A REVIEW ON ACTIVE PHYTOFRACTIONS FOR ANTI-DIABETIC POTENTIAL OF TORILIS LEPTOPHYLLA

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ABSTRACT

Torilis leptophylla, a medicinal plant, demonstrates antidiabetic potential through various bioactive phytocompounds. studies have shown that its extracts and isolated compounds can inhibit alpha-glucosidase, reducing glucose absorption, and lower blood sugar levels in diabetic models. specific compounds like isoscutellarein-8-o-β-d-glucopyranoside (ig) have shown strong inhibitory activity against alpha-glucosidase and effectively reduced hyperglycemia. additionally, torilis leptophylla extracts possess antioxidant properties, further contributing to their potential for diabetes management.

Torilis leptophylla, a medicinal plant, possesses several phytofractions with antidiabetic potential. Specifically, the methanolic, n-hexane, chloroform, ethyl acetate, n-butanol, and residual aqueous fractions have shown notable antioxidant properties. Additionally, the plant contains compounds like alkaloids, glycosides, saponins, tannins, and terpenoids, which may contribute to its antidiabetic effects. The flavonoid-rich fractions, in particular, have demonstrated α-glucosidase and α-amylase inhibitory activities, indicating their ability to control blood sugar levels.

Torilis leptophylla, a medicinal plant, possesses potential anti-diabetic properties due to its rich phytochemical composition. Specifically, its extracts and isolated compounds demonstrate α-glucosidase inhibition and anti-hyperglycemic activity, which are key to managing diabetes.

Torilis leptophylla holds promise as a source of natural anti-diabetic agents due to its ability to inhibit glucose absorption, reduce blood glucose levels, and potentially regulate insulin sensitivity. The active phytofractions, including ethanol and aqueous extracts and the isolated IG compound, contribute to its antidiabetic potential.

Keywords: Torilisleptophylla,Antidiabetic Potential,Phytofraction Analysis, DPPH, Antioxidant, Oxidative stress, TBARS

1 INTRODUCTION

Torilis leptophylla, commonly known as bristlefruit hedgeparsley, is an annual herb belonging to the Apiaceae (carrot or parsley) family. It is native to Europe, Africa, and parts of Asia. This plant is characterized by its finely divided leaves and bristly fruits, and it thrives in disturbed habitats like roadsides, fields, and waste areas.

Key characteristics:

- **Common name:** Bristlefruit hedgeparsley.
- **Family:** Apiaceae (carrot or parsley family).
- **Native range:** Europe, Africa, and parts of Asia.
- **Growth habit:** Annual herb, typically growing up to 60 cm tall.
- **Leaves:** Bipinnate, with linear segments.
- **Fruits:** Oval to ovoid, bristly, with bristles that are slightly ascending and up to 1 mm long, according to Go Botany: Native Plant Trust.
- **Habitat:** Roadsides, fields, and waste areas.
- **Other features:** Umbels with 2-5 unequal rays, involucral bracts lacking, and calyx teeth acuminate.

Torilis leptophylla, a plant species, has shown promising anti-diabetic potential through its ability to inhibit key enzymes involved in glucose regulation, reduce blood glucose levels, and improve lipid profiles in animal models. Specifically, extracts of T. leptophylla have demonstrated significant inhibition of α-amylase and α-glucosidase, enzymes that play a crucial role in carbohydrate digestion and glucose absorption. Furthermore, these extractshave shown the ability to lower blood glucose levels and improve lipid profiles in diabetic animal models.

Elaboration:

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels, leading to various health complications. The management of diabetes often involves lifestyle modifications, pharmacological interventions, and in some cases, complementary therapies. Medicinal plants have long been a source of potential therapeutic agents for diabetes, and T. leptophylla is one such plant that has gained attention for its anti-diabetic properties.

Key findings related to T. leptophylla's anti-diabetic potential:

- **Inhibition of key enzymes:**

Extracts of T. leptophylla have demonstrated significant inhibition of α-amylase and α-glucosidase, enzymes that are critical in the breakdown of carbohydrates and the subsequent absorption of glucose into the bloodstream. By inhibiting these enzymes, T. leptophylla can help to slow down the rate at which glucose enters the bloodstream, preventing rapid spikes in blood sugar levels.

- **Blood glucose reduction:**

Studies in animal models have shown that extracts of T. leptophylla can effectively lower blood glucose levels, indicating its potential in managing hyperglycemia, a hallmark of diabetes.

