic qualities. It is indigenous to the Middle East and Mediterranean. It contains between 0.03 and 2.6% essential oil.

➢ *Scientific Classification of the Plant*

- Kingdom: Plantae
- Class: Magnoliolipsida
- Sub class: Viridiplantae-green plants
- Order: Apiales
- Family: Apiaceae
- Genus: Coriandrum
- Species:sativum

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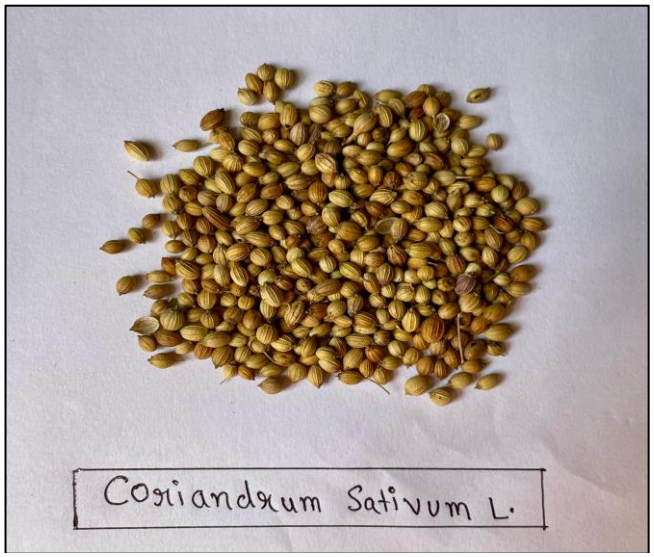

Fig 5 Coriandrumsativum l.

➢ *Traditional uses:*

Coriandrumsativum l. is commonly known as "Dhanya" in India. Dhaniya is very frangranced and is used in many different industries, including food. For millennium, plants have been essential to preserving human health and elevating the standard of living. Sausage is also flavored with it. The entire plant is edible, and fresh leaves are frequently used as an ingredient in salads and chutneys as well as a garnish. The green herb is also used to prepare the solvent-extracted oleoresin or steam-distilled essential oil. Coriander juice, when fresh, is very beneficial for treating numerous iron and vitamin deficits. Its juice, one or two teaspoons, when mixed with cool buttermilk, is immensely helpful in healing a wide range of ailments.

Because they have so many health benefits, fresh leaves can be eaten raw. However, if the leaves are not plucked, the seeds grown and fully developed in end of summer, giving off a subtle scent that can be used as dry form of spice. Additionally, dhaniya plant is utilized to treat illnesses such as respiratory tract infections, digestive tract abnormalities, and urinary tract infections. Numerous pharmacological properties of coriander have been documented, including antilipidemic, anti-spasmodic, anti-diabetes, antioxidative, and anti-mutagenic properties. A key component in pickle preparation is dried coriander fruit. It's occasionally used to cover over strange flavors. Vegetable oil rich in monounsaturated fatty acids, particularly petroselinic acid, is found in the fruits of this plant.

There are several ways to extract this oil; the three most commonly used techniques are organic solvent extraction (sometimes called soxhlet extraction), supercritical fluid extraction, and steam distillation. Coriander oil is also used as an antimicrobial agent due to its broad spectrum antibacterial activity. This oil can be encapsulated in alginates, chitosan, and other materials to aid in the separation, preservation, transportation, and release of its active ingredients, which include vitamins, flavors, peptides, minerals, fatty acids, polyunsaturated fatty acids, antioxidants, enzymes, and living cells. Coriander powder and essential oil are utilized as natural food preservatives because of their antibacterial, antifungal, and antioxidant properties. The commercial worth of an essential oil is determined by its physical characteristics, chemical composition, and fragrance quality.[64]

➢ *Studies on the Antidiabetic effect of Coriandrumsativum*

Coriander seed extract is a traditional medicine used by diabetic patients. When powdered coriander seed extract was given to diabetic rats, their insulin levels rose and their blood glucose levels sharply dropped. In addition to inhibiting peroxidative damage, the administration of its seed extract restored antioxidant levels and antioxidant enzymes in rats with diabetes.[65] Coriander's ability to release insulin and resemble insulin was investigated by Gray and Flatt (1999).[66]It was demonstrated that ingesting it aqueously increased the synthesis of insulin by colon B-cell lines by a ratio of 1.3–5.7. An aqueous extract of coriander (1 mg/ml) improved the 2-deoxyglucose transport, glucose oxidation, and glucose absorption into glycogen of isolated murine abdominal muscle.

