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Antidiabetic herbal drugs and polyherbal formulation used for diabetes: A review

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Abstract

The main objective of this project is to prepare and evaluate anti-diabetic drugs based on drying, grinding and ethanol extraction using local fenugreek seeds, fenugreek seeds and *Gymnema* leaves. The above mentioned plants have good anti-diabetic, anti-microbial, antioxidant and anti-inflammatory properties. Tablets were prepared after preliminary formulation studies and measured by weight change, hardness, friability, thickness and disintegration time.

Keywords: Herbal vati, *Syzygium cumini*, *Trigonella foenum-graceum*, *Gymnema sylvestre* anti-diabetic tablet

Introduction

Diabetes Mellitus is a group of metabolic diseases that are characterized by long-term illness (change) and high blood sugar (high blood sugar). Only half of the people who are unaware of the disease receive appropriate treatment. It is caused by insulin deficiency or insulin resistance or both. Insulin secreted from the beta cells of the pancreas to control blood sugar. Acute hyperglycemia is associated with long-term damage, dysfunction and failure of many organs, especially the eyes, kidneys, blood vessels, heart and veins, and therefore involves many different organisms, It contains many phytochemicals such as various Proteins, calcium, carbohydrates, etc.

Types of diabetes

Diabetes results in the impairment of the body's ability to use food because either the Pancreas does not make insulin or the body cannot use insulin properly. Hypoglycemia (low Blood glucose) is most commonly seen in diabetic patients, when the body gets too much Insulin, too little food, a delayed meal, or more than the usual amount of exercise. When the Body gets too little insulin, too much food, or too little exercise, it results in hyperglycemia.

1. Types of DM Type-I or Insulin Dependent Diabetes Mellitus (IDDM)

Juvenile diabetes is an immune-mediated disease and is characterized by destruction of pancreatic beta cells by T-cell-mediated immunity, which reduces pancreatic cell lifespan by one third, and ketoacidosis in tissues and fluids.

2. Type-II or Non-insulin Dependent Diabetes Mellitus (NIDDM)

Adult-onset diabetes is characterized by inadequate insulin secretion, with a response to elevated blood glucose levels indicative of NIDDM. Decreased insulin sensitivity is unusual, and the hyperglycemia can be reversed by insulin-sensitizing drugs or by reducing hepatic glucose.

3. Gestational diabetes mellitus (GDM)

In pregnant women without diabetes, gestational diabetes occurs almost at the end of the third month of pregnancy or the beginning of the fourth month of pregnancy. It is characterized by carbohydrate intolerance caused by hormonal changes resulting from

pregnancy that prevent the body from using insulin. Gestational diabetes affects 4% of pregnancies and disappears after birth.

Mechanism of Action of Herbal anti-diabetes

The antidiabetic activity of plants is due to several mechanisms. The mechanisms of herbal antidiabetic drugs can be divided into:

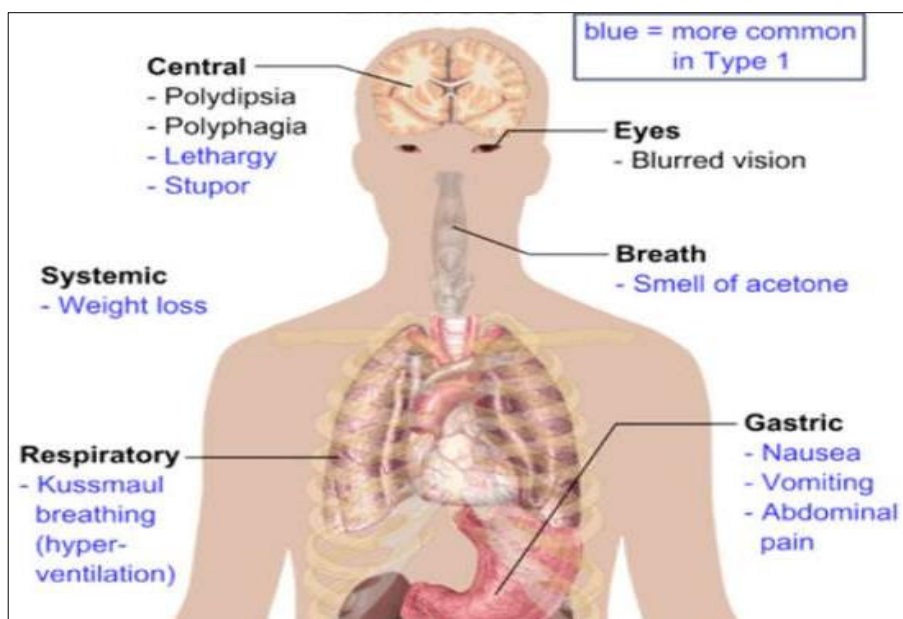
- Adrenomimetics, pancreatic β -cell potassium channel blockade, cAMP (second messenger) stimulation.
- Inhibition of renal glucose reabsorption
- Stimulates pancreatic beta cells to secrete insulin or / and insulin
- Inhibits the degradation process
- Reduces insulin resistance
- Provides beta cells with important elements such as

calcium, zinc, magnesium, manganese and Copper.

- Regenerates and / or repairs pancreatic cells beta cells
- Increases the size and composition of islet cells
- Promotes insulin secretion
- Promotes glycogenogenesis and glycolysis
- Anti-inflammatory effects Blocking islet cells destroys beta Cell
- Improves digestion and reduces blood sugar and area.

Signs and symptoms

Symptoms of untreated diabetes include polyuria, excessive thirst, and weight loss. Other signs and symptoms also occur, such as fatigue, blurred vision, and genital irritation from candidiasis. About half of those affected may be asymptomatic. Type 1 occurs soon after the preclinical stage, while type 2 has a more rapid onset;



Advantages

- Herbs have a long history of use, tolerance and good acceptance.
- Medicinal plants are the only hope for us to have cheaper food for the masses in the world.
- Availability of medicinal plants is not a problem especially in developing countries like India with its agro-climatic, cultural and ethno-biological diversity.
- Cultivation and processing of plants and herbs is environment-friendly.
- Long-term and proven use of herbs shows them to be safe and effective.
- All over the world, medicinal plants have provided many of the most powerful medicines for the vast arsenal of modern medicine, either in crude form or in the pure substances that make up modern medicine.

Diagnostic Methods of Diabetes

Diabetes is diagnosed by one of the following

- Fasting blood glucose ≤ 7.0 mmol/L (126 mg/dL).

- Plasma glucose ≤ 11.1 mmol/L (200 mg/dL) $<$ br $>$ Glycated heme (Hb) A1C $\leq 6.5\%$ Oral Glucose Tolerance Test (OGTT).

Individuals with fasting blood glucose between 100 and 125 mg/dL are considered to have impaired diabetes, also called prediabetes. Fasting blood glucose is popular because it is inexpensive and easy to perform. Diabetes should be confirmed with a second test on a different day. HbA1c is an indicator of the average blood glucose concentration over the last three months and is recommended as a useful test for the diagnosis of type 2 diabetes because it overcomes many of the problems associated with the OGTT. The most commonly used anthropometric measurements to measure obesity are BMI (body mass index), WC (waist circumference), and WHR (waist-hip ratio). The most commonly used criteria for the diagnosis of obesity are the National Cholesterol Education Program (NCEP) and ATP III criteria. Regarding sensitivity, Pandya *et al.* [5] has shown that WC is a better indicator of diabetes than BMI.