- **Improvement in lipid profiles:**

In addition to its effects on blood glucose, T. leptophylla extracts have also shown the ability to improve lipid profiles in diabetic animals, specifically by reducing triglycerides and LDL cholesterol levels, while increasing HDL cholesterol levels. This is important because diabetes is often associated with dyslipidemia, which increases the risk of cardiovascular complications.

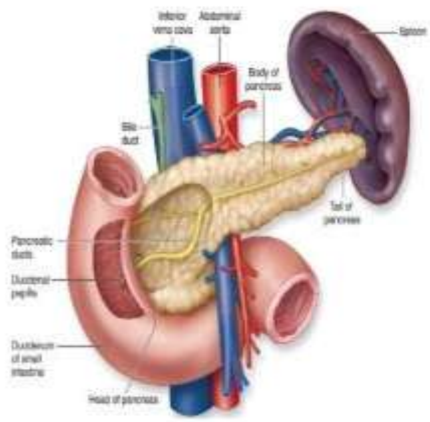
Further research:

While the findings on T. leptophylla's anti-diabetic potential are promising, further research is needed to isolate and identify the specific compounds responsible for these effects. Additionally, more extensive studies in human subjects are necessary to confirm the efficacy and safety of T. leptophylla as a therapeutic agent for diabetes.

Anti – Diabetic Potential

Diabetes mellitus (DM) is a metabolic disorder characterised by hyperglycaemia and interruption of the metabolism of protein, carbohydrate and fat. It may be associated with distinctive symptoms, such as polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger).

... uction of the beta cells of the pancreas, which leads to insulin deficiency. Some of the processes can cause resistance to insulin, leading to increased plasma glucose levels and abnormalities of carbohydrate, fat and protein metabolism. Diabetes is due to either the pancreas not producingenough insulin or the cells of the body not responding properly to the insulin produced.



There are three main types of diabetes mellitus:

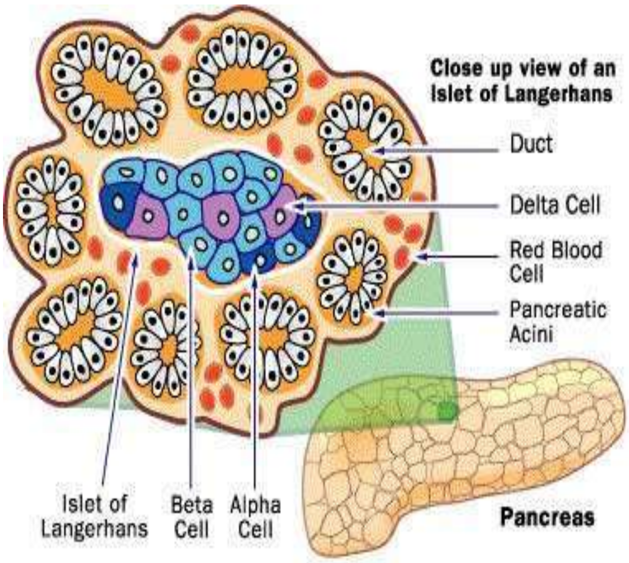
Type 1 DM

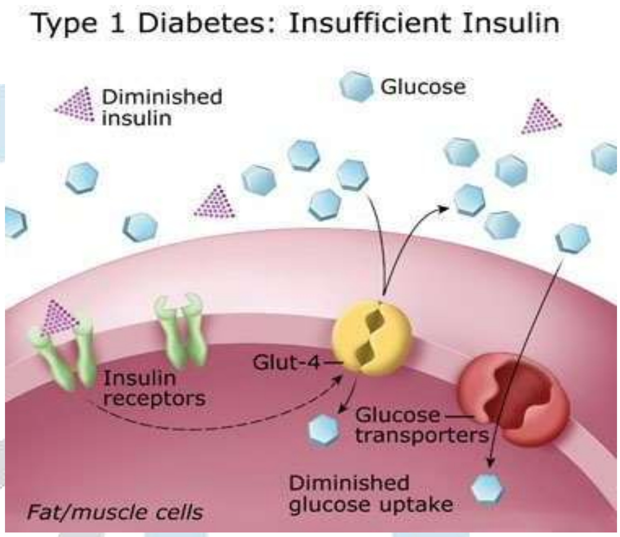
Type 2 DM

Gestational Diabetes

Type 1 DM

Results from the pancreas's failure to produce enoughinsulin





This form was previously referred to as "insulin- dependent diabetes mellitus" (IDDM) or "juvenilediabetes".The cause is unknown.