E. Trachyspermumammi

Known as Ajwain, *Trachyspermumammi (L.)* belonging to the highly valued medicinally important family, Apiaceae. According to reports, the herb is commonly grown in dried and semi-dried areas with highly salted soil. Although ajwain is native to Egypt, it is grown and distributed widely over the world, including Iran, Pakistan, Afghanistan, India, and Europe. The herb should be picked in May or June, and it is typically grown in October or November.

➢ *Scientific Classification of the Plant*

- Kingdom-Plantae
- Division- magnoliophyta
- Class- magnoliopsida
- Order-Apiales
- Family-Apiaceae
- Genus -Trachyspermum Species-ammi

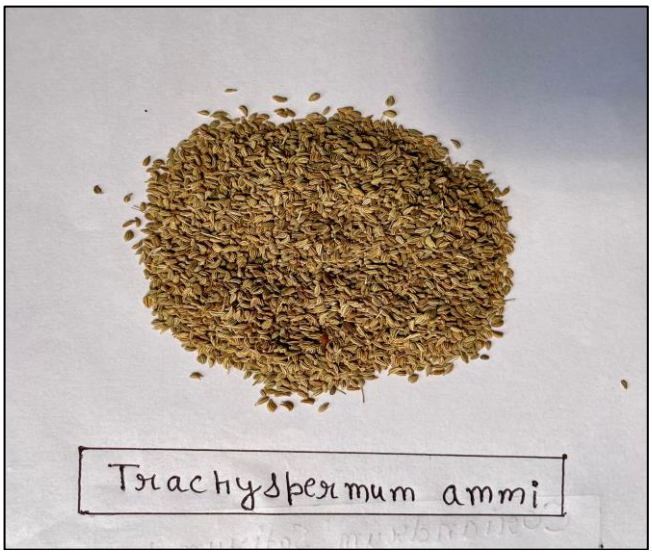

Fig 6 Trachyspermumammi

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- *Uses:*

Traditional medical systems have long employed ajwain for a range of pharmacological and therapeutic purposes. Ajwain was well-known in TPM i.e Traditional Persian Medicine for thousands of years. Ajwain's temperament can be described as hot and dry in the third degree, with hints of bitterness and acridity. In the realm of neurology, oral application of seed has been claimed to be beneficial for tremor, palsy, paralysis, and other neural problems.

In order to treat auditory weakness and control diseased situations, Persian practitioners also used ocular and ear drops made from Ajwain seeds. Fruits were often used to treat liver and spleen conditions as well as gastrointestinal issues such nausea, vomiting, reflux, cramping in the abdomen, and appetite loss. They were also claimed to have carminative and stimulating qualities, and to be helpful for gastrointestinal issues.

Ajwain has been documented as an anthelmintic and an antidote for a number of naturally occurring poisonous substances. If combined with wine, it was also thought to help dissolve calculi and stones. The seeds were also thought to have aphrodisiac, galactagogue, and diuretic properties by Persian healers. Traditional medical systems have long employed ajwain for a range of pharmacological and therapeutic purposes. Ajwain was well-known in Traditional Persian Medicine (TPM) for thousands of years. Ajwain's temperament can be described as hot and dry in the third degree, with hints of bitterness and acridity.

In order to treat auditory weakness and control diseased situations, Persian practitioners also used ocular and ear drops made from Ajwain seeds. Ajwain has been also useful in the treatment of cough, pleurisy, and dysphonia in the respiratory system. Fruits were commonly used to treat liver and spleen conditions as well as GIT issues like vomiting, reflux, nausea and appetite loss. They were also claimed to have carminative and stimulating qualities, and to be helpful for gastrointestinal issues.It has been shown that ajwain functions as both an anthelmintic and an antidote for several naturally occurring toxic chemicals. It was also believed to aid in the dissolution of calculi and stones when mixed with wine.The seeds were also thought to have aphrodisiac, galactagogue, and diuretic properties by Persian healers.[67]

