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Review on: Polyherbal Antidiabetic Tea Bag

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Abstract : *High blood glucose levels are a hallmark of diabetes mellitus, a chronic illness caused by either inadequate insulin production or inadequate insulin function. This terrible illness is widespread throughout the world and is posing a major threat to human health. It is brought on by the pancreas's insufficient or inefficient production of insulin, which causes the blood glucose concentration to rise or fall. It has been defined as a common metabolic disorder of the metabolism of carbohydrates, proteins, and fats that is characterized by hyperglycemia and is caused by an absolute or relative lack of insulin. The use of hypoglycemic herbs and their polyherbal formulations is the novel aspect of this review article. Numerous medicinal herbs have been used for the diabetes mellitus in traditional systems of medicine worldwide as they are a great source of phytochemical constituents and many of them are known to be effective against diabetes. Medicinal herbs with antidiabetic activities are being more desired, to lesser side effect and low cost. [2,3,12].*

Keywords: Indian insulin, bioactive molecules, antidiabetic, antioxidant, tea bag infusion development, traditional medicine, polyherbal formulation, Type 2 diabetes mellitus

I. INTRODUCTION

High blood sugar levels are a hallmark of diabetes mellitus, a chronic metabolic disease that can be caused by problems with insulin production, its efficacy, or both. Diabetes is brought on by cellular dysfunction and hormonal dysregulation, which raise fasting blood glucose levels and result in hyperglycemia and glucose intolerance. [4,5,12,13]

TYPE OF DIABETES MELLITUS:

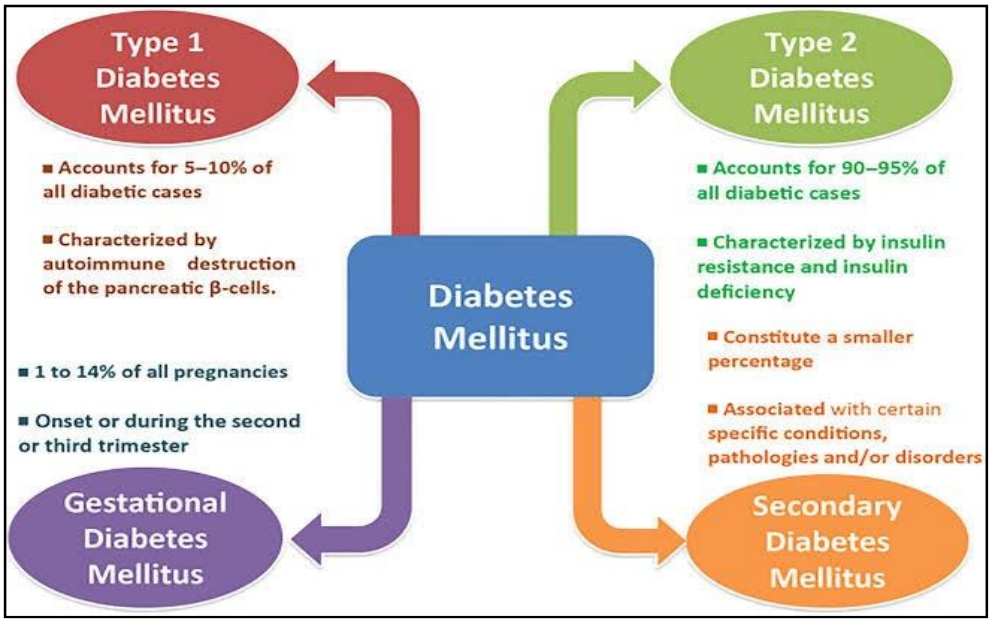
Type 1 diabetes mellitus (Insulin dependent diabetes mellitus) –Also referred to as insulin-sensitive diabetes or juvenile diabetes. an autoimmune disease in which the immune system kills insulin-producing pancreatic cells. It begins in childhood (adolescence).

Type 1 diabetes can be identified well in advance of the onset of abnormal insulin secretion, with a consistent decline beginning at least two years prior to diagnosis. Damage from viruses like the mumps virus and coxsackie virus B4, chemicals, harmful cytotoxins, and the release of antibodies from sensitized immune cells are examples of extrinsic factors that could impact beta cell functioning.[4,5]

Type 2 diabetes mellitus (non-insulin dependent diabetes mellitus) – The most prevalent type occurs when the body develops insulin resistance. It is strongly associated with genetics, obesity, and lifestyle. All other types of diabetes are vastly outnumbered by type 2 diabetes. Individuals with NIDDM are not susceptible to ketosis and do not require exogenous insulin to prevent ketonuria. Insulin resistance and relative insulin deficiency work together to cause type 2 diabetes. It is mainly linked to genetic predisposition, physical activity, and obesity. Adipose tissue, muscle, and the liver all have insulin resistance. In addition to the progressive loss of prancreatic B cell function brought on by persistent glucotoxicity, lipotoxicity, and endoplasmic reticulum stress, the disease is primarily caused by insulin resistance in skeletal muscle, liver, and adipose tissue.

