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Original Research Article

Evaluation of Antidiabetic Activity of the Pulp of *Tamarindus Indica* Linn

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Abstract

Tamarindus indica belongs to family Caesalpiniaceae. *Tamarindus indica* is believed to have antidiabetic, hepatoprotective and many other medicinal properties. Different parts of the plant possess some or the other activity which makes this plant more useful. Besides, many of its beneficial effects, one of the significant effects is management of diabetes. Because of its multiple mechanisms of action, it provides better management of diabetes as compared to synthetic compound, because insulin and oral hypoglycaemic drugs have undesirable side effects. Present article focuses on the antidiabetic activity of *Tamarindus indica* along with its mechanism in the body.

Keywords: *Tamarindus indica*, Diabetes, Antidiabetic activity, Tetul tree, Extract.

Introduction:

As per ancient literature, more than 800 plants are reported to have antidiabetic properties. Ethnopharmacological surveys indicate that more than 1200 plants are used in traditional medicine for their alleged hypoglycemic activity[1,2]. The knowledge of the ancient system of herbals in treatment of diabetes may be useful in its management. Ayurvedic antidiabetic herbs improve digestive power, increase one of the Rasas (gastric secretions); being Laghu, get easily digested in the body; and being Ruksha, decrease output of overall body fluids e.g. urine, sweat etc. Mellitus, as the history reveals, existed with the Indians since prehistoric age. Plants-based products have been popular all over the world for the centuries. In diabetes, some herbal alternatives are proven to provide symptomatic relief and assist in the prevention of the secondary complications of the disease. Some herbs have also been proven to help in the regeneration of ß-cells and in overcoming resistance. In addition to maintaining normal blood sugar level, some herbs are also reported to possess antioxidant activity and cholesterol- lowering action[6,7]

The management of type 2 diabetes mellitus (NIDDM) is possible with the drugs that can lower the blood sugar level in one hand and restore the liver glycogen level on the other. In modern system of medicine, there is no drug, which is reported to possess both of these properties. Metformin, a less toxic biguanides and potent oral glucose-lowering agent, was developed from Galega officianalis and used to treat diabetes. Out of dozens of oral medications for diabetes, only one medication (metformin) is approved for use in children, and it has been originated from herbs[10,14]. A large number of antidiabetic medicines are available in the pharmaceutical market for diabetes and its related complications. However, currently no effective therapy is available to cure the disease. Due to unwanted side effects, the efficacies of these compounds are debatable and there is a demand for new compounds for the treatment of diabetes. In the last few years, there has been a growing interest in the herbal medicine in care and management of diabetes both in developing and developed countries, due to their natural origin and less side effects.

Mechanism of action of herbal antidiabetics[1,9]

The antidiabetic activity of herbs depends upon variety of mechanisms. The mechanism of action of herbal anti-diabetic could be grouped as:

- Adrenomimeticism, pancreatic β-cell potassium channel blocking, cAMP (2nd messenger) stimulation.
- Inhibition in renal glucose reabsorption.
- Stimulation of insulin secretion from β-cells of islets or/ and inhibition of insulin degradative processes.
- Reduction in insulin resistance.
- Providing certain necessary elements like calcium, zinc, magnesium, manganese and copper for the β-cells.
- Protective effect on the destruction of the β-cells.
- Regenerating and/or repairing pancreatic β-cells.
- Increasing the size and number of cells in the islets of Langerhans.
- Inhibition of β -galactocidase and α–glucocidase.
- Cortisol lowering activities.
- Inhibition of α-amylase.
- Preventing oxidative stress that is possibly involved in pancreatic ß-cell dysfunction found in diabetes.

A wide range of plant constituents could have different sites of action within the body. Herbs exerts different mechanism of actions including the mechanism of actions of synthetic oral hypoglycaemic drugs. As an indication of the flowing ability of a powder.

***Tamarindus indica* linn[10,12]**

Tamarindus indica Linn. [family-Caesalpiniaceae (Fabaceae)], locally known as Tetul tree. It is a large ample, evergreen tree, 12-18 m high with round bushy crown and comparatively smaller bole. Phytochemical investigation revealed the presence of many active constituents, such as phenolic compounds, cardiac glycosides, L-(-)mallic acid, tartaric acid, the mucilage and pectin, arabinose, xylose, galactose, glucose, and uronic acid[11,12]. The fruit pulp tartarate, invert sugar, gum and pectin. It also contains traces of oxalic acid. Seed testa contains a fixed oil. Seeds cotyledons contain albuminoids, fat and carbohydrates[13,14]. Traditional healers claim that the seed of the plant possess antidiabetic properties. It is preferred to be used for abdominal pain, diarrhea and dysentery, some bacterial infections and parasitic infestations, wound healing, constipation and inflammation. It is a rich source of most of the essential amino acids and phytochemicals, and hence the plant is reported to possess antidiabetic, antimicrobial, antivenomic, antioxidant, antimalarial, cardioprotective,

hepatoprotective, antiasthmatic, laxative and anti-hyperlipidemic activity.