SIGNS AND SYMPTOMS

the classic symptoms of untreated diabetes are

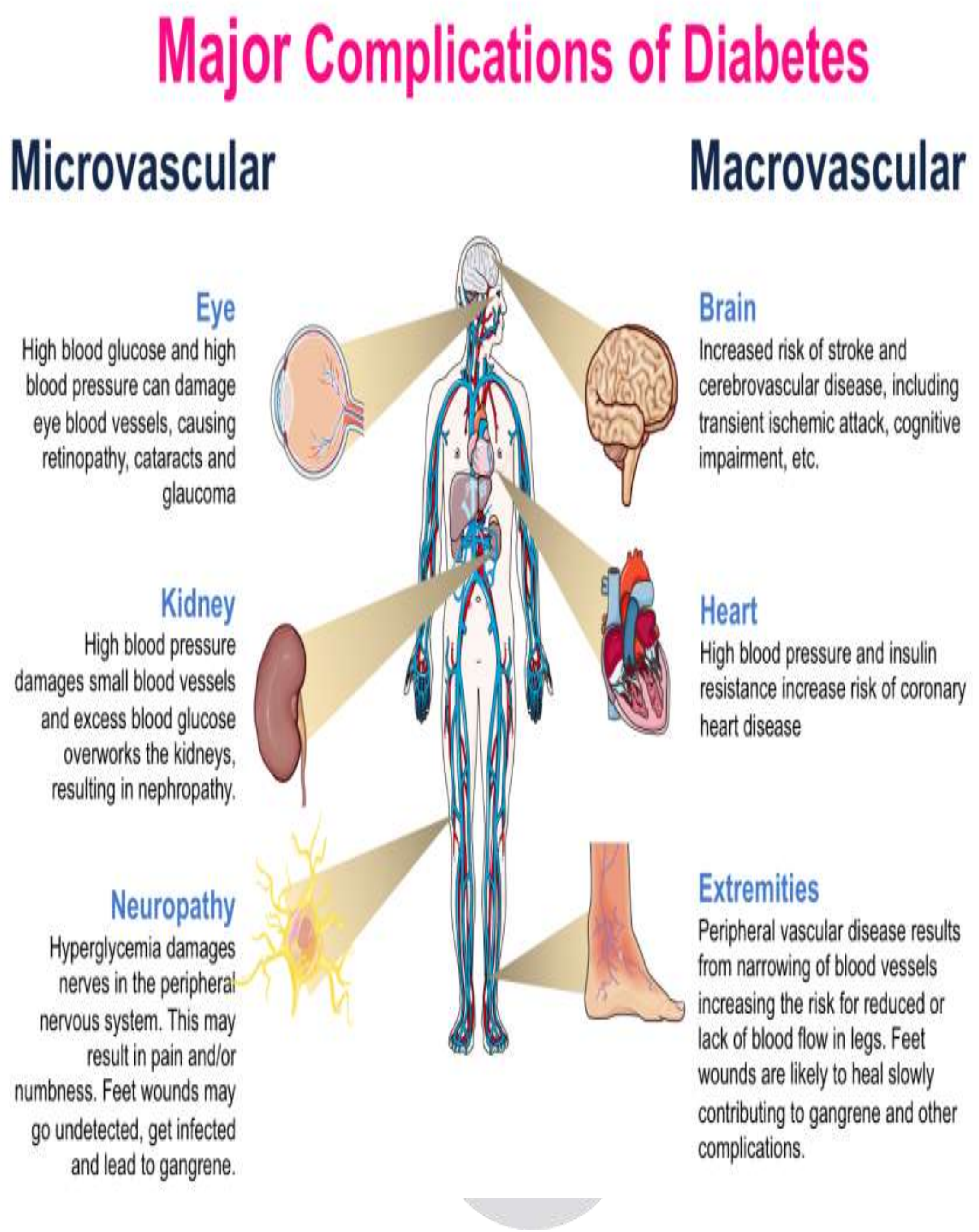
weight loss

polyuria (increased urination)

polydipsia (increased thirst) and

polyphag

ia (increased hunger)



2 Significance of the Study

In developing countries, traditional and herbal medicine including the folk medicinal practice scatters to nearly 70 % of the population because of accessibility, affordability as well as the time tested dependability. They mainly use or dependent on herbal medicine because of the side effects of the most of the modern drugs. So the herbal medicine was selected for the present research.

Chemical substances derived from animals, plants and microbes have been used to treat various human diseases since the dawn of the medicine. The investigation of natural products as source of novel therapeutic agents has reached its peak in the western pharmaceutical industry in the period 1970-1980, which resulted in the synthesis of non-synthetic compounds or molecules. Of the 877 small-molecule New Chemical Entities (NCEs) introduced between 1981-2002, roughly half almost 49% were natural products, semi-synthetic natural product analogues or synthetic compounds based on natural products.

