

Anti-diabetic Potential of Bangladeshi Medicinal Plants: A Review

Md. Mofazzal Hossain¹, Musrat Jahan Shorna²

ABSTRACT: *Diabetes mellitus is an endocrine disease which is the most common disease in the world. Diabetes mellitus occurs from insulin deficiency or due to ineffectiveness of the insulin produced by the body. The first symptom of the disease is an increase in blood glucose or hyperglycemia. Diabetes mellitus are clinically classified mainly two type, i) type 1 diabetes, ii) type 2 diabetes. This diabetes is a chronic disease and to control the blood glucose level, patient often needs to take medicine and insulin depending on the type and severity of diabetes. Most of the medicines used in disease has side effect. However, many medicinal plants and products are properly used globally in treatment of many diseases. Many medicinal plants are available in Bangladesh which is pure and effective to decrease blood glucose level and increase insulin secretion from pancreas. This review article, find out around 19 plants which has anti-diabetic activity.*

Keywords: *Diabetes mellitus, pancreases, insulin, glucose, hyperglycemia.*

1. INTRODUCTION

The disease is caused by the inability of pancreas to produce insulin or inability of the body metabolic system to properly use the insulin produced is called diabetic mellitus or chronic hyperglycemia. Diabetic mellitus has mainly two type, one is type 1 diabetic (insulin dependent diabetic) and second one is type 2 diabetic (non-insulin dependent diabetic). Another types are maturity-onset diabetes of the young (MODY), gestational diabetes, neonatal diabetes, and steroid-induced diabetes [1]. Type 1 diabetes, or juvenile-onset diabetes, results from a cellular-mediated autoimmune destruction of the β -cells of the pancreas. Type 2 diabetic occurs in more insidious onset where an imbalance between insulin levels and insulin sensitivity causes a functional deficit of insulin. Insulin resistance is multifactorial in type 2 diabetic but commonly develops from obesity and aging [2]. Around 200 million

¹ Associate Professor, Department of Pharmacy, UITS.

* Corresponding author: Email: mofazzal.hossain@uits.edu.bd

² Research Fellow, Department of Pharmacy, UITS.

Email: b.pharm.shorna@gmail.com

people of the world are currently suffering from diabetes and the figure is projected to rise to 300 million within 2025 by the World Health Organization [3]. In 2012 there were 1.5 million deaths worldwide directly caused by diabetes [4]. Oral anti-diabetic drugs are classified in several groups such as, Sulfonylurea group (Glibenclamide, Gliclazide, Glimepiride, Glipizide), Biguanides group (Metformin), α -glucosidase inhibitor (Acarbose), Meglitinide analogues (Nateglinide, Repaglinide), Thiazolidinedione group (Pioglitazone, Rosiglitazone), Combination preparation (Glimepiride + Pioglitazone, Glimepiride + Rosiglitazone, Glipizide + Metformin, Metformin + Vildagliptin, Rosiglitazone + Metformin, Metformin + Sitagliptin, Pioglitazone + Metformin), Dipeptidyl peptidase-4 (DPP-4) inhibitor (Sitagliptin, Vildagliptin). Insulin preparations are, short acting insulin (regular human insulin), medium acting insulin (neutral or biphasic isophane insulin), and long acting insulin (insulin glargine).

This group of oral anti-diabetic drugs or insulin are available in Bangladesh. From the diabetic many diseases also arise in the body such as neurological, cardiovascular, retinal and renal complications [5]. Every drug has some side effects, so this drug also has some side effects such as for insulin major adverse effects is hypoglycemia, for oral anti-diabetic drugs the adverse effects are hyperinsulinemia, hypoglycemia, renal dysfunction, liver toxicity, nasopharyngitis, headache, weight gain [6]. On the other hand, plants have no side effects. Many plants grow in Bangladesh which have anti-diabetic activity [7,8,10,11]. For example *Achyranthes rubro fusca*, *Aloe barbadensis*, *Azadirachta indica*, *Camellia sinensis*, *Annona squamosa*, *Catharanthus roseus*, *Acacia arbica*, ***Tamarindus indica***, ***Albizia lebeck***, ***Amaranthus tricolor***, *Brassica nigra*, *Cajanus cajan*, *Trigonella foenum-graecum*, ***Syzygium jambolana***, *Zizyphus mauritiana*, *Aegle marmelos*, *Allium sativum*, ***Moringa oleifera***, *Citrullus colocynthis*, these plants have decrease blood glucose level and increase insulin secretion from pancreas [7,8,10,10,13,14,15,16,17,18,19,20,21,22,23,.....35]. This review would be helpful to isolate the Bangladeshi plants which have anti-diabetic activity.