- *Studies on the Antidiabetic effect of Trachyspermumammi*

GC/MS was used to examine the essential oil of the bark of Cinnamomum zeylanicum Blume and the seeds of Trachyspermum ammi (L.) Sprague, both of which are grown in Iraq.The essential oils were extracted using a procedure called hydrodistillation. We also looked into how α-glucosidase inhibition affected the ethanolic extracts and essential oils from T. ammi seeds and C. zeylanicum bark. Twenty-two components totaling 99.18% were extracted from the essential oil of T. ammi seeds, and fourteen elements totaling 99.92% were extracted from the essential oil of C. zeylanicum bark.The two main ingredients of the essential oil extracted from the bark of C. zeylanicum were eugenol (1.58%) and cinnamic aldehyde (95.89%). T. ammi seeds were primarily composed of thymol (62.52%), p-cymene (20.26%), γ-terpinene (12.77%), and β-pinene (2.24%). The α-glucosidase inhibition test results indicated concentration-dependent enzyme inhibition, with IC50 values for the ethanolic extract and essential oil of C. zeylanicum bark being 90±0.85 and 180±2.61, respectively; and for the essential oil and ethanolic extract of T. ammi seeds being 160±1.27 and 220±2.03, respectively. The results of this investigation demonstrated that by blocking the α-glucosidase enzyme, the bark of C. zeylanicum and the seeds of T. ammi can be utilized to lower postprandial hyperglycemia.[68]

In a different study, the essential oils of Zataria multiflora, Thymus kotschyanus, Oliveriadecumbens, and Trachyspermum ammmi were combined with gelatin-pectin composite to examine their in vitro antidiabetic and antioxidant properties.The gas chromatography–mass spectrometry characterization indicates that the main constituents of the essential oils are thymol (1.2%–86.4%), carvacrol (3.2%–52.4%), gamma-terpinene (0.0%–12.7%), para-cymene (3.2%–5.2%), geraniol (0.0%–14.5%), and spathulenol (0.0%–13.6%). The gelatin-pectin composite displayed low conductivity (265–278 µS/cm), low surface tension (19.0–23.5 mN/m), low Newtonian viscosity (23.7–28.5 mPa.s), negative zeta-potential (14.2–16.9 mV), and nanoscale particle size (313–336 nm) upon the addition of the essential oils. Additionally, the pH (2.40–3.04) was acidic. These rheological properties cause globular gelatin-pectin nanoparticles to develop, with a size range of 500–700 nm. The FTIR spectra of the essential oils and the gelatin-pectin showed some resemblance, suggesting noncovalent interactions between them.Anti-glucose oxidation (130–150 µg/ml), antilipid peroxidation (120–130 µg/ml), antiprotein oxidation (150–168 µg/ml), antiprotein glycation (145–170 µg/ml), antiamylase (216–230 µg/ml), and antiglucosidase (212–238 µg/ml) activity were demonstrated by the gelatin-pectin composite.The gelatin-pectin composite's antioxidant capacity was greatly enhanced by the essential oils, establishing it as a natural ingredient that can be recommended for the treatment of oxidative stress.[69]

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Table 1 Previously Studied Antidiabetic Spices [70,71]

S.no	Botanical name	Common name	Parts used	References
1	*CinnamomumzeylanicumBreyn.*	Cinnamon (Cn)	Bark	Hemlata et al (2019)
2	*Cuminumcyminum L.*	Cumin (Cm)	Seeds	Hemlata et al (2019)
3	*Syzygiumaromaticum (L)*	Clove (Cl)	Buds	Hemlata et al (2019)
4	*Foeniculumvulgare*	Fennel (Fn)	Seeds	Hemlata et al (2019)
5	*Trigonellafoenum-graecum L.*	Fenugreek (Fg)	Seeds	Hemlata et al (2019)
6	*Myristicafragrans*	Nutmeg (Nm)	Seeds	Hemlata et al (2019)
7	*Piper nigrum*	Black pepper	Fruit, leaves and seeds	Upasani et al (2013)
8	*Elettariacardamomum*	Cardamom	Seeds and leaves	Hemlata et al (2019)
9	*CinnamomumzeylanicumBreyn.*	Cinnamon	Bark	Hemlata et al (2018)
10	*Curcuma longa*	Halad, haldi	Tuber	Upasani et al (2013)
11	*Allium Sativum*	Garlic	Bulb, leaves, flowers	Otunola&Afolayan(2014)
12	*Zingiberofficinale*	Ginger	Stem	Otunola&Afolayan (2014)
13	(*Pimpinellaanisum* L.)	Anise	Seeds, roots and l eaves	Shobha RI et al (2013)

III. EXTRACTION AND SCREENING

➢ *Preparation of Extracts*

The collected spices seeds were grinded to form spices powder, 10 g of the powdered spices were weighed, combined with 100 ml of distilled water in conical flasks, and put down in a rotatory shaker set to rotate at 150 rpm for a whole day. Whatman No. 1 filter paper was used to filter it after a day. Drying was achieved by evaporating the filtrates at 40 degree celsius in a hot air oven. Before being used, the extracts were kept in sample bottles.