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It is a complicated, multifactorial metabolic disease that reflects dynamic interactions between genetic susceptibility, immunoregulation, and environmental exposure and goes far beyond chronic hyperglycemia.[5,7,8]



(Figure no.1)

Individuals with fasting blood glucose levels greater than 110 mg/dL (6.1 mmol) and postprandial glucose levels of 200 mg/dL (11.1 mmol) are typically considered diabetics. Insulin controls blood glucose levels in accordance with growth hormone, corticosteroids, glucagon, and adrenaline. 85–95% of people with diabetes have type 2 diabetes, and obesity is one of the main causes of the disease. Severe hyperglycemia, hyperlipidemia, and associated complications have a negative impact on quality of life. An antidiabetic medication's therapeutic strategy should be able to stop the development of diabetic complications in addition to controlling blood sugar levels. [4,14]

MANAGEMENT OF DIABETES:

Pharmacological intervention, physical activity, and dietary and lifestyle modifications are frequently used to manage diabetes. Conventional commercial drugs are the most common pharmacological intervention; they are expensive and have negative side effects. The goals of these treatments are to improve insulin secretion and sensitivity while lowering hyperglycemia. Since ancient times, people have used medicinal plants to treat various illnesses, including diabetes. The purpose of this review was to compile the pharmacological evidence regarding the antidiabetic effects of green, black, white, oolong, and pu-erh teas from in vitro, ex vivo, in vivo, and clinical studies.[14,17]

ETIOLOGY:

Genetic susceptibility, autoimmune mechanisms, insulin resistance, beta cell dysfunction, environmental factors, and metabolic changes associated with pregnancy are all considered to be part of this multifactorial process.[5,7,8]

Major etiological factors include: [5,6,11]