Traditional plant-based medicines still exert great deal of importance to people living in developing countries and also serve as source to discovery of new drug candidates for a variety of diseases that threaten human health.

3 Pharmacology Activity :-

Antioxidant Activity:

Torilis leptophylla extracts exhibit antioxidant properties, which are crucial for managing diabetes-related complications like oxidative stress.

Alpha-glucosidase Inhibition:

torilis leptophylla extracts, particularly ethanol and aqueous extracts, have been shown to inhibit alpha-glucosidase, an enzyme responsible for carbohydrate breakdown in the small intestine. this inhibition reduces the absorption of glucose, contributing to lower blood sugar levels.

Anti-hyperglycemic Activity:

In STZ-induced diabetic mice models, Torilis leptophylla extracts, particularly the ethanol extract, demonstrated a significant reduction in blood glucose levels compared to diabetic controls. This indicates a strong anti-hyperglycemic effect.

Specific Compounds:

Isoscutellarein-8-O-β-D-glucopyranoside (IG), an isolated compound from the ethanol extract of Torilis leptophylla, exhibits strong alpha-glucosidase inhibitory activity, even exceeding the potency of acarbose, a common alpha-glucosidase inhibitor.

Antioxidant Properties:

Torilis leptophylla extracts possess antioxidant properties, which are beneficial in managing diabetes-related complications such as oxidative stress.

Mechanisms of Action:

The antidiabetic activity of Torilis leptophylla is likely due to multiple mechanisms, including alpha-glucosidase inhibition, reduced glucose absorption, and improved insulin sensitivity.

Phytofraction Analysis:

Torilis leptophylla, when extracted using different solvents, yields several fractions with varying degrees of antioxidant activity. The methanolic fraction (TLM), in particular, exhibits high total phenolic content.

Antioxidant Properties:

The various fractions, including TLM, TLE (ethyl acetate), and others, demonstrate significant antioxidant activity through various assays like DPPH, ABTS, phosphomolybdate, and hydroxyl radical scavenging.

Antidiabetic Potential:

The plant's active fractions, particularly the flavonoid-rich ones, show promising results in inhibiting α-glucosidase and α-amylase, key enzymes involved in carbohydrate metabolism. These enzymes play a role in the digestion and absorption of carbohydrates, making their inhibition crucial for managing blood sugar levels in diabetic individuals.

Other Compounds:

Beyond flavonoids, Torilis leptophylla also contains other compounds like alkaloids, glycosides, saponins, tannins, and terpenoids, which may also contribute to its antidiabetic and antioxidant properties. For example, glycosides and saponins are known to enhance insulin sensitivity and improve glucose metabolism.

In Vivo Studies:

In vivo experiments have shown that administration of Torilis leptophylla extracts can significantly reduce lipid peroxidation and increase GSH (glutathione) levels in the liver, further supporting its antioxidant and potential anti diabetic effects.

4 RESEARCH ENVISAGED

In the absence of any active therapeutic compound of extracts of these biological herbs, there is a need in identification of an active compound and its evaluation by suitable animal model against diabetes.

Our aim is to isolation and identification of an active compound from whole plant extracts of in whole plant extracts Torilis leptophylla L and its evaluation by suitable animal models.

5 DRUG PROFILE

Plant Name: Torilis leptophylla

Kingdom: Plantae

Phylum: Tracheophyta

Class: Equisetopsida

Subclass: Magnoliidae

Order: Apiales

Family : Apiaceae

Genus: Torilis

Species : Torilis leptophylla

Torilis leptophylla whole plant

6 Phyto-Pharmacological Investigations;

1 **Naima Saeed et al., (2012)** during antioxidant investigations of plant Torilis leptophylla found EC50 values for DPPH, hydroxyl, phosphomolybdate and ABTS, whereas another weak and positive correlation was determined between TFC and EC50 values for superoxide anion and hydroxyl radicals.

2 Naima Saeed et al., (2015) showed the existence of alkaloids, anthraquinones, cardiac glycosides, coumarins, flavonoids, saponins, phlobatannins, tannins and terpenoids in whole plant extracts Torilis leptophylla L. Presence of anthraquinones and phlobatannins were not recorded in all fractions. The total phenolic contents (TPC) (121.9 ± 3.1 mg GAE/g extract) of TLM while total flavonoid contents (TFC) of TLE (60.9 ± 2.2 mg RTE/g extract), TLM (59.6 ± 1.5 mg RTE/g extract) and TLB (55.0 ± 2.5 mg RTE/g extract) were found significantly higher as compared to other solvent fractions.

