

Antidiabetic Effect of Acute Extract of Seed of Tamarindus Indica on Animals

Bhakti Waghade^{*1}, Ankita Wadinkar², Sakshi Zaware³,
Avinash Thanage⁴

¹Department Of Pharmacology, Dr VithalraoVikhe Patil Foundations CollegeOfPharmacy, Vilad Ghat, Ahmednagar-414111, Maharashtra, India.

²Department Of Pharmacology, Dr VithalraoVikhe Patil Foundations College Of Pharmacy, Vilad Ghat, Ahmednagar-414111, Maharashtra, India.

³Department Of Pharmacology ,Dr VithalraoVikhe Patil Foundations College Of Pharmacy, Vilad Ghat, Ahmednagar-414111, Maharashtra, India.

⁴Department Of Pharmacology ,Dr VithalraoVikhe Patil Foundations College Of Pharmacy, Vilad Ghat, Ahmednagar-414111, Maharashtra, India.

Submitted: 05-11-2022

Accepted: 20-11-2022

ABSTRACT

TAMARINDUS INDICA was used as a traditional medicine for the management of diabetes mellitus in human and experimental animals. The present investigation draws a comparison of the protective antioxidant activity, total phenol content and the antihyperglycemic activity of the methanolic extract of Cajanus cajan root (MCC) and Tamarindus indica seeds (MTI).

Antioxidant and antidiabetic activities of Tamarindus Indica leaf extracts from Malaysian macerated (TIME) and Soxhlet (TISE) were investigated. In the present study, aqueous extract of seed of Tamarindus indica was found to have potent antidiabetogenic activity that reduces blood sugar level in streptozotocin (STZ)- induced diabetic male rat.

In Indian traditional system of medicine, herbal remedies are prescribed for the treatment of diseases including diabetes mellitus. Tamarind seed extract inhibited the PLA₂, protease, hyaluronidase, L-amino acid oxidase and 5' nucleotidase enzyme activities of venom in a dose dependent manner. Antioxidant study and quantification of phenolic compound of both the extracts revealed that they have high antioxidant capacity.

KEYWORDS: - Tamarindus indica, Diabetic Mellitus, antioxidant activity, antidiabetic, Streptozotocin.

and leaves of Tamarindus indica are already reported to have antidiabetic property but there is an inadequate data on Tamarindus indica fruit pulp though it is reported to have hypoglycemic activity.¹

It is a dicotyledonous plant. For the management of insulin –dependent diabetes mellitus and to reflect the enzyme activities related to blood glucose level modified by this extract. Although many of the drugs are available in the market, none of them are proved to be promising agents to cure diabetes completely. In a certain parts of Malaysia Tamarindus indica leaves are easily available and they used in foods.¹

The leaves and fruits of tamarind are having unique sour taste possess cooling, carminative, digestive, laxative, interferon stimulatory, antiscorbutic properties. Phenolic antioxidants are reported for tamarind seeds. Seed coats may play an important role in chemical protection from oxidative damage by possessing endogenous antioxidants.³

The aim of these review study is to find out effect of aqueous extract of Tamarindus indica seed on pancreatic islets and beta cells in STZ – induced diabetic rats by means of stereological method.³

I. INTRODUCTION

Tamarindus indica (family – Caesalpiniaceae) is known as tamarind, as well-known plant of the Indian medicinal system. Seed



Fig.1: Tamarindus Indica Fruits

➤ **Scientific classification-**

Kingdom = Plantae.

Clade = Tracheophytes.

Clade = Angiosperms.

Clade = Eudicots.

Subfamily = Detarioideae.

Clade = Rosids.

Order = Fabales.

Family = Fabaceae.

Tribe = Amherstieae.

Genus = Tamarindus .L

Species = T. indica.