Table 1: Some of the crude drugs used for antidiabetic activity

Scientific Name	Family	Local Name	Mode of Use
<i>Abrus precatorius</i> L.	Fabaceae	Guruvinda	Leaf juice (2 teaspoon) given orally twice a day till cure.
<i>Annona squamosa</i> L.	Annonaceae	Sitphalam	Leaves (25 g) are taken with milk orally daily in the morning.
<i>Andrographis paniculata</i> (Burm. f.)	Acanthaceae	Neela vemu	Decoction of the leaves (50 ml) is prescribed thrice a day after food or fresh raw leaves eaten every day.
<i>Coccinia grandis</i> (L.)	Cucurbitaceae	Donda	Leaf juice and mucilage from immature fruits (2 teaspoon) are given twice or thrice a day after food.
<i>Pongamia glabra</i>	Fabaceae	Ganuga	Tender leaves are mixed with turmeric and made into small round structures called gulgula and taken early morning with empty stomach.
<i>Mangifera indica</i>	Anacardiaceae	Mameedi	Young brown rusty leaves are taken early morning with empty stomach.
<i>Annona squamosa</i>	Annonaceae	Seetaphalam	Young leaves are taken early morning.
<i>Tinospora cordifolia</i>	Menispermaceae	Teepateega	Bark extract is taken early morning.
<i>Momordica charantia</i>	Cucurbitaceae	Kakara	Leaf juice mixed with cucumber taken orally.
<i>Gymnema sylvestre</i> (Retz.)	Asclepiadaceae	Podapthri	Leaf juice is taken early morning with empty stomach.
<i>Bougainvillea spectabilis</i> Willd	Nyctaginaceae	Kagithal puvvu	Young tender leaves are taken early morning.
<i>Biophytum sensitivum</i> (L.)	Oxalidaceae	Pedda atipati	Leaf juice is taken early morning with empty stomach.
<i>Cassia auriculata</i>	Caesalpiniaceae	Thngedu	Root extract is taken orally.
<i>Eugenia jambolana</i>	Myrtaceae	Naeraedu	Seed powder is taken.
<i>Terminalia bellirica</i>	Combretaceae	thani	Dried fruit is taken.
<i>Ricinus communis</i>	Euphorbiaceae	Amudamu	Dried root powder is taken early morning.
<i>Vernonia anthelmintica</i>	Asteraceae	shadevi	Seed powder is taken.
<i>Vinca rosea</i>	Apocynaceae	Bila Ganneru	Dried whole plant extract is taken.
<i>Cyperus rotundus</i> L.	Cyperaceae	Tunga musti	Dry tuber powder is administered daily twice.
<i>Ficus hispida</i>	Moraceae	Bommidu	Ripe fruits are consumed daily; stem bark is used.
<i>Helicteres isora</i>	Sterculiaceae	Malikaya	Root extract is taken orally.

Ingredients

1. *Syzygium cumini*
2. *Trigonella foenum-graceum*
3. *Gymnema sylvestre*

Table 2: Antidiabetic Effects of Various Medicinal Plants

Plant Name	Common Name	Antidiabetic Effect
<i>Withania somnifera</i>	Ashvagandha	Hypoglycemic effect
<i>Punica granatum</i>	Anar	Anti-hyperglycemic effect
<i>Emblica officinalis</i>	Amla	Hypoglycemic effect
<i>Ipomoea batatas</i>	Sakkargand	Reduces insulin resistance
<i>Murraya Koenigii</i>	Curry patta	Hypoglycemic effect
<i>Eugenia jambolana</i>	Jamun	Anti-hyperglycemic effect
<i>Aegle marmelos</i>	Bel	Decrease blood sugar
<i>Aloe vera</i>	Aloe	Hypoglycemic effect
<i>Azadirachta indica</i>	Neem	Anti-diabetic activity
<i>Momordica charantia</i>	Bitter gourd	Anti-hyperglycemic agent
<i>Ocimum sanctum</i>	Holy basil	Blood sugar reduction

How they acts**1. Jamun (*Syzygium cumini*)**

The aim of this study was to isolate *S. cumini* [SC] seeds and demonstrate its anti-inflammatory properties. A compound called mycaminose was isolated from SC seed extract. Mycaminose (50 mg/kg) isolated from cumin seeds and the mixture extracted with ethyl acetate [EA] and methanol [ME] (200 and 400 mg/kg) were studied against streptozotocin (STZ) induced diabetes. Antidiabetic activity of streptozotocin (STZ) induced diabetes.

