



A REVIEW ANTIDIABETIC ACTIVITY

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ABSTRACT:

Diabetes mellitus (DM) is a long-life metabolic disorder, characterized by high blood glucose levels. The hyperglycemic condition generally leads to irreversible nerve injury and vascular damage. Among different types of diabetes, type 2 is more common and has spread all over the world. Although various therapeutic approaches have been developed to control type 2 DM, regulating blood glucose levels has still remained a controversial challenge for patients. Also, most prescription drugs cause different side effects, such as gastrointestinal disorders. Thus, developing novel and efficient antidiabetic agents possessing fewer adverse effects is in high demand.

Diabetes is a metabolic disease that affected 9.3% of adults worldwide in 2019. Its co-occurrence is suspected to increase mortality from COVID-19. The treatment of diabetes is mainly based on the long-term use of pharmacological agents, often expensive and causing unpleasant side effects. There is an alarming increase in the number of pharmaceuticals taken in Europe. The aim of this paper is to concisely collect information concerning the few antidiabetic or hypoglycaemic raw plant materials that are present in the consciousness of Europeans and relatively easily accessible to them on the market and sometimes even grown on European plantations. The following raw materials are discussed in this mini-review: *Morus alba* L., *Cinnamomum zeylanicum* J. Presl, *Trigonella foenum-graecum* L., *Phaseolus vulgaris* L., *Zingiber officinale* Rosc., and *Panax ginseng* C.A. Meyer in terms of scientifically tested antidiabetic activity and the presence of characteristic biologically active compounds and their specific properties, including antioxidant properties. The characteristics of these raw materials are based on in vitro as well as in vivo studies: on animals and in clinical studies. In addition, for each plant, the possibility to use certain morphological elements in the light of EFSA legislation is given.

KEYWORDS: antidiabetic, hypoglycaemic activity, medicinal plants, white mulberry, fenugreek, cinnamon, ginseng, ginger, common bean, diabetes

INTRODUCTION:

Diabetes mellitus is a growing global health concern, with increasing prevalence and mortality rates. Despite advances in modern medicine, the search for effective and safe antidiabetic agents continues. Many plants and compounds have been investigated for their potential antidiabetic activity, offering new avenues for treatment and management. This review aims to summarize the current state of research on antidiabetic activity, highlighting promising leads and future directions. Diabetes mellitus (DM) is a chronic metabolic disease which is described by hyperglycemia and high blood sugar levels in postprandial and fasting state. It is characterized by defects in insulin secretion, insulin action, or both of them [1]. The total number of diabetic patients in the world has been anticipated to rise from 171 million in 2000 to 366 million in 2030 [2]. Considering the long-term side effects of DM, it has become one of the major causes of morbidity in the world [3]. There are different types of diabetes based on its pathogenesis, including insulin-dependent (type I), noninsulin-dependent (type II), and gestational. Type 2 DM is more common than the other types in which the body's insulin receptors become resistant to the normal insulin effects. Then, β cells of the pancreas respond to the high blood glucose levels by producing more insulin to manage the situation. However, the insulin overproduction makes β cells wear themselves out [4, 5].

Patients with DM may experience some complications such as retinopathy, neuropathy, nephropathy, cataracts, peripheral vascular insufficiencies, and damaged nerves resulting from chronic hyperglycemia [5–7]. High blood glucose levels in type 2 DM can be controlled by using insulin or oral antidiabetic drugs [8]. Different pathways and mechanisms are considered for preventing the progression of the disease. They may include inhibition of intestinal α -glucosidase and α -amylase, inhibition of aldose reductase, insulin synthesis and secretion, inhibition of lens aldose reductase, oxidative stress protection, inhibition of formation of advanced glycation end products, lowering plasma glucose levels, altering enzyme activity of hexokinases and glucose-6-phosphate, inhibition of postprandial hyperglycemia, stimulation of GLUT-4, decreasing activity of G6P, and reducing the level of skeletal hexokinases [5].

One of the most popular approaches to the management of blood glucose levels is the inhibition of key enzymes [9]. α -Glucosidase and α -amylase are two carbohydrate digestive enzymes which can cause elevated postprandial hyperglycemia (PPHG); thus, their inhibition plays a significant role in controlling PPHG in patients with type 2 DM. Inhibition of α -glucosidase leads to the reduction of disaccharide hydrolysis, and inhibition of α -amylase disrupts the breakdown of starch to simple sugars. Some of these compounds are clinically used, and the results have shown significant reduction of blood glucose levels in patients [10, 11]. The most important side effect related to the approved Food and Drug Administration (FDA) antitype 2 DM drugs,

including voglibose, acarbose, miglitol, sulphonylureas, and thiazolidine, is gastrointestinal problems such as swelling, abdominal distention, diarrhea, and meteorism, which need more attention. Thus, investigation of different therapeutic agents with lower side effects is in high demand.