• **Synonyms :**

- 1). Cavaraea Speg (1916)
- 2). Cavaraea elegans spg (1916)
- 3). Tamarindus erythraeus Mattei (1908)
- 4). Tamarindus occidentalis Gaertn (1791)
- 5). Tamarindus officinalis Hook (1851)
- 6). Tamarindus samalensis Matteqi (1908)
- 7). Tamarindus umbrosa salisb (1796)

❖ **Fruit :**

- The fruit is an in dehiscent legume sometimes called as a pod, 12 to 15 cm in length with hard, brown shell.⁵
- The fruit has fleshy, juicy, acidic pulp . It is mature when the flesh is coloured brown or reddish brown.⁸
- The tamarinds of Asia have longer pods whereas African and west Indian varieties have shorter pods (containing one to six seeds).¹⁰
- The seeds are some what flattened and glossy brown . The fruit is best described as sweet and sour in taste and is high in tartaric acid , sugar, vitamins B and unusually for fruit, calcium.¹⁸

❖ **Etymology –**

- The name derives from Arabic romanized tamar hindi ,Indian date. Several early medicinal herbalists and physicians wrote tamar indi , medieval latin use was tamarindus and marco polo wrote of tamarandi.^{2 1}
- In colombia , Costa Rica, Ecuador ,Cuba , the Dominican Republic Guatemala ,El Salvador , Honduras , Mexico ,Peru ,Puerto Rico , Venezuela, Italy ,Spain, and throughtout the Lusosphere , it is called tamarindo.¹⁷
- In those countries it is often used to make the beverage of same name .⁴
- In the carribbean tamarind is sometimes called tamon. Countries in the Malay world like Indonesia called it assam jawa (Javanese sour fruit) or simply asam and sukaer in Timor .⁶
- While in the Philippines ,it is called Sampalok or Sampaloc in Filipino, and Sambeg in Cebuano.¹⁹
- Tamarindus indica is sometimes confused with □Manila tamarind (Pithecellobium dulce).²⁵
- While in the same taxonomic family fabaceae, manila tamarind is a different plant native to Mexico and known locally as guamuchili.²⁰
- Tamarind paste has many culinary uses including a flavouring for chutneys, curries and traditional sharbat syrup drink.²⁹
- Tamarind sweet chutney is popular in India as dressing for many snacks.¹⁴
- In Mexico and Caribbean , the pulp is diluted with water and sugared to make an aqua fresca drink.¹¹

❖ **Diabetic medication:**

- Drugs used in diabetes treat diabetes mellitus by altering the glucose level in the blood .With the exceptions of insulin ,most GLP receptor agonists (liraglutide,exenatide, and others) and pramlintide,all are administered orally and are thus also called oral hypoglycemic agents or oral antihyperglecemic agents.¹²
- There are different classes of antidiabetic drugs, and their selection depend on the nature of the diabetes ,age,and the situation of the person , as well as other factors.¹⁴
- Diabetes mellitus type 1 is a disease caused by the lack of insulin .Insulin must be used in type1, which must be injected.¹³
- Diabetic mellitus type 2 is a disease of insulin resistance by cells.Type 2 diabetes mellitus is the most common types of diabetes .Treatment includes agent that¹⁸

- 1) Increase the amount of the insulin secreted by the pancreas .
- 2) Increase the sensitivity of target organs to insulin .
- 3) Decrease the rate at which glucose is absorbed from the gastrointestinal tract, and
- 4) Increase loss of glucose through urination.¹⁹

- Several groups of drugs , mostly given by mouth ,are effective in type 2, often in combination .The therapeutic combination in type 2 may include insulin ,not necessarily because oral agents have failed completely, but in search of a desired combination of effects.

-The great advantage of injected insulin in type 2 is that a well –educated patient can adjust the dose ,or even take additional doses, can adjust the dose, or ven take additional doses ,when blood glucose levels measured by the patient ,usually with a simple meter ,as needed by the measured amount of sugar in the blood.²⁰

- Insulin

- Insulin is usually given subcutaneously ,either by injections or by an insulin pump.In acute care settings ,insulin may also be given intravenously .Insulin are typically characterized by the rate at which they are metabolized by the body ,yielding different peak times and durations of action.²⁴