**2. Fenugreek (*Trigonella foenum-graceum*)**

Anti-hyperglycemic effects associated with decreased somatostatin and increased plasma glucagon levels the anti-hyperglycemic effects of fenugreek are thought to be due to amino acids 4-Hydroxysoleucine works by: Increasing insulin and glucose absorption in peripheral tissues.



3. Gurmar (*Gymnema sylvestre*): Aqueous extracts of *G. sylvestre* have been reported to cause a reversible increase in calcium and insulin secretion from beta cells in type 2

diabetic rats and humans. Regeneration of pancreatic cells voluntarily increases insulin levels.



4. Karela (Bitter Melon): Bitter melon can repair damaged beta cells, thereby increasing insulin levels and improving insulin sensitivity/signaling. It has been reported that bitter melon can block glucose absorption by inhibiting glucosidase in the intestine and inhibiting disaccharidase activity.



5. Haldi (*Curcuma Longa*)

Ethanol extract of turmeric (*Curcuma Longa* L. rhizome) inhibits the increase in blood sugar in type 2 diabetic KK-A(y) mice. In an *in vitro* test, the extract strengthened the human adipocyte differentiation in a dose-dependent manner and Showed human peroxisome proliferator-activated receptor (PPAR)-gamma ligand-binding activity in a GAL4-PPAR-Gamma chimera assay.



6. Ashwagandha (*withania-somnifera*): Ashwagandha, together with other ingredients of the combined preparation

(Transina), has been reported to reduce streptozotocin (STZ)-induced hyperglycemia in rats. This anti-hyperglycemic effect may be due to islet free radical scavenging activity, since the hyperglycemic activity of STZ is due to islet cell superoxide dismutase (SOD) activity, leading to accumulation of degenerative oxidative free radicals in pancreatic beta cells.



7. Neem (*Azadirachta indica*)

Neem is known to have hypolipidemic, hypoglycemic, anti-inflammatory and hepatoprotective properties. And nimboicinone, Nimolinone, kulaktone, nimocinolide, isomocinolide, Nimbin, salanine, azadirachtin, flavonoids, myricetin, Meldenindiol, vilasinin, margosinolide, isomargosinolide, Meldeninolidin, br. Indica leaves have medicinal properties and bougainvillea Spectabilis leaves contain d-pinitol (3-O-Methylchiro-inositol), which is said to have insulin-like properties function.



Marketed formulation



Fig 1: Sharing dyab-ten



Fig 2: Herbal hills jambu



Fig 3: Stevia-33



Fig 4: Diab-fit



Fig 5: Madhumar capsula



Fig 6: Daya stone powder



Fig 7: Diabetone tablet



Fig 8: Kumari-SAAR

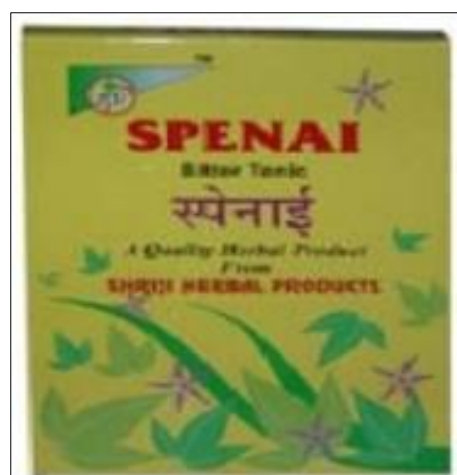


Fig 9: Spenni



Fig 10: Blue berry

Conclusion

In this study, it was determined that physicochemical parameters such as herbal density, tap density, carrs index, Hausner ratio and sensory properties can be effectively used in the standardization of individual and compound herbal formulations of herbal antidiabetic drugs. The results of this study can be used as a reference in the use of sample limits for quality control and quality assurance of antibiotics.

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