OBJECTIVES:

1. Review and categorize antidiabetic agents:

- To identify and compile a comprehensive list of different classes of antidiabetic agents explored in the literature, such as medicinal plants, synthetic drugs, and bioactive compounds.
- To classify these agents based on their origin (e.g., specific plant species, chemical class) and mechanism of action (e.g., insulin secretion, inhibition of glucose absorption).

2. Analyze mechanisms of action:

- To summarize the reported mechanisms through which various agents exhibit their antidiabetic effects. This includes examining how they might:
 - Enhance insulin secretion from pancreatic β -cells.
 - Increase insulin sensitivity in target tissues.

3. Evaluate research methodologies and findings:

To assess the methodologies employed in experimental studies (both *in vitro* and *in vivo*) that have evaluated antidiabetic activity.

4. Identify knowledge gaps and future directions:

- To pinpoint areas where research is lacking, such as unexplored plant species, unconfirmed mechanisms, or insufficient safety and toxicity data.

5. Assess safety and efficacy:

- To evaluate the potential adverse effects and toxicity associated with different antidiabetic agents, particularly herbal or novel compounds.

IMPORTANCE:

The evaluation of antidiabetic activity is of great importance due to the increasing global prevalence of diabetes mellitus, a chronic metabolic disorder that leads to serious complications such as cardiovascular disease, neuropathy, nephropathy, and retinopathy. Current antidiabetic drugs, while effective, often have limitations including side effects, high cost, and reduced efficacy over time. Therefore, exploring new agents—especially from natural sources with minimal toxicity—has become a vital area of research. Studying antidiabetic activity helps identify potential compounds that can regulate blood glucose levels, enhance insulin secretion or sensitivity, and prevent secondary complications. Such investigations contribute to the development of safer, more effective, and affordable therapeutic options to improve the quality of life of diabetic patients.

STEPS OF ANTIDIABETIC FACE PACK:

 Antidiabetic Face Pack – Steps

1. Gather Ingredients

Choose ingredients known for their antibacterial, antioxidant, and skin-healing properties. Common ingredients include:

Neem powder – antimicrobial and purifying

Tulsi (holy basil) powder – antibacterial, antioxidant

Aloe vera gel – moisturizing, soothing

Turmeric powder – anti-inflammatory and brightening

Multani mitti (Fuller's earth) – absorbs excess oil, cleanses

Honey – natural humectant and antibacterial

2. Preparation of the Pack

1. Take 1 teaspoon neem powder.
2. Add 1 teaspoon tulsi powder.
3. Add ½ teaspoon turmeric powder.
4. Mix in 1 teaspoon multani mitti.

3. Cleansing

Wash your face with a mild herbal cleanser or lukewarm water to remove dust and oil. Pat the skin dry with a clean towel.

4. Application

Apply the paste evenly over your face and neck, avoiding the eye and lip area. Use gentle circular motions while applying to enhance absorption and blood flow.

5. Drying Time

Leave the face pack on for 15–20 minutes or until it starts to dry. Avoid talking or moving your facial muscles too much during this time.

6. Rinsing

Rinse off the pack with lukewarm water using gentle circular motions.

Do not use soap immediately afterward.

Pat dry with a soft towel.

7. Moisturizing

Apply a light, non-comedogenic moisturizer or aloe vera gel afterward to keep the skin hydrated.

8. Frequency of Use

Use the face pack 2–3 times a week for best results. People with diabetes should also maintain good blood sugar control, as it directly affects skin health.

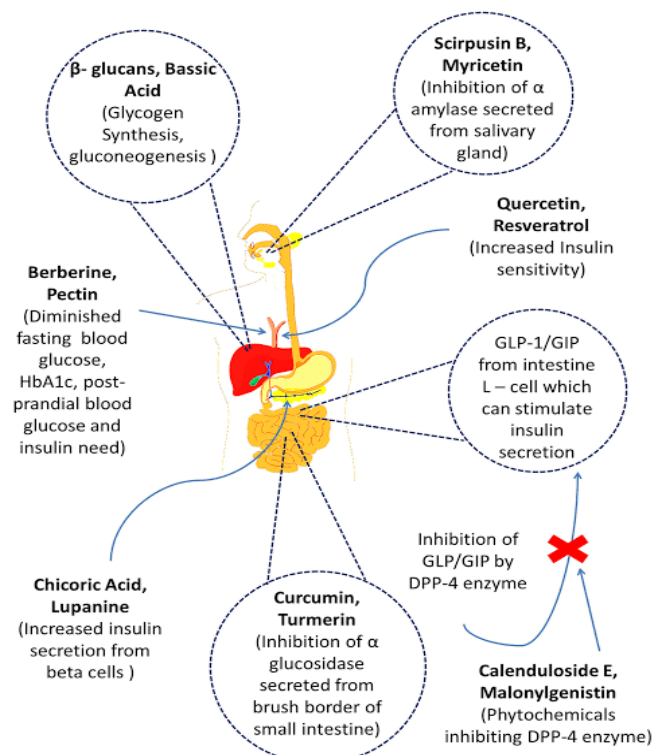
BENEFITS OF APPLYING FACE PACK:

Benefits of applying a face pack

Face packs are used for cosmetic and dermatological purposes, focusing on the skin's health and appearance, not systemic metabolic functions. The recognized benefits of face packs include:

- **Deep cleansing:** They can help to draw out impurities, unclog pores, and remove excess oil and dirt from the skin.
- **Improved appearance:** Face packs can enhance skin radiance, improve texture, and reduce the appearance of blemishes and acne.
- **Exfoliation:** Some packs contain ingredients that help remove dead skin cells.
- **Hydration:** Moisturizing face masks can boost skin hydration.
- **Relaxation:** The process of applying and waiting for a face pack can have a therapeutic, relaxing effect.

•DIAGRAM:



PROCEDURE FOR FACE PACK FORMULATION:

1. Antidiabetic activity for face packs The process uses natural ingredients that are commonly Used For skin problems.
2. It involves extracting an alkaloid called 'berberine' from medicinal plants with antidiabetic properties such as 'Berberis vulgaris'.
3. The process is done using a "green" method, which uses a mixture of glycerol and water, which keeps the skin healthy and improves skin elasticity.
4. In addition, face packs are prepared using ingredients such as multani mitti, turmeric, sandalwood, rose water and aloe vera to brighten the skin and make it acne-free.

FORMULATION TABLE:

Table 1.
Ingredients of Ayurvedic Formulation

Ayurvedic Name	Scientific name	Quantity
Rasa (prada) suddha	Mercury	1 part
Gandhaka suddha	Sulphur	1 part
Loha bhasma	Iron	1 part
Abhra (abhraka) bhasma	Mica	1 part
Kanya (kumara) swarasa	<i>Aloe barbadensis</i> Mill.	¼ part, for mardana
Eranda patra	<i>Ricinus communis</i> Linn.	Q.S. for avestana

USES OF FACE PACK:

Certain ingredients commonly found in face packs and other skincare products can be beneficial for skin problems that often affect people with diabetes.

- **Turmeric:** Known for its antibacterial, antiseptic, and anti-inflammatory properties, turmeric can help address acne and pimples that may occur.
- **Honey:** This ingredient has moisturizing properties and can help fight skin infections.
- **Aloe Vera:** This powerful moisturizer with soothing properties can benefit dry, sensitive skin and has antimicrobial qualities that help with acne and blemishes.
- **Neem:** Often used for oily and acne-prone skin, neem is a powerful antiseptic.
- **Multani Mitti (Fuller's Earth):** This ingredient is known for detoxifying the skin, improving circulation, and helping with acne and blemishes.
- **Sandalwood:** Benefits include soothing irritated skin and anti-tanning and anti-aging effects.
- **Oatmeal:** An oatmeal paste can be used to moisturize the skin and control itching.
- **Moisturizers:** Products containing ingredients like urea and ceramides are particularly important for people with diabetes to combat dryness and prevent cracks that can lead to infection.

ADVANTAGE:

1. Potential for novel therapeutic leads with improved efficacy and safety profiles
2. Reduced risk of adverse effects associated with synthetic antidiabetic agents
3. Accessibility and affordability of plant-based treatments, particularly in resource-limited settings
4. Opportunities for synergistic combinations and personalized treatment approaches

DISADVANTAGES:

1. **Hypoglycemia:** A major side effect of many drugs, especially sulfonylureas, which can be severe and dangerous.
2. **Gastrointestinal and other side effects:** Common side effects include nausea, diarrhea, and weight gain, while others may cause pancreatitis or lactic acidosis.
3. **Need for monitoring:** Requires regular blood glucose monitoring and, in some cases, liver or renal function tests.
4. **Slow onset of action:** Some drugs may have a slow onset, which can make them less effective for acute needs.
5. **Drug interactions:** Can interact with other medications (e.g., aspirin, beta-blockers) and increase the risk of side effects, especially hypoglycemia.
6. **Contraindications:** Certain drugs are not suitable for patients with specific conditions, such as heart failure, renal disease, or a history of pancreatitis.

CONCLUSION:

The present review has presented comprehensive details of anti-diabetic plants used in the treatment of diabetes mellitus. It shows that the plants highlighted above have potent hypoglycemic effects. Many new bioactive drugs isolated from plants having hypoglycemic effects showed antidiabetic activity equivalent to these plant, plant parts or plant extract and sometimes even more potent than known synthetic oral hypoglycemic agents. However, many other active agents obtained from plants have not been well characterized. More investigations must be carried out to evaluate the mechanism of action of medicinal plants with antidiabetic effect. The toxic effect of these plants should also be elucidated.

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