- Faster acting insulins peak quickly and are subsequently metabolized ,while longer acting insulins tends to have extended peak times and remain active in the body for more significant periods.¹⁵

-Examples of rapid acting insulins (peak at ~1 hour) are:

-Insulin lispro (Humalog)

- Insulin aspart (Novolog)

- Insulin glulisine(Apidra)

- Examples of short acting insulins (peak 2~4 hours) are:

- Regular insulin (Humulin R,Novolin R)

- Prompt insulin zinc (Semilente)

- Examples of intermediate acting insulins (peak 4~10 hour)are:

- Isophane insulin, neutral protamine hagedorn (NPH) (Humulin N ,Novolin N)¹⁴

-Insulin zinc (Lente)

- Examples of long acting insulins (duration 24 hours ,often without peak) are:

-Extended insulin zinc insulin (uitralente)

- Insulin glargine (lantus)

- Insulin detemir (levemir)

- Insulin degludec (Tresiba).¹⁴

-Insulin degludec is sometimes classed separately as an “ultra –long”acting insulin due to its duration of action 42 hours,compared with 24 hours for most other long acting insulin preparations. and NPH insulin did not show any clear benefits or serious adverse effects for any particular form of insulin for nocturnal hypoglycemia ,severe hypoglycemia ,glycated hemoglobin A1c, non – fatal myocardial infraction /stroke ,health –related quality of life or all –cause mortality.The same review did not find any difference in effects of using these insulin analogues between adults and children.²⁸

- Most oral anti diabetic agents are contraindicated in pregnancy ,in which insulin is preferred.²⁷

- Insulin is not administered by other routes, although this has been studied . An inhaled form was briefly licensed but was subsequently withdrawn.²⁷

- Insulin sensitizers address the core problem in type 2diabetes – insulin resistance.²²

- Biguanides

- Biguanides reduce hepatic glucose output and increase uptake of glucose by the periphery, including skeletal muscle.Although it must be used with caution in patients with impaired liver or kidney function ,metformin is the only widely used oral drug that does not cause weight gain.²¹

-Typical reduction in glycated hemoglobin (A1C) values for metformin is 1.5-2.0%.

-**Metformin**(Glucophage)may be the best choice for patients who also have heart failure , but it should be temporarily discontinued before any radiographic procedure involving intravenous iodinated contrast , as patient are at an increased risk of lactic acidosis.²⁷

- **Phenformin** (DBI) was used from 1960s through 1980s , but was withdrawn due to lactic acidosis risk.²⁷

- **Buformin** also was withdrawn due to lactic acidosis risk.

- Metformin is usually the first line medication used for treatment of type 2 diabetes .In general ,it is prescribed at initial diagnosis in conjunction with exercise and weight loss , as opposed to in the past ,where it was prescribed after diet and exercise had failed . There is an immediate release as well as an extended – release formulation , typically reserved for patients experiencing gastrointestinal side effects. It is also available in combination with other oral diabetic medication.²⁴

- **Thiazolidinediones** – Thiazolidinediones (TZDs) ,also known as “ glitazones,” bind to

PPAR, peroxysome proliferator activated receptor, a type of nuclear regulatory protein involved in transcription of genes regulating glucose and fat metabolism. These PPARs act on peroxysome proliferator responsive elements (PPRE).³⁰

The PPREs influence insulin-sensitive genes, which enhance production of mRNAs of insulin-dependent enzymes. The final result is better use of glucose by the cells. These drug also enhance PPAR- α activity and hence lead to a rise in HDL and some larger components of LDL.³⁰

Typical reductions in glycated hemoglobin (A1C) values are 1.5-2.0%. Some examples are:

- Rosiglitazone (Avandia): the European Medicines Agency recommended in September 2010 that it be suspended from the EU market due to elevated cardiovascular risks.²⁵
- Pioglitazone (Actos): remains on the market but has also been associated with increased cardiovascular risks.²⁷
- Troglitazone (Rezulin): used in 1990s, withdrawn due to hepatitis and liver damage risk.²⁷
- **Lyn kinase activators** – The LYN kinase activator tolimidone has been reported to potentiate insulin signaling in a manner that is distinct from the glitazones. The compound has demonstrated positive results in a Phase 2a clinical study involving 130 diabetic subjects.²³

