IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, February 2026
Impact Factor: 8.2

# A Review of Herbal Antidiabetic Teas in the Management of Diabetes Mellitus

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**Abstract:** *Diabetes mellitus is a common metabolic disorder in which the human body fails to produce insulin hormone, this leads to the increase in blood glucose levels. Diabetes affects more than 387 million people worldwide, posing a significant threat to their personal well-being and global economies. Normally, medicinal plants such as Methi, Kalonji, Dhania, Jeera, Ajwain, Saunf, Pippali, Amla powder, Ashwagandha, Javas, Dried Ginger, Cinnamon, Black Pepper are widely used in the treatment of diabetes mellitus, but other spices are effective to treat diabetes. Still, the spices that we use as ingredients play an important role in food. They can also treat diabetes. This article describes their anti-diabetic activity of those, medicinal spices. Herbal tea also known as a tisane, is a beverage created by steeping dried herbs, flowers, spices, root, in hot water. Herbal tea is usually caffeine free.*

**Keywords:** Diabetes Mellitus, Symptoms, formulation of powder tea, Dosing

## I. INTRODUCTION

Diabetes mellitus is a chronic metabolic condition characterized by hyperglycemia, define as fasting plasma glucose above 7.0 mmol/L, or plasma glucose above 11.1 mmol/L, 2 hours after a meal[1,2]. This condition is caused by insulin deficiency, frequently combined with insulin resistance. The transport of glucose from the systemic circulation into the cell insulin hormone facilitates this process. Absence of this hormone leads to sugar accumulation in the blood[3]. The symptoms of hyperglycemia include polyuria, polydipsia, and polyphagia, urinary tract infection, among others[4]. According to the World Health Organization, at least Diabetes mellitus affects approximately 171 million people worldwide[5]. Drugs used to treat diabetes mellitus include insulin, sulfonylureas (glibenclamide, glimepiride, and glipizide); Biguanides (metformin), meglitinide derivatives, alpha-glucosidase inhibitors; Thiazolidinediones, among others[6]. According to reports, over 1,200 plants have been used in traditional medicine for the management of diabetes mellitus because of hypoglycemic activity[7]. The majority of these plants contain antioxidants, flavonoids, tannins another phytochemical capable of stimulating and regenerating pancreatic beta cells. They Increase insulin secretion and improve glucose uptake in tissues. Combinations of these herbal remedies are usually used in the management of the dieases[8]. Tablets are drug delivery systems that provide an accurate and convenient way of administering unit doses of medications are introduced into the body. They are easy to transport, swallow, and attractive in appearance. The unpleasant odor or taste of the drug could be masked. They shield the medicament.Form atmospheric conditions of moisture, light, or air, thus prolonging their Physicochemical and microbiological stability. Theyare easy to administer and can deliver the intended drug dose with a high degree of accuracy[9].


DOI: 10.48175/IJARSCT-31239

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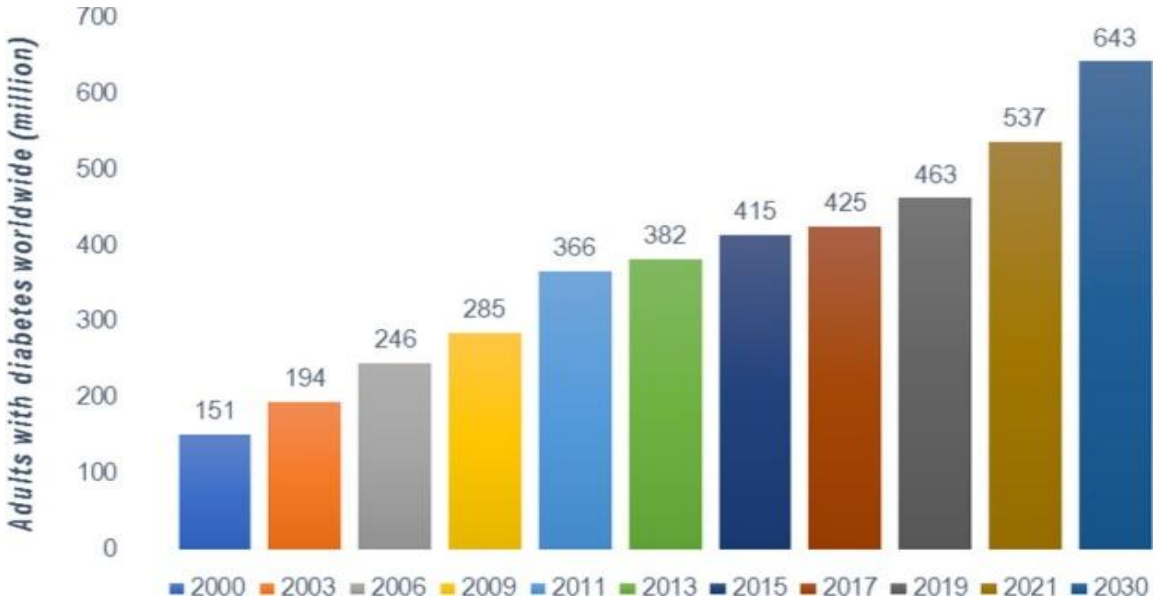