Genetic predisposition and family history

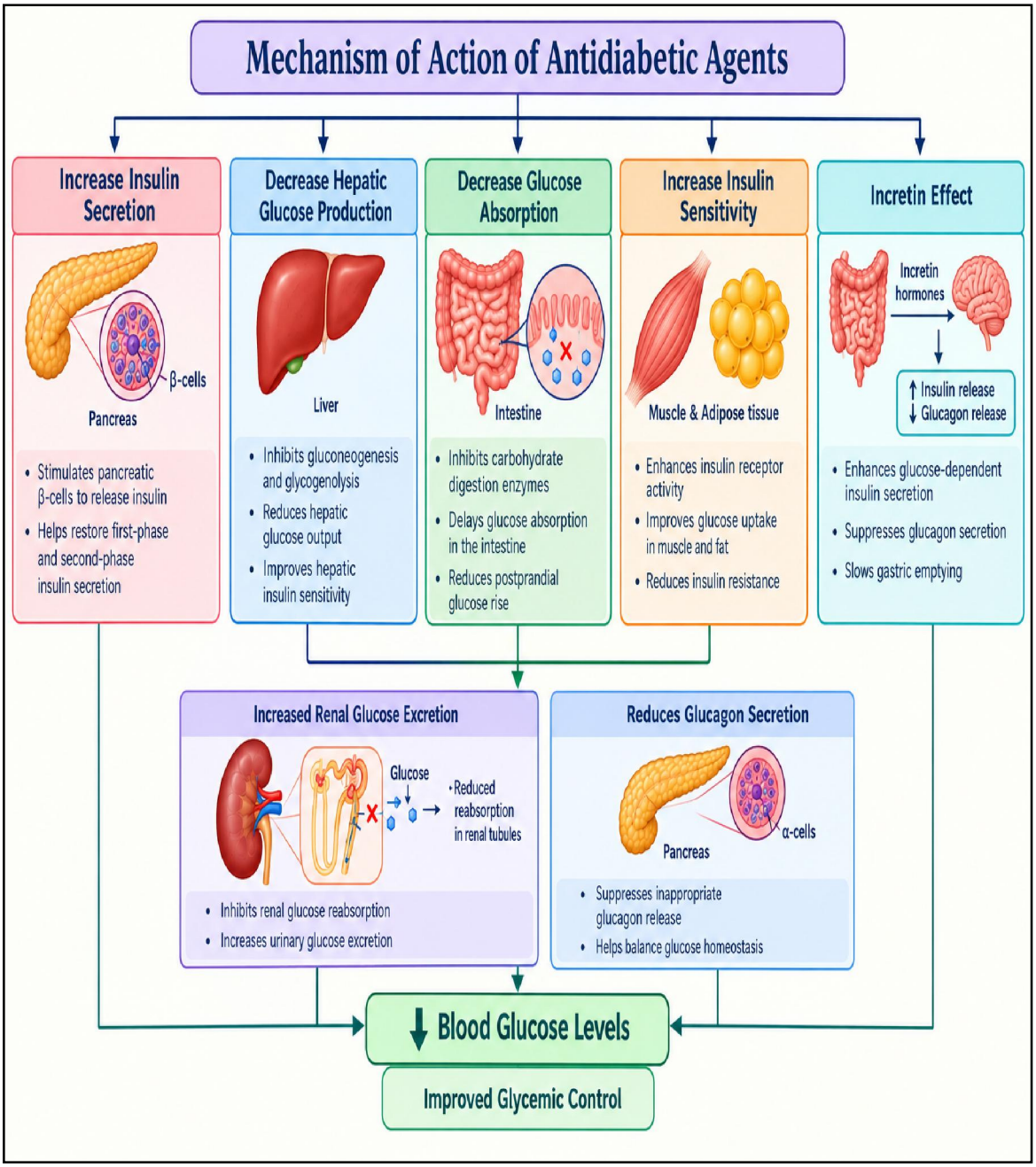
Overweight and obesity

Physical inactivity

Unhealthy dietary patterns

Increasing age

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(Figure no.2)

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CAUSES

1) Insulin resistance: Insulin resistance is the primary cause of type 2 diabetes. When cells in your muscles, fat, and liver do not react to insulin as they should, you develop insulin resistance. [5,7]

2) Autoimmune disease: When your immune system targets the insulin-producing cell in your pancreas, you develop type 1 diabetes and LADA .[4,5]

3) Hormonal imbalance: Insulin resistance is brought on by the placenta hormone during pregnancy. Type 2 diabetes can also be brought on by other hormone-related conditions like acromegaly and Cushing syndrome.[5]

4) Pancreatic injuries: Your pancreas's capacity to produce insulin may be impacted by physical injuries, illnesses, or surgeries, which can lead to Type 3c diabetes [5].

5) Genetic mutations: Neonatal diabetes and MODY can be brought on by specific genetic mutations. [5]

6) Long-term complications of diabetes: Excessively high blood glucose levels can harm your body's tissues and organs. The most prevalent kind of long-term diabetes complication is cardiovascular. [4,5,16]

They include

Coronary artery disease

Heart attack

Stroke

Atherosclerosis

DIAGNOSIS OF DIABETES MELLITUS:

Diabetes mellitus is a diagnosed by demonstrating persistent hyperglycemia using blood glucose or HbA1c test. [4]

Diagnosis test	Diabetes
HbA1c	≥6.5% (≥48mmol/mol)
Fasting plasma glucose	≥126mg/dL (≥7.0mmol/L)
2-hour OGTT	≥200mg/dL (≥11.1mmol/mol)
Random plasma glucose	≥200mg/dL (≥11.1mmol/mol)

PLANT PROFILE

Table 1: Taxonomical classification of Aegle marmelos [22,23]

Parameters	Information
Plant name	Bael
Scientific name	Aegle marmelos
Image	 [24]

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Taxonomical classification	**Kingdom:** Plantae **Division:** Magnoliphyta **Class:** Magnoliopsida **Order:** Sapindales **Family:** Rutaceae **Genus:** Aegle **Species:** Aegle marmelos

Biological source	Bael consist of dried leaves from the plants Aegle marmelos
Chemical constituents	Tannins, Flavonoids, Alkaloids, Marmelosin.
Uses	Used in the management of diabetes mellitus
Category	Antidiabetic Anti-inflammatory Digestive aids

Table 2: Taxonomical classification of Cinnamomum zeylanicum [25,26]

Parameters	Information
Plant name	Cinnamon
Scientific name	Cinnamomum zeylanicum
Image	 [28]

Taxonomical classification	**Kingdom**: Plantae **Phylum**: Magnoliophyta **Class**: Magnoliopsida **Other**: Laurales **Family**: Lauraceae **Genus**: Cinnamomum **Species**: Cinnamomum zeylanicum
Biological source	Cinnamon consists of the dried inner bark of the shoots of coppiced trees of Cinnamomum zeylanicum Nees.