Alpha – glucosidase inhibitors – alpha – glucosidase inhibitors are “diabetes pills” but not technically hypoglycemic agents because they do not have a direct effect on insulin secretion or sensitivity. These agents slow the digestion of starch in the small intestine, so that glucose from the starch of a meal enters the bloodstream more slowly, and can be matched more effectively by an impaired insulin response or sensitivity. These agents are effective by themselves only in the earliest stages of impaired glucose tolerance, but can be helpful in combination with other agents in type 2 diabetes. Typical reductions in glycated hemoglobin (A1C) values are 0.5-1.0%.²⁶

- Diabetes is a chronic metabolic disease characterized by elevated level of blood glucose which leads overtime to serious damage to the heart, blood vessels, eyes, kidneys and nerves

Glucose is an important source of energy for the cell that make up the muscle and tissues. It's also the brain's main source of fuel. The main cause of Diabetes varies by type. Too much sugar in the blood can lead to serious health problems. Chronic diabetes condition includes type 1 and type 2 diabetes. Potentially reversible diabetes condition includes pre diabetes and gestational diabetes.⁸

Prediabetic happens when blood sugar level is higher than normal. But the blood sugar level isn't high enough to be called diabetes and prediabetes can lead to diabetes unless steps are taken to prevent it. Gestational diabetes happens during pregnancy but it may go away after the baby is born.⁹

Typical reductions in glycated hemoglobin (A1C) values are 0.5-1.0%.¹⁵

- Diabetes is a chronic metabolic disease characterized by elevated level of blood glucose which leads overtime to serious damage to the heart, blood vessels, eyes, kidneys and nerves

Glucose is an important source of energy for the cell that make up the muscle and tissues. It's also the brain's main source of fuel. The main cause of Diabetes varies by type. Too much sugar in the blood can lead to serious health problems. Chronic diabetes condition includes type 1 and type 2 diabetes. Potentially reversible diabetes condition includes pre diabetes and gestational diabetes.¹³

Prediabetic happens when blood sugar level is higher than normal. But the blood sugar level isn't high enough to be called diabetes and prediabetes can lead to diabetes unless steps are taken to prevent it. Gestational diabetes happens during pregnancy but it may go away after the baby is born.¹³

❖ **Sign and Symptoms:**

- Lose weight without trying
- Very hungry
- Have blurry vision
- Feel very tired
- Have very dry skin
- Have numb or tingling hands or feet
- Are very thirsty

II. MATERIAL AND METHOD:

➤ **Plant material:**

In the month of May seeds of *Tamarindus indica* were collected from Bhadutola, Paschim Medinipur district. Material of *Tamarindus indica* was introduced by taxonomist of central national herbarium (Calcutta).²

➤ **Drugs and Chemical:**

Explicit Chemicals Private Ltd, Pune, India produced Alloxan. Metformin is procured by from USV Ltd, Mumbai, India. Neom laboratories Ltd, produced Ketamine injection in Mumbai, India²

➤ **Animals:**

sixty matured normoglycemic male Wistar Rat weighing 200 to 250gm were used to perform the studies. The rats are maintained in a room at 23°C with a fixed 12h artificial light period. Standard rodent diet was feed to all the Rats.¹⁷

➤ **Preparation of plant extract:**

fresh fruit of *Tamarindus indica* were cut into small pieces, seed were removed and air dried. 100gm of *Tamarindus indica* fruit pulp were soaked in 500ml of 95% of ethanol in a round flask for 24 hrs. Reflux condensation is used for the extraction of the *Tamarindus indica* fruit pulp by the help of Soxhlet apparatus at 60 to 80°C for 9hrs. The pulp is concentrated by using distillation apparatus till it gets syrupy form obtain.¹⁶

REFERENCE:

- [1]. Sridevi Chigurapati, Eric Wong Kwang Yiik, Shantini Vijavabalan, Kesavanarayanan Krishnan. Southeast Asian Journal of Tropical Medicine and Public Health 51(4), 559-569, 2020 Antioxidant and antidiabetic properties of *Tamarindus indica* leaf ethanolic extract from Malaysia.
- [2]. Lotfi M Aroua, Hind R Almuaylan, fahad M Alminderei sabri Messaoudi, Sridevi Chigurapathi a facile approach synthesis of benzoylaryl benzimidazole as potential α -amylase and α -glucosidase inhibitor with antioxidant activity .Bioorganic Chemistry 114, 105073, 2021.
- [3]. Sridevi Chigurapathi NISCAIR-CSIR, India, 2021 antidiabetic and antioxidant potential of *Durio zibethinus* Murr. leaves ethanolic extract.
- [4]. Aftab Alam, Mumtaz Ali, Najeeb Ur Rehman, Saeed Ullah, Sobia Ahsan Halim, Abdul latif, Aimal khan, bio-oriented synthesis of Novel (s)-flurbiprofen clubbed Hydrazone Schiff's bases for Diabetic Management :In vitro and in silico studies Pharmaceuticals 15(6), 672, 2022.
- [5]. Sontaya sookying, Acharaporn Duangjai, Surasak Surasak saokaew, pochamana phisalprapa botanical aspects, phytochemical and toxicity of *tamarindus indica* leaf and 9,977015, 2022.
- [6]. SS. Nikam, AS Kulkarni, RD Chakole, MS Charde potential of benzimidazole as antidiabetic agents.
- [7]. Aishwarya Shishodia, Prashant kumar Dhakad, Shubhangi Gumber. Evaluation of anti diabetic activity of pulp of *tamarindus indica* linn
- [8]. Narendar Koyaguru, MG Jamadar, Shobha V, Hulgol, Nagendra Nayak, Saeed M, Yendigeri antidiabetic and hepatoprotective activities of *tamarindus indica* fruit pulp in alloxan induced diabetic rat. International journal of pharmacology and clinical science 2(2), 2013.
- [9]. Apian Subramoniyam plants with antidiabetic mellitus properties CRC press, 2016.
- [10]. A Tamil Selvi, J Kanagraj, P Sarvanann, V Brinda, T Senthivelan, preservation of goat skin using *tamarindus indica* leaf extract green process approach J. soc Leather Technol Chem 99, 107-114, 2015.
- [11]. Siti Rosmani MD Zin, Normadian M Kassim, Mohammad A Alshwash, Noor Eliza Hashim biological activity of *anastatica hierochuntica* L. A systematic review biomedicine and pharmacotherapy 91, 611-620, 2017.
- [12]. Rajesh Nivesh Krishna, Roy Anitha Devraj Ezhilarasan Aqueous extract of *tamarindus indica* fruit pulp exhibits antihyperglycemic activity Avicenna Journal of phytomedicine 10(5), 440, 2020.
- [13]. V Hemanth Kumar, IM Nayak, Shobha V Hulgol, Saeed M yendigeri, K Narendar antidiabetic and hypolipidemic activity of *Gymnema Sylvestre* in dexamethasone induced insulin resistance in Albino Rats. International journal of Medical Research and Health Sciences 4(3), 639-645, 2015
- [14]. R Retnosari, S Marfuah study of antibacterial activity of *Tamarindus indica* Linn seed oil and its fatty acids JOP Conference series : Earth and Environmental science 299(1), 012004, 2019.