**Figure 1:** Estimate of the global prevalence of diabetes worldwide (20-79-year age group).

## DIABETES MELLITUS

Diabetes mellitus is a major global health concern, and its prevalence is expected to increase from 171 million in 2000 to 366 million in 2030. Diabetes mellitus is defined by habitual Hyperglycemic and postprandial hyperglycemic, both leading to increased micro and macro Vascular morbidity and overall mortality[10, 11].

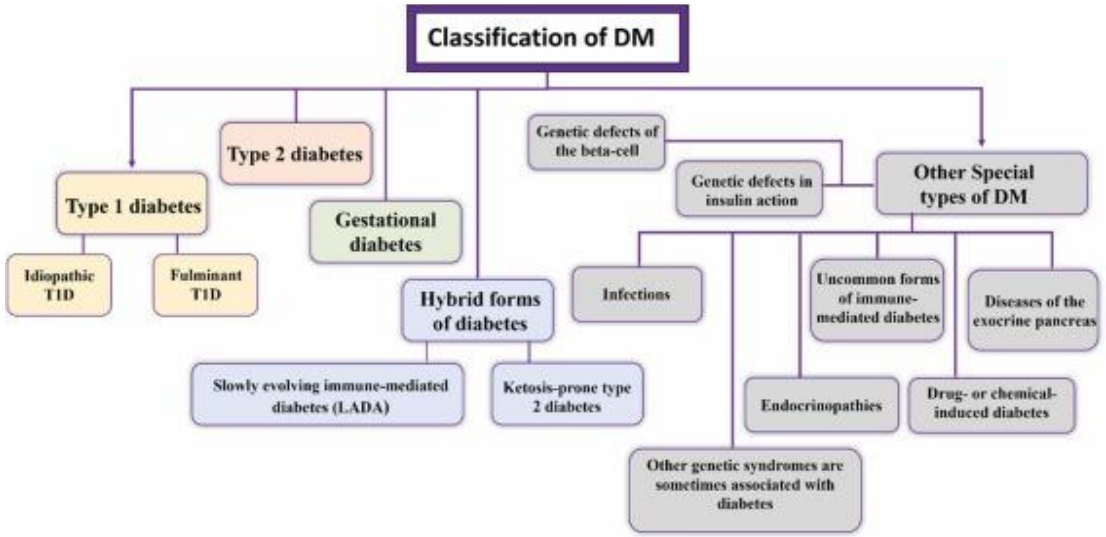


**Fig. 2**: The most recent classification of DM represents the various types and subtypes of Type1 Diabetes, Types 2 Diabetes, gestational diabetes, and hybrid forms of Diabetes (LADA and Ketosis-prone Type 2 Diabetes), and other Special Types of Diabetes[12].

## TYPES OF DIABETES MELLITUS 4

1) Type 1 diabetes mellitus
2) Type 2 diabetes mellitus
3) Gestational Diabetes


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**1) TYPE 1 DIABETES MELLITUS**

Type 1 diabetes mellitus occurs when pancreatic beta cells do not produce enough insulin. Metabolize excess glucose and control hyperglycemia. Type 1 diabetic mellitus affects 5 to 10% of people and is most common in children, so it is also known as "Juvenile diabetes" or "insulin-dependent diabetes"[13]. Several antibodies are generated during T1DM, also known as islet cell antibodies (ICA), glutamic acid decarboxylase (GADA), and Insulinoma the association protein two antibodies (IA2A) and the first autoantibody were detected in T1DM patients. IAA antibodies were detected in T1DM before supplementation with exogenous insulin and produced against the insulin and proinsulin. IA2A and GADA are produced by beta cells. have been identified in 75-80% of T1DM patients. GADA participates in the synthesis of gamma amino butyrate in pancreatic cells. GAD65 is an antigenic target for Type 1 diabetes. The human leukocyte complex (HLA), specifically the DR and DQ genes, contributes significantly to the Pathogenesis of T1DM[14]. Genes like HLA-DQA1, HLA-DQB1, and HLA-DRB1 belonged to the HLA family.