2. METHOD

Using specific keywords like "medicinal plants", "traditional plants", "antidiabetic plants", "antihyperglycemic plants", "survey of antidiabetic plants", "survey of medicinal plants", "ethnobotanical survey", "ethnomedicinal survey", plus "Bangladesh," we reviewed scientific articles published in journals by electronic databases (Google Scholar, PubMed, Medline, Web of Science, DOAJ, and Scopus).

We looked at 34 survey publications (Published between 1990-2021) that provided information on how local people employed medicinal plant species to treat diabetes. In order to compile a list of medicinal plants used to cure diabetes in Bangladesh, we used distributions introducing direct data.

3. RESULT

Table: Plant sources of anti-diabetic agent in Bangladesh.

Scientific name	Family	Local name	Plant part	Extraction solvent	Pharmacological activity
<i>Acacia arbica</i>	Fabaceae	Babla	Bark	Chloroform	Decrease serum glucose level, increase insulin secretion from pancreases
<i>Achyranthes ubrofusca</i>	Amaranthaceae	Opangif ul	Leaf	Ethanol	Decreased the blood glucose level and increased pancreatic enzymes
<i>Aloe barbadensis</i>	Asphodelaceae	Gritokumari	Leaf	Ethanol	Showing anti-diabetic effects by improving insulin secretion.
<i>Azadirachta indica</i>	Meliaceae	Neem	Leaf	Ethanol	Control blood glucose level
<i>Camellia sinensis</i>	Theaceae	Tea	Leaf	Flavanols	Anti-hyperglycemic, hypolipidemic and α amylase inhibitor activity
<i>Allium sativum</i>	Amaryllidaceae	Garlic	Pulp	Ethanol	A-amylase inhibitor, hypoglycemic, α glycosidase inhibitor, anti-hyperglycemic effect
<i>Annona squamosa</i>	Annonaceae	Ata fol	Leaf	Ethanol	Hypoglycemic and antioxidant effects
<i>Brassica nigra</i>	Brassicaceae	Sorisa	Seed	Ethanol	Hypoglycemic activity
<i>Cajanuscajan</i>	Fabaceae	Dal	Seed	Ethyl Acetate and Methanol	Hypoglycemic effect

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<i>Zizyphusmaurritiana</i>	Rhamnaceae	Boroi	Fruit	Petroleum Ether, Chloroform, Acetone, Ethanol	Hypoglycemic activity
<i>Trigonellafoenum-graecum</i>	Fabaceae	Mathi	Seed	Ethanol and Hydro-alcohol	Blood glucose-lowering capacity
<i>Tamarindusindica</i>	Fabaceae	Tatul	Stem bark	Hydro-alcohol	Reduced blood glucose levels
<i>Syzygiumjambolana</i>	Myrtaceae	Jamrul	Seed	Ethanol	Enhanced endogenous insulin production
<i>Moringaoleifera</i>	Moringaceae	Sojna data	Pods	Methanol	Reduce serum glucose and nitric oxide levels, increase in serum insulin and protein levels
<i>Momordicaharantia</i>	Cucurbitaceae	Korola	Pulp	Ethanol	Antihyperglycemic and antioxidative effect
<i>Citrulluscolocynthis</i>	Cucurbitaceae	Rakalso sa	Root	Ethanol	Reduce blood sugar levels
<i>Catharanthusroseus</i>	Apocynaceae	Noyant ara	Leaf	Dichloromethane-methanol and ethanol	Reduced blood glucose levels
<i>Aeglemarmelos</i>	Rutaceae	Bal	Fruits	Methanol	Reduced in blood glucose levels and increase pancreases activity
<i>Albizzialebbek</i>	Fabaceae	Shirish	Stem bark	Methanol/dichloromethane	Decreased fasting blood glucose
<i>Amaranthstricolor</i>	Amaranthaceae	Data	bark	Methanol	Reduced blood glucose levels