3 Nasreen Noshin et al., (2023) reported terpenes were studied from a pharmacological point of view with relatively high frequencies for antifungal, antibacterial, cytotoxic and anti-inflammatory activities. Preliminary structure-activity relationships were highlighted implying opposite effects between hydroxylation and methylation in favor of different activities. Crude extracts and isolated compounds have shown several biological activities (antibacterial, anticancer, antiangiogenic, antiproliferative, etc.), thus providing authentic scientific proof for their diverse uses in folk medicines.

Torilis leptophylla belonging to the Apiaceae family or more commonly known as Bristle fruit Hedge parsley, is a forb of the genus Torilis, distributed in Asia, Europe and North Africa.Phytochemical screening of TLM revealed the presence of alkaloids, anthraquinones, cardiac glycosides, coumarins, flavonoids, saponins, phlobatannins, tannins and terpenoids.

Ethnobotanical studies of Trollis genus have documented various pharmacological effects such as anti-allergenic, antifungal, antibacterial, anti-inflammatory, anti-proliferative and sedative activities. The plant part possesses medicinal properties and is used to treat various diseases and disorders such as lymphadenitis, rheumatism, infertility, chronic diarrhea, carbuncle, dysentery, fever, hemorrhoids, metabolic disorders, spasm, and uterine tumors.

In Japan, the fruit is used to cure skin diseases, testitis, arthroneuralgia, impotence, and renal disorders, besides its consumption for healing amnesia, pruritis, acidosis, women's diseases,

4 Saba Batool et al., (2022) reported Torilis leptophylla could significantly protect gastric mucosa from damage by indomethacin. Gastric ulcer reduced the body weight in indomethacin induced animals (28 ± 2.53, 29.66 ± 3.88, 29.66 ± 2.33, 31 ± 3.52,32 ± 3.099 g in group II, III, IV, V and VI respectively) at day 3. Omeprazole and TLM treated groups reduced the gastric volume and pH as compared to positive control. Ulcer index (18.83, 5.14, 3.42, 1.71, 1.76 of the group II, III, IV, V and VI respectively) depicted significant reduction by treatment groups. Ulcer's percentage inhibition (72.7, 81.8, 90.88, 90.65 of low, median and high dose of TLM and standard drug respectively) was increased.

5 Yong Fang et al., (2016) reported cognitive dysfunction and brain injury associated with enhanced oxidative stress can be reversed by the antioxidant properties of the TL extract. The study showed approximately 1.5-fold improvement in object recognition index of TL extract- treated anesthetized rats compared with the control group of anesthetized animals. Additionally, the escape latency values of the anesthetized rats in Morris water maze experiments were reduced following TL extract treatment at all time points throughout the 5-day study protocol. Finally, biomarkers of oxidative stress in the brain indicate that the levels of superoxide dismutase and catalase enzymes were improved.

7 Material and methods

A detailed study was performed on the anti-diabetic Potential activity of the methanol extract of whole plant of *Torilis leptophylla* (TLM) and its derived fractions {*n*-hexane (TLH), chloroform (TLC) ethyl acetate (TLE) *n*-butanol (TLB) and residual aqueous fraction (TLA)} by *in vitro* chemical analyses and carbon tetrachloride (CCl_4) induced hepatic injuries (lipid peroxidation and glutathione contents) in male Sprague-Dawley rat. The total yield, total phenolic (TPC) and total flavonoid contents (TFC) of all the fractions were also determined. TLM was also subjected to preliminary phytochemical screening test for various constituents.

Key Phyto fractions and their Potential:

Ethanol and Aqueous Extracts:

These extracts of Torilis leptophylla exhibit strong α-glucosidase inhibitory activity, exceeding that of acarbose, a known α-glucosidase inhibitor, at similar concentrations. In STZ-induced diabetic mice, both extracts showed significant reduction in blood glucose levels.

Isoscutellarein-8-O-β-D-glucopyranoside (IG):

This compound isolated from the ethanol extract demonstrates potent α-glucosidase inhibition, surpassing acarbose tenfold. It also effectively mimics the anti-hyperglycemic effects of the standard drug glibenclamide.

Other Potential Phytochemicals:

ResearchGate reports that the plant extracts contain total phenolic and total flavonoid contents, which are associated with antioxidant properties. The presence of flavonoids, particularly apigenin, naringin, and patuletin derivatives, in the extracts suggests their potential in regulating blood sugar and lipid metabolism, a study published in MDPI.

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