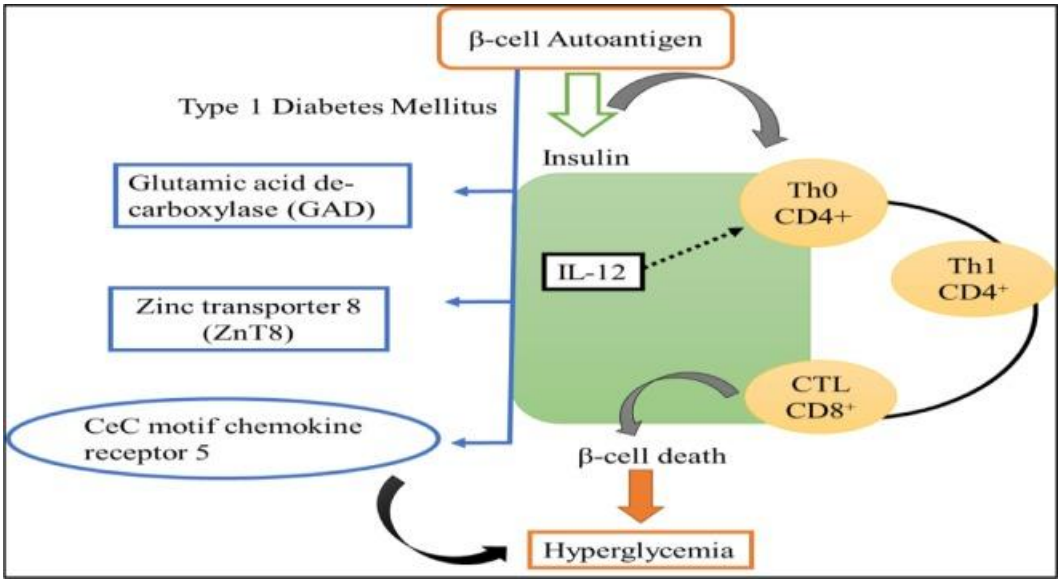


**Fig. 3:** The diagram depicts the progression of type 1 diabetes. Type 1 diabetes autoimmune diseases are cause by the production of beta-cell specific auto antigen production by producing different pro-inflammatory cytokines like IL-12. IL-12production activates the Th0 CD4+, leading to the production of CTL CD8+[15].

**2) TYPE 2 DIABETES MELLITUS**

Type 2 diabetes mellitus also known as adult-onset diabetes, usually starts during old age accounts for approximately 95% of the diabetic population[16]. The features of T2DM cause insulinproduction to decrease and, in some cases, pancreatic beta-cell failure. It reduced transport of glucose into the liver, muscles and adipocytes[17]. The diagnosis of T2DM has been unclear for many years, resulting in chronic effects due to persistent hyperglycemia. It is a polygenic disorder that results from the complex interaction among various genetic and environmental aspects. However, type 2 diabetes is linked to aging and lifestyle conditions, such as sedentary physical inactivity, cigarette smoking and contributes to the progression of T2DM is more significant than type 2 diabetes mellitus (T2DM) [18].

It has been Reported that the threatened risk factors for T2DM are not or organ dependent but develops due to the multiple gene interactions found throughout genome. These genes include KCNJ11 encodes TCF7L2, PPARG, CDKAL1, JAZF1, HHEX, SL30A8 and IGF2BP2. the islet ATP-sensitive potassium channel (transcription factor 7-like 2) that modulates proglucagon gene expression, resulting in the production of GLP-1 (glucagon-like peptide-1)[19].