A. Medicinal plants of anti-diabetic potential available in Bangladesh:

Achyranthes rubrofusca:

Achyranthes rubrofusca is locally known asopangi ful. From this plant's part leaf is used for anti-diabetic drug extraction. Hypoglycemic activity of the ethanol extracts of *Achyranthes rubrofusca* leaves in alloxan-induced diabetic rats [7]. Ethanol extracts significantly decreased the blood glucose level and increased pancreatic enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione levels [7, 8].



Figure 01: *Achyranthes rubrofusca*.

Aloe

Aloe barbadensis is known locally gitocumari. From this plant's leaf is use for anti-diabetic drug extraction. The extracted chemical is ethanol. This plant leaves also contain phenolic acids/polyphenols, sterols, alkaloids, fatty acids, and indoles [9]. Aloe vera extract shows antidiabetic effects by improving insulin secretion and pancreatic β - cell function by restoring pancreatic islet [10].



Figure 2: *Aloe barbadensis*.

Azadirachta indica:

Azadirachta indica is commonly known as neem. Ethanolic extract of leaf from this plant is used for anti-diabetic drug. This extract has similar effects as the anti-diabetic drug glibenclamide. The neem extract can control blood glucose and appears to be helpful in preventing or delaying the onset of diabetes [11].



Figure 3: *Azadirachta indica*.

Camellia sinensis:

Camellia sinensis is locally known as tea. Leaves are used for the extraction anti-diabetic drug. The major flavanols in tea are: catechin (C), epicatechin (EC), epicatechingallate (ECG), galocatechin (GC), epigallocatechin (EGC), and epigallocatechingallate (EGCG) give in the test animals for one month, then show the antihyperglycemic, hypolipidemic and α -amylase inhibitor activity [12]. Tea also regulates the hematobiocemical parameters such as creatinine, urea, uric acid, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) and reduced body weight.



Figure 4: *Camellia sinensis*.

Allium sativum:

Allium sativum is locally known as garlic. Garlic contains ethanol which has α -amylase inhibitor, hypoglycemic, α -glucosidase inhibitor, antihyperglycemic effect [13, 14]. Daily oral administration of garlic extract significantly decreased plasma glucose levels by increasing plasma insulin levels [15].



Figure 5: *Allium sativum*.

***Annona squamosa*:**

Annona squamosalis locally called as ata fol. Ethanolic extract of leaves and seeds has hypoglycemic and antioxidant effects. If diabetic patient administered *Annona squamosa* aqueous extract for 30 days caused a significant reduction in the blood glucose, lipids, and lipid peroxidation, but increase the activity of the plasma insulin and antioxidant enzymes, like catalase and superoxide dismutase [16].



Figure 6: *Annona squamosa*.

***Brassica nigra*:**

Brassica nigra is locally known as assorisa. It is commonly called as mastered. Ethanol extract of Mastered seed decreases the fasting blood glucose level. Pharmacologically, mastered seed increases the glycosylated hemoglobin and serum lipids levels [17].



Figure 7: *Brassica nigra*.

Cajanus cajan:

Cajanus cajan's local name is dal. *Cajanuscajan* seed contain hypoglycemic effect [18]. But plant's leaves and stems has hyperglycemic effect [19]. Different parts of the plants are used in Africa, Asia, and South America to control disorders, including ulcer, diarrhea, pain, diabetes, cough, and sores.



Figure 8: *Cajanus cajan*.

Zizyphus mauritiana:

Zizyphus mauritiana is locally known as borai and commonly called as jujube. Petroleum ether, Chloroform, Acetone, Ethanol and Aqueous extracts of Jujube contains hypoglycemic activity, and also