Chemical constituents[3,5]

The fruit pulp contains organic acids such as tartaric acid, acetic acid, citric acid, formic acid, mallic acid and succinic acid. The pulp shows the presence of high amounts of ascorbic acid, vitamin B_1, B_3; amino acids, such as alanine, phenylalanine, proline, serine, leucine, invert sugar (25-30%); pectin, proteins, fats; pyrazines (trans 2-hexenal) and some fragrant thrazoles (2-ethylthiazole, 2 methylthiazole). The fruit pulp contains predominantly volatile constituents viz. 44% furan derivatives such as furfural, 2-acetyl furan, 5-methyl furfural and 38% carboxylic acid derivatives such as palmitic acid, oleic acid and phenylacetaldelyl. Pulp also contains alkaloids, glycorides, saponins, sesquiterpenes, flavonoids, tannins and phlobatannins in addition.

Vernacular names

In India, Tamarind is known by a wide variety of vernacular names: Tetuli (Assamese); Amli, Nuli, Textili Tentul (Bengali); Amali, Ambali (Gujarati); Ambli, Amli, Imli, (Hindi); Puli (Malayalam); Amli, Chinch, Chitz (Marathi); Koya, Tentuli (Oriya); Imli (Punjabi); Chinta (Telugu).

Medicinal and pharmacologic properties[7,10]

1. **Antimicrobial activity**- *T. indica* has a broad spectrum of antibacterial activity. The methanolic leaf extract of *T. indica* was assessed for antibacterial activity against Burkholderia pseudomallei. The antimicrobial activity of the concentrated extracts (aqueous, ethonolic, acetone extract) were evaluated by determination of the diameter of zone of inhibition against both gram-negative and gram-positive bacteria and fungi using the paper disk diffusion method. These have potent antimicrobial activity against Salmonella paratyphi, Bacillus subtilis, Salmonella typhi, and Staphylococcus aureus.
2. **Antioxidant properties-** All extracts of *T. indica* exhibited good antioxidant activity (64.5–71.7%) against the linoleic acid emulsion system and the values were lower and higher than the synthetic antioxidant, butylated hydroxyl anisole and ascorbic acid. Ethanolic extract of fruit pulp of *T. indica* showed significant antioxidant and hypolipidemic activity in hypercholesterolemic hamsters.
3. **Malaria and fever-** Fruits of Tamarind are known as a febrifuge in Madagascar. In Ghana, malaria is treated with Tamarind leaves, and the fruit pulp is used as a febrifuge and laxative.
4. **Diarrhea and dysentery-** Tamarind is also used for treating diarrhea and dysentery. The Tamarind pulp with lemon is used to treat diarrhea, and the root is used to treat dysentery.
5. **Helminthes infections (parasitic worms)-** Tamarind leaves are used in the extraction of Guinea worms, and afterward in the treatment of wounds, left by the parasite. macerate of the seeds is used as vermifuge, and also the fruits are used for this purpose.

Extraction of pulp

Fresh fruits of *Tamarindus indica* are cut into small pieces, seeds are removed and air dried. The dried pieces of *Tamarindus indica* fruit pulp, weighing 100 g, are soaked in 500 ml of 95% ethanol in a round flask for about 24 hours. The process of extraction is done by reflux condensation method using soxhlet apparatus at 60-80ºC for 9 hours. The extract is concentrated by distillation apparatus till a syrupy consistency is obtained. Finally, the

extract is put in a china dish and evaporated at 40-60^{0}C temperature in a water bath.

Phytochemical Estimation of the Extract

The extract of *Tamarinds indica* is subjected to qualitative analysis for the various phytoconstituents like alkaloids, carbohydrates, glycosides, sterols, saponins, tannins, protein, amino acid, and flavonoids.

Antidiabetic activity

1. Animals: Adult albino wistar male rat, weighing 200-230 g are used for the study.
2. Equipment and drug: Animal house, animals, weighing balance, streptozotocin, glibenclamide and other basic apparatus needed for the experiment.
3. Groups of animals: Each group contains 5 animals.
   Group I – Control group treated with normal saline injection.
   Group II – Standard group treated with glibenclamide.
   Group III – Untreated diabetic group.
   Group IV, V and VI – Test groups treated with *Tamrind indica linn* pulp extract.

Animal model:

Blood glucose lowering effect:

A. The animals are fasted for 12 hours but have access to water before and during the experiment.
B. Diabetes is induced in groups II-VI by slow intra – peritoneal injection of 55mg/kg solution of STZ in 0.1 ml citrate buffer (pH 4.5).
C. Blood is withdrawn from the tip of the tail, before and after 48-72 hours after inducing diabetes, to measure the blood glucose level using blood glucometer kit.
D. Control group I will receive normal saline (2m1/kg body weight).
E. Standard group II will receive 2.5mg/kg body weight of glibenclamide.
F. Group III will remain diabetic and untreated.
G. Test group IV-VI will receive 100, 200 and 300 mg/kg body weight of the extract respectively.

Result:

After obtaining all the data, process and compare the results for various groups. Antidiabetic activity of *Tamarindus indica* extract may be estimated.

Conclusion:

Diabetes mellitus (DM) is a metabolic disorder of multiple aetiologies characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism, resulting from defects in insulin secretion, insulin action or both. DM is grossly reflected by profound changes in protein metabolism and by a negative nitrogen balance and loss of nitrogen from most organs. Increased urea nitrogen production in DM may be accounted for by enhanced catabolism of both liver and plasma proteins. Management of DM without any side effects is still a challenge to the medical system. There is an increasing demand to use natural products with antidiabetic activity, because insulin and oral hypoglycaemic drugs have undesirable side effects. Medicinal plants are a good source of natural antioxidants believed to exert their effect by reducing the formation of the final active metabolite of the drug-induced systems or by scavenging the reactive molecular species to prevent their reaching a target site.

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