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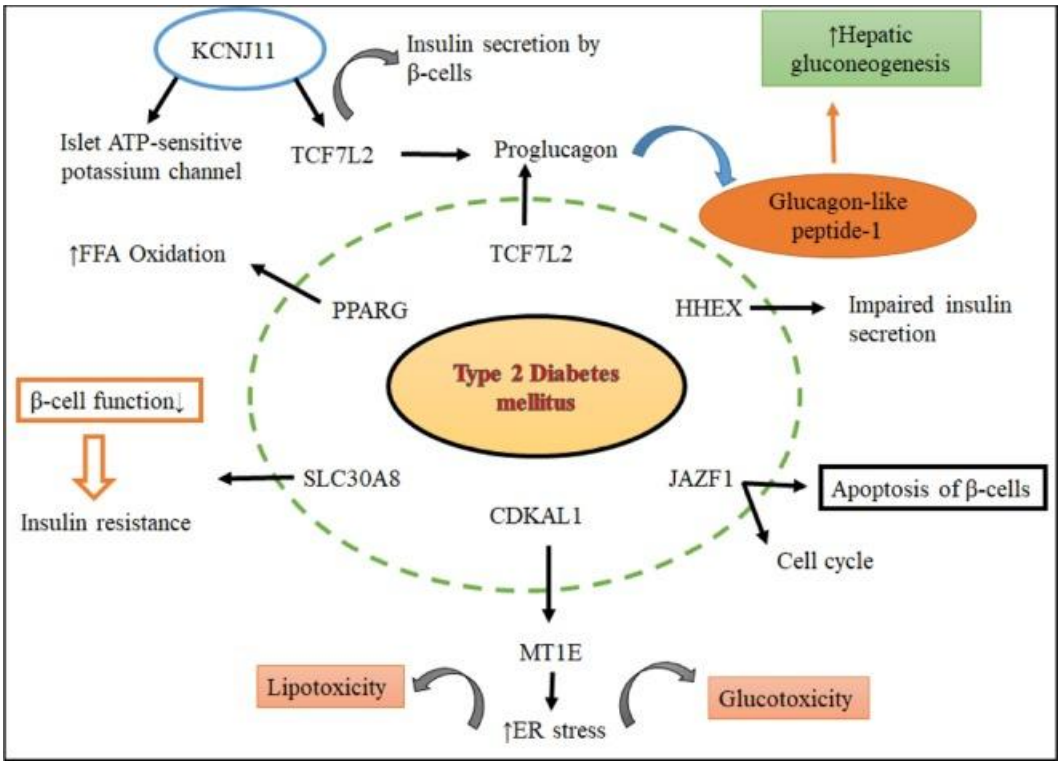


**Fig.4:** illustrates the progression of type2 diabetes mellitus. During type 2 diabetes mellitus beta-cell of pancreas increases insulin in sufficient quantity, but body cell becomes CDKAL1and MT1E activation result in insulin resistance because they are insensitive to insulin. ER stress leads to glucotoxicity and lipotoxicity. Other changes includePPARG TCF7L2 activation promotes the oxidation of free fatty acids. Proglucagon production, glucagon-like peptide-1 production and an increase in hepatic gluconeogenesis. Activation of HHEX impairs insulin secretion. JAZFA activation causes beta-cell apoptosis as well as cell cycle defects.

### 3) GESTATIONAL DIABETES MELLITUS

Due to some abnormal metabolic activity during pregnancy, glucose levelsincreases (hyperglycemia) and produces diabetes like condition in the mother, which directly impacts gestational diabetes is a condition affecting the growing fetus. Hyperglycemic state pregnant women have an increased risk of adverse maternal, fetal, and neonatal outcomes. Carbohydrate intolerance during pregnancy is one of the characteristics of gestation diabetes[20]. Women patients with gestational diabetes mellitus (GDM) are at higher risk for Gestational diabetes mellitus (GDM) may be a maternal hyperglycemia puts the developing fetus at risk for neonatal mortality.to secrete more and more insulin, resulting in hyper-stimulation of fetal growth. After birth, this hyperglycemic condition may be reversed in women[21].

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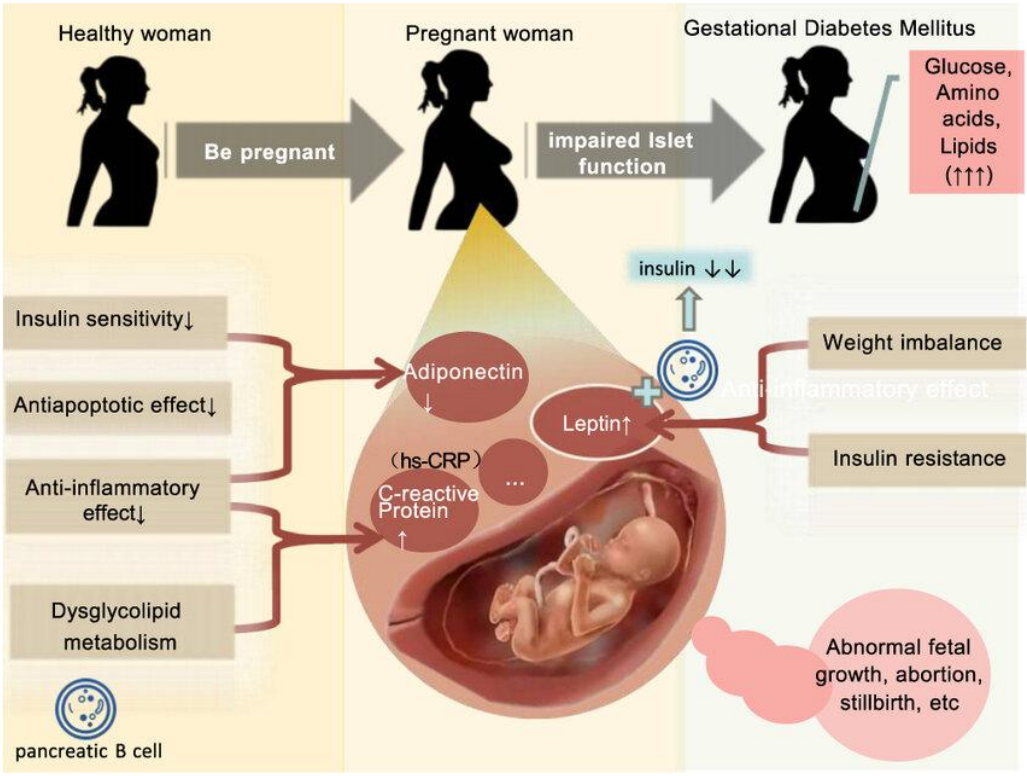


**Fig. 5:** The diagram shows the progression of Gestational Diabetes Mellitus. It occurs in pregnancy.

**SYMPTOMS OF DIABETES MELLITUS**

1. Frequent Urination
2. Weakness
3. Nausea
4. Weight Loss
5. Increased Thirst.
6. Bruises
7. Hunger
8. Blurred Vision
9. Tingling in Hands

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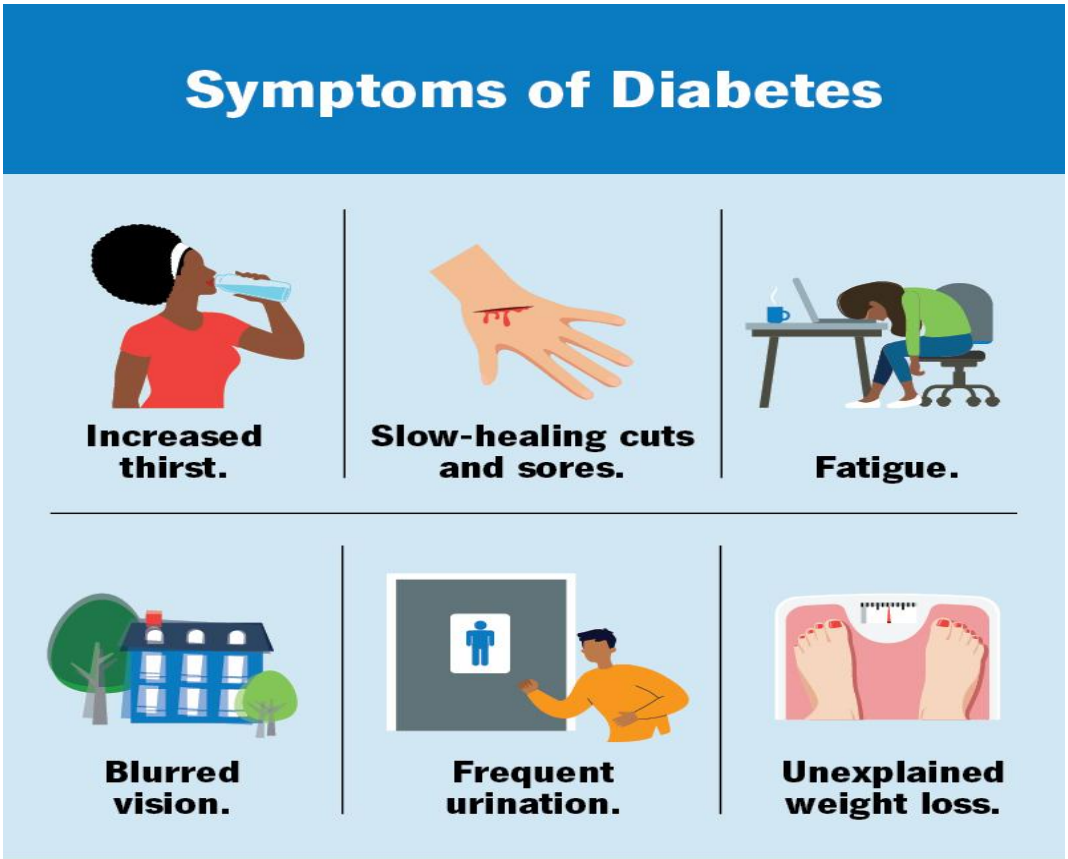


**Fig. 6: Symptoms of Diabetes**

**PLANT USED IN ANTI-DIABETES MELLITUS**

1) Fenugreek. (Methi)
2) Black Cumin. (Kalonji)
3) Coriander seeds. (Dhania)
4) Cumin seeds, (Jeera)
5) Carom seeds (Ajwain)
6) Fennel seeds (Saunf)
7) Long pepper (Pippali)
8) Indian Gooseberry Powder (Amla powder)
9) Withania Somnifera (Ashwagandha)
10) Flaxseed (Javas)
11) Dried Ginger (sunth)
12) Cinnamon (Dalchini)
13) Black Peppercorns (Kali Mirch)

**PLANT PROFILE**

**1) Fenugreek (Methi):**

Synonyms:- Methi, Methika, and Chandrika

Biological Source: - Methi is made from dried, ripe seeds of *Trigonella foenum-graecum*. Family: - ***Leguminaceae***[22].

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Chemical constituents: Fenugreek seeds contain (11) % triadenosine, (4) % essential oil, and (6.20) % protein contains active ingredients such as diosgenin, fatty oil, gum[23].

Medicinal use: 1) Fenugreek seed's role in reduction of blood glucose in diabetics.2) Reduce glucose absorption, and lower glucose uptake in the small intestine due to their high fiber content. 3) Protect bets cells and elevate serum insulin levels. 4) It is also reduces proinflammatory cytokines and pancreatic enzymes, supports glycogen replenishment[24].

**Fig. 7: fenugreek.**

**2) Black Cumin Seed (Kalonji);**

Synonyms:- Black caraway, nigella, Roman coriander,

Biological source: - It consists of dried seeds of Nigella Sativa belonging to family; ***Ranunculaceae.***

Chemical constituents: - It includes Carvone, Alpha pinene, p-cymene, and oleic acid[25].

Medicinal use: - 1) Kalonji stimulates the growth of cells that produce insulin in the pancreas, which raises insulin levels in the blood. 2) This also leads to a decrease in blood glucose level[26.27]. 3) This helps to maintain your blood glucose level.

**Fig. 8: Black cumin seed.**

**3) Coriander seeds (Dhania):**

Synonyms: - Dhania, Dhane, Coriander, and Kotthambari[28].

Biological source: - Coriander is derived from dried ripe fruits of Coriandrum Sativum Linn., belonging to family; ***Apiaceae***.

Chemical constituents: - coriander consists of sugars, alkaloids, tannins, resins, sterols, and fixed oil present in fruits. Petroselinic acid (cis-6-octadecenoic acid, 18:2-), linoleic acid (18:2), oleic acid (18:1), and palmitic acid (16:0) are the fatty acids found in coriander fruits[29,30].

Medicinal use: - 1) Increased levels of lipid oxidative damage products and proteins have been found in the serum of diabetic patients. 2) They increased release of insulin from the pancreatic cells. 3) Increase glucose uptake, metabolism, and insulin secretion[31].

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**Fig. 9: Coriander seeds.**

**4) Cumin seed (Jeera):**

Synonyms: - Jira, Cuminia cyminum J. F. Gmel., Cuminum odorum Salisb, Cuminum sativum J. Sm[32].

Biological source: - It made out of dried ripe fruits of cuminum cyminum Linn, belonging to family***; Unbelliferae***.

Chemical constituents: - cumin includes coumarin, glycoside, flavonoid, protein, resin, saponin, tannin and steroid, anthraquinone, an alkaloid[33].

Medicinal use: - 1) Cumin seeds may also help regulate blood sugar levels. 2) It improved insulin sensitivity in humans. 3) Reduce blood glucose level. 4) Cumin seed contain that have anti-inflammatory properties[34].

**Fig. 10: Cumin seed.**

**5) Carom Seed (Ajwain):**

Synonyms: - Ajwain, Ammi copticum L., Carum copticum L[35].

Biological source: - It is fresh seeds of the plant *Trachyspermum ammi* L., belonging to family; ***Apiaceae***[36.37].

Chemical constituents: - Ajwain includes fiber (11.9%), Carbohydrates (24.6%), Tannins, glycosides, moisture (8.9%), Protein (17.1%), Fat (21.1%), Saponins, and Flavones. From fruits oleic, linoleic, palmitic, resin[38].

Medicinal uses: - 1) Ajwian is used to treat a variety of illnesses, including germicide and asthma, cough syrups, antiseptics. 2) It helps to treat limb weakness, paralysis, chest pains, diseases of liver, spleen vomiting[39].

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**Fig. 11: Ajwian**.

**6) Fennel:**

Synonyms: - Sweet fennel, Anethum foeniculum L., and fennel.

Biological source: - It is obtained from Foeniculum Vulgare is a perennial, aromatic plant. Belonging to family; ***Apiaceae*** (Umbelliferae).

Chemical Constituents: - It consists of saponins, Flavonoids, cardiac glycosides, sterols, coumarins and volatile oils.

Medicinal uses: - 1) It exhibits Anti- inflammatory activity. 2) Foeniculum vulgare tree leaves are used for curing diabetes. 3) It is used in the treatment of mouth ulcer, liver pain. 4) Used in fevers, and muscular pain[40].

**Fig. 12: fennel.**

**7) Long pepper (Pippali):**

Synonyms: - , Pippali, Piper latifolium hunter, P. Saramentosum Wall.

Biological sources: - Pippali's biological source is the plant Piper Longum (long pepper), belonging to family***;*** ***piperaceae***[41].

Chemical Constituents: - Two alkaloids piperlongumine & piperlonguminine, n-hexadecane, phenyl ethyl alcohol, reducing sugar, glycosides[42].

Medicinal uses: - 1) It has antidiabetic properties. 2) It shows anti-inflammatory activity. 3) Pippali fruits showed insecticidal and insect-repellent activity[41, 43].

**Fig. 13: Pippali.**

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**8) Amla Powder:**

Synonyms:- Embica

Biological Source: - It is obtained from Phyllanthus embolic L., belonging to family; ***Phyllanthaceae.***

Chemical Constituents: - 1, 6-di-o-galloylbeta-d-glucose, kaempferol, Ellargic Garlic acid, corilagin, chebulinic acid[44].

Medicinal uses: - 1) Amla inhibits the growth and spread of various cancers like breast, pancreas, liver cancers. 2) It is used in treatment of Diabetes Mellitus. 3) Used to preventing ageing and maintain strength in old age[45].

**Fig. 14: Amla.**

**9) Ashwagandha:**

Synonyms: - Withania somnifera, Indian winter cherry, and Indian Ginseng.

Biological source: - It consist of dried roots and stem bases of Withania somnifera, etc. belonging to family; ***Solanaceae.***

Chemical Constituents: - Withanine, tropine, Somniferin. Anahygrine. Choline, etc.

Medicinal uses:-1) Ashwagnadha has anti-diabetic properties. 2) Its ability to reduce blood glucose levels. 3) It used in the treatment of many diseases associated with inflammation in the body, like cardiovascular disease. 4) Used in Autoimmune diseases such as diabetes, cancers[44, 46].

**Fig. 15: Ashwagandha**.

**10) Flaxseed (Javas)**

Synonyms: - Javas, Linum humile Mill.

Biological Source: - It is obtained from Linum Usitatissimum. Belonging to family; ***Linaceae[47].***

Chemical Constituents: - It containing 9-10% of saturated fatty acids (palmitic and stearic), oleic acid, α-linolenic acid, 20% monounsaturated fatty acids[48].

Medicinal uses: - 1) It is used in respiratory disorders. 2) Used in abdominal pain, constipation. 3) Used in the treatment of diabetes mellitus. 4) Used in treatment of urinary tract infection[49].

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**Fig.16: Flaxseed (Javas).**

**11) Dried Ginger**:

Synonyms: - Gingerin, Rhizoma zingiberis, Zingibere, Ginger Officinale.

Biological Sources: - The ginger is the rhizomes of Zingiber officinale, Roscose and dried in the sun. Belonging to family; ***Zingiberaceae.***

Chemical Constituents: - Protein (2.3%), Fat (0.9%), carbohydrates (12.3%), mineral, fiber, phosphorous, calcium, iron, riboflavin, thiamine.

Medicinal uses: - 1) used as an anticancer agent. 2) It is used in treatment of anti- inflammatory. 3) Immune stimulating properties[50]. 4) Ginger lower blood sugar levels and enhances insulin sensitivity[51].

**Fig.17: Dried ginger (Sunth).**

**12) Cinnamon bark:**

Synonyms: - Dalchini, Cinnamon bark.

Biological Source: - It is obtained from dried inner bark of the Cinnamomum Zeylanicum. Belonging to family; ***Lauraceae[52].***

Chemical Constituents: - Volatile oils, mucilage, calcium oxalate, starch and mannitol, eugenol, essential oil.

Medicinal uses: - 1) It reduce the blood glucose level and cholesterol. 2) It used to improve the bodyweight gain. 3) Effective in diabetes mellitus treatment[53].

**Fig. 18: cinnamon bark.**


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**13) Black Peppercorns:**

Synonyms: kali Mirch, black pepper, Golmirch.

Biological Source: - Is the dried, unripe fruit of the perennial climbing vine Piper nigrum L., belonging to family; ***Piperaceae.***

Chemical Constituents: - resin, volatile oil, piperine, fatty oil, starch, mineral salts, malic acid, albumin[54, 55].

Medicinal uses: - 1) It control blood sugar level. 2) Minimizes heart related problems. 3) Improve digestive system. 4) Helps in weight loss.