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Chemical constituents	Eugenol, Cinnamaldehyde, Cinnamic acid.
Uses	Increases insulin sensitivity, Reduces fasting blood sugar level.
Category	Antidiabetic Anti-inflammatory Antioxidant

Table 3: Taxonomical classification of Ocimum sanctum [29,30]

Parameters	**Information**
Plant name	Tulsi

Scientific name	Ocimum sanctum
Image	 [31]
Taxonomical classification	**Kingdom:** Plantae **Division:** Magnoliophyta **Class:** Magnoliopsida **Order:** Lamiales **Family:** Lamiaceae **Genus:** Ocimum **Species:** O. sanctum
Biological source	Tulsi consists of the fresh and dried leaves of Ocimum sanctum Linn.
Chemical constituents	Essential oil- eugenol, benzaldehyde, terpinol, camphor, camphene.

Uses	It helps to enhance insulin function It manages stress and cortisol control.
Category	Antidiabetic Antibacterial Antilipidemic

Table: 4 Taxonomical classifications of stevia rebaudiana [32]

Parameters	**Information**
Plant name	Stevia
Scientific name	Stevia rebaudiana

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Image	 [33]
Taxonomical classification	**Kingdom**: Plantae **Division**: Tracheophyta **Class**: Magnoliopsida **Order**: Asterales **Family**: Asteraceae **Genus**: Stevia **Species**: Stevia rebaudiana
Biological source	Stevia is derived from the leaves of Stevia rebaudiana plant
Chemical constituents	Stevioside, steviol glycosides, rebaudiosides A-E
Uses	Control blood sugar level Help in weight management
Category	Nonnutritive sweetener

Table: 5 taxonomical classifications of Cymbopogon citratus[34]

Parameters	Information
Plant name	Lemongrass
Scientific name	Cymbopogon citratus

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Image	 [35]
Taxonomical classification	**Kingdom:** Plantae **Division:** Magnoliophyta **Class:** Liliopsida **Order:** Poales **Family:** Poaceae **Genus:** Cymbopogon Spreng **Species:** citratus
Biological source	Lemon grass is obtained from the fresh or dried leaves and aerial parts of Cymbopogon flexuosus or Cymbopogon citratus.
Chemical constituents	Citral α, citral β, nerol, citronellal
Uses	Used to give taste and aroma It helps to lower post-meal blood sugar
Category	Antibacterial Anti-inflammatory Antimutagenicity

Different techniques for preparation of antidiabetic teabags

Standard raw material preparation method (washing, drying, and grinding).
Wet granulation co-processing method.
Polyherbal infusion and blending method,

Method of preparation

STANDARD RAW MATERIAL PREPARATION :-

1. Collection and authentication: Gather verified crude drugs of stevia, tulsi, cinnamon, lemongrass, and Bael from a reputable source. [36]

2. Cleaning and drying: Cleaning and drying the herbal material to get rid of any foreign objects. Dry the material at a low temperature if there is any moisture. [36]

3. Size reduction: Use a clean grinder or mortar and pestle to separately grind dry material. [36]

4. Sieving: To achieve a comparatively uniform particle size, run each powder through an appropriate sieve. [36]

5. Weighing: Using the chosen formulation ratio as a guide, precisely weigh each powdered ingredient. [36]

6. Blending: To achieve a uniform blend, mix the powder using geometric dilution or trituration. [36]

7. Filling: Pour the necessary amount of blend into a teabag pouch or food-grade filter paper.

8. Sealing and packaging: Properly seal the teabag and place each one in a moisture-resistant pouch. [36]

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9. Infusion: One teabag may be infused for five to ten minutes in 150 to 200 milliliters of hot water for laboratory testing. [36]

II. CONCLUSION

A growing interest in investigating plant-based treatment options has been spurred by the growing problem of diabetes mellitus and its complications related to oxidative stress. The goal of the current study was to successfully design, formulate, and assess a polyherbal teabag intended for the treatment of diabetes mellitus. A promising herbal strategy for the supportive treatment of diabetes mellitus is represented by polyherbal antidiabetic tea bags. By reducing carbohydrate-digesting enzymes, improving glucose utilization, and protecting against oxidative stress, a combination of medicinal plants like bael (Aegle marmelos) leaves, cinnamon (Cinnamomum verum), tulsi (Ocimum sanctum), lemongrass (Cymbopogon citratus), and stevia (Stevia rebaudiana) may offer complementary antidiabetic, antioxidant, and metabolic benefits. [2,3,12,22,23,25,27]

Compared to some traditional herbal preparations, the tea-bag dosage form has a number of benefits, including ease of preparation, portability, acceptable taste, and improved patient compliance. To establish standardized formulations, stability, safety, dose optimization, pharmacological efficacy, and clinical effectiveness, more research is necessary as there is currently little evidence for polyherbal combinations. All things considered, polyherbal antidiabetic tea bags have a lot of potential as a handy supplemental herbal formulation; however, without sufficient clinical evidence, they shouldn't be used in place of prescribed antidiabetic therapy. [29,30,32,34]

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