- [15]. Rahel B Villegas – Gonzalez ,Maria E Paez-penunuri,Gilberto Mercado – Mercado Francisco J.Blancas Compuestos bioactivas y propiedades saludables del tamarindo(*Tamarindus indica* L). *Biotecnia* 18(1),10-21,2016.
- [16]. EM Sutrisna , Devi usdiana ,Rizky Maidina Taqwin ,Ahmed Roni Rosyidi Hypolipidemic effect of *Tamarindus indica* L. fruit on Triton x-100- induced hyperlipidemia in wistar rats. *National journal of physiology ,pharmacy and pharmacology* 5(4),285-285,1970.
- [17]. Wina Nazula Makrufa Pemanfaatan Asam Jawa(*Tamarindus indica*) untuk Menurunkan kadar Glukosa Darah pada Diabetes Mellitus .*Journal Ilmu kedokteran Dan kesehatan* 6(3)2019.
- [18]. R Maiti, D Jana ,UK Das ,D Ghosh Antidiabetic effect of aqueous extract of seed of *Tamarindus indica* in Streptozotocin – induced diabetic rats *Journal of ethnopharmacology* 92(1),85-91,2004
- [19]. Annie Shirwaikar ,K Rajendran,Rakesh Barik Effect of aqueous bark extract of *Garuga pinnata* Roxb in streptozotocin nicotinamide induced type II diabetes mellitus *Journal of ethnopharmacology* 107 (2), 285-290, 2006.
- [20]. Bhavana Sharma, Chandrajeet Balomajumdar, Partha Roy. Hypoglycemic and hypolipidemic effect of flavonoid rich extract from *Eugenia jambolana* seeds on streptozotocin induced diabetic rats. *Food and chemical toxicology* 46 (7), 2376-2383, 2008
- [21]. F.Martinello, SM Soares, Joao Jose franco, AC dos Santos A Sugohora Sergio Britta Garcia Hypolipemic and antioxidant activities from *Tamarindus Indica* L. pulp fruit extract in hypercholesterolemic hamsters *Food and chemicals toxicology* 44(6), 810,2006.
- [22]. P.Siddhuragu Antioxidant activity of polyphenolic compound extracted from defatted raw and dry heated *Tamarindus Indica* seed coat *LWT-food science and technology* 40 (6), 982-990, 2007.
- [23]. GB Kvishankar, N Lakshmidhevi, S Mahadeva Murthy, HS Prakash SR Niranjna Diabetes and medicinal plants. *International J.Pharm Biomed Sci* 2 (3), 65-80, 2011
- [24]. Rajkumar Maiti, Uttam Kumar Das, Debidas Gosh Attenuation of hyperlipidemia in streptozotocin induced diabetic rats by aqueous extract of seed of *Tamarindus Indica* *Biological and Pharmaceutical Bulletin* 28 (7), 1172-1176, 2005
- [25]. Santosh Singh Bhadoriya, Aditya Ganeshpurkar, Jitendra Narwaria, Gopal Rai, Alok pal Jain *Tamarindus Indica* :Extent of explored potential pharmacognosy reviews 5 (9), 73, 2011.
- [26]. Nurhanani Razali, Sarni Mat-Junit, Amirah Faizah Abdule-Mutalib, Senthilkumar Subramaniam effect of various solvents as the extraction of antioxidant phenolics from the leaves, seeds, veins and skins of *Tamarindus Indica* L. *Food chemistry* 131 (2), 441-448, 2012.
- [27]. Pinar Kuru *Tamarindus Indica* and its health related effects *Asian Pacific Journal of Tropical Biomedicine* 4(9), 676-681, 2014.
- [28]. Urszula Tril, Juana Fernandez- Lopes, Jose Angel Perez Alvarez Manuel Vivda-Martos Chemical physicochemical, technological, antibacterial and antioxidant properties of rich fiber powder extract obtained from tamarind (*Tamarindus Indica* L) *Industrial crops and products* 55, 155-162, 2014.
- [29]. Radhika Sharma, Sunil Kamboj, Ranjeet Khurana, Gursharan Singh, Vikas Rana. Physicochemical and functional performance of pectin extracted by QbD approach from *Tamarindus Indica* L. pulp carbohydrate polymers 134, 364-374, 2015
- [30]. Nurhanani Razali, Sarni Mat-Junit, Azhar Ariffin, Nur siti Fatimah Ramli, Azlina Abdul Aziz polyphenol from the extracted and fraction of *T. Indica* seed procted Hep G2 cells against oxidative stress. *BMC complementary and alternative medicine* 15(1), 1-16, 2015