**Fig. 19: Black Pepper.**

**Formulation Table: -**

| Sr. No. | Ingredient | Quantity |
|---|---|---|
| 1 | Fenugreek (Methi) | 15gm. |
| 2 | Black Cumin (Kalonji) | 15 gm. |
| 3 | Coriander Seed (Dhania) | 5 gm. |
| 4 | Cumin Seed (Jeera) | 14 gm. |
| 5 | Carom Seed (Ajwain) | 10 gm. |
| 6 | Fennel Seed (Saunf) | 7 gm. |
| 7 | Long Pepper (Pippali) | 5 gm. |
| 8 | Indian Gooseberry Powder (Amla Powder) | 12 gm. |
| 9 | Withania Somnifera (Ashwagandha) | 5 gm. |
| 10 | Flaxseed (Javas) | 6 gm. |
| 11 | Dried Ginger (Sunth) | 5 gm. |
| 12 | Cinnamon (Dalchini) | 8 gm. |
| 13 | Black Peppercorns (Kali Mirch) | 3 gm. |

**Table 1: Formula**


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**PREPARATION METHOD:**

The following steps are employed for the formulation of herbal anti-diabetic powder tea.

1) Drying
2) Grinding
3) Weighing
4) Mixing
5) Sieving
6) Packing

**1) Drying:**

The ingredients including **methi, kalonji, dhania, jeera, ajwain, saunf, pippali, amla, ashwagandha, javas, sunth, dalchini, and kali mirch,** are required for the herbal powder tea.The ingredients should be spreadin a single, thin layer on a clean surface and dried in the sun. Cover with a thin cloth to keep out dust/pests. Place the tray in direct sunlight for several days until the ingredients are completely dry, brittle and crisp.

Alternatively, these can be dry-roasted over a low heat until they are crisp and fragrant before cooling and storage[56].

**2) Grinding:**

All the Ingredients required for the herbal powder tea preparation are grinded by motor and pastel. Grind hard ingredients first start with the toughest ingredients to break them down, **Ashwagandha and sunth** (dried ginger), these fibrous ingredients need initial crushing with a mortar and pestle or by using the pulse function on an electric grinder. **Dalchini and pippali** can be added next.

Grind the seeds and add the cooled, dry-roasted seeds, (**methi, kalonji**, **dhaniya, jeera, ajwain, saunf, kali mirch**) in small batches. Grind until the desired texture is achieved, whether coarse or fine. Grind **Javas (Flax seeds)** last, just before final mixing.

**3) Weighing:**

The herbal powders required for the preparation are weighed separately. Weighed all the ingredient for powder preparation according to their taken quantity, and as per need for taste and flavor of powder.

**4) Mixing:**

All these fine ingredients methi powder, kalonji powder, dhania powder, jeera powder, ajwain powder, saunf powder, pippali powder, amla powder, ashwagandha powder, javas powder, sunth powder, dalchini powder, kali mirch powder, were mixed thoroughly by a mixer to form a homogenous fine powder[57].

**5) Sieving:**

Use a fine-mesh sieve, generally an 80-mesh or 60-mesh sieve is recommended for fine, uniform powder suitable for consumption in a formulation. Pass the ground powder through the sieve into a clean bowl or container[58]**.**

**Fig 20: Diabetic powder**

**6) Packing:**

The final product should be stored in an airtight container in a cool, dry, and dark palce[59].

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## II. RESULT

The formulation demonstrated potential for use as an anti-diabetic. The formulation tea is taken every day, and the results reveal that the sugar level is down after 8 days. The composition helps to reduce blood sugar levels. The organoleptic properties of the provided formulation are shown in the following table.

**Physiochemical Parameters: -**

| **Properties** | **Observation** |
|---|---|
| Colour | Brown |
| Odour | Aromatic |
| Taste | Slightly Spicy |
| Texture | Smooth |

**Table 2: Result**

**Dosing:**

Quantity: 1 to 2 teaspoons (about 2-3 grams) of powder per serving.
Frequency: Once or twice daily, typically before breakfast and dinner or after meals.
Preparation: Take 100 to 200 ml of water and warm it for two minutes. Then add 1-2 teaspoons of herbal powder and mix well, and consume.

**Fig 21: Anti-diabetic Tea.**

## III. CONCLUSION

The prepared formulation is beneficial to the all the persons. The formulation is prepared form the natural herbs, there is lower the risk of side effect are lower. This plant is widely recognized for helping to reduce blood sugar levels. The formulation of herbal tea powder is considered. It is beneficial to a wide range of people because it is made from natural herbs, reducing the possibility of side effects. The formulated herbal anti-diabetic tea powder has been good scope in the future, natural remedies will be researched.

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International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, February 2026 Impact Factor: 8.2

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