Fig 7 Filteration of Spices to form the Extract

➢ *Qualitative Analysis of Phytochemicals in Spices Crude Extracts*

The presence of different secondary metabolites, including saponins, tannins, carbohydrates, and alkaloids, was examined in the crude extracts of the spices.The various tests were performed by using the stocks prepared for each spice extract:

- *Fehling Test:*

One milliliter of extract and one milliliter of newly made Fehling solution were mixed and boiled in a water bath. Brick-red precipitate suggested the presence of carbs.

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Fig 8 Fehling Test for Carbohydrates

Fig 9 Heating of Solution

- *Gelatin Test for Tannins:*

1 ml of extract was mixed with 50 µl of gelatin. The appearance of white precipitate indicates presence of tannins.

Fig 10 Gelatin Test for Tannins

- *Dragendorff's Test for Alkaloids:*

A 500 µl dose of Dragendorff's reagent was put beside the test tube holding one milliliter of extract. Alkaloids were present when an orange or orange-reddish precipitate formed.

- *Foam Test for Saponins:*

We dissolved 10 milligrams of extract in 20 milliliters of water. After giving the mixture a good shake, the mixture was watched for a stable, long-lasting foam for fifteen minutes. The appearance of foam at the surface suggested that saponin was present.

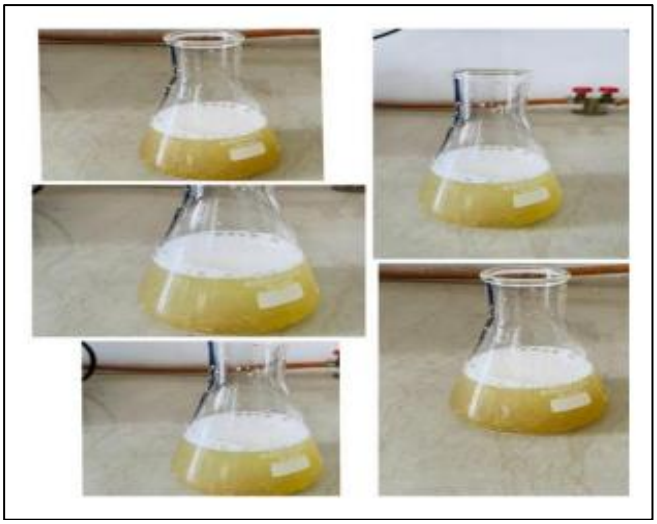

Fig 11 Foam Test for Saponin

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IV. DISCUSSION

➢ *Collection of Plants:*

For the present study different five different spices samples has beencollected from the local market. Black pepper seeds, anise seeds, corom seeds and coriander seeds were studied for their antidiabetic potential.

Fig 12 Spices Collected from the Local Market

Fig 13 The Spices were Converted in Powdered form and then Dissolved in 100 ml of Water used as Solvent

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Fig 14 The Mixture of Spices were Shaken for 24 Hours in Incubator

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V. SUMMARY AND CONCLUSION

From the local market 5 different types of spices were collected and grinded well to make them in powdered form. Following that, spices crude extracts were prepared by filtrationand the extract were weighed in five different labeled test tube.All the five spices are anti-diabetic as each of them are able to reduce the activity of the enzyme alpha-amylase, which has the function of breaking down the glycosidic bonds of starch molecules into small-chain dextrins.

The five spices extracts were then checked for the presence of phytochemicals like saponins, alkaloids, tannins and carbohydrates. Tannins were found to be present in black pepper, whereas alkaloids were present in both black pepper and anise seeds.

From the above study, it can be concluded that the following spices *Pimpinellaanisum L*(Anise seeds)., *Piper nigrum*(Black Pepper), *Cuminumcyminum L*(Cumin seeds)., *Coriandrumsativum*(Coriander seeds) *and Trachyspermumammi* (Carom seeds) inhibit the activity of the enzyme alpha amylase, thus reducing blood sugar level due to the presence of phytoconstituents. All these spices can be used in the treatment of Diabetes Mellitus, as these are beneficial for the management of blood sugar level. These spices also contain some important phytochemicals like tannins and alkaloids, which enhance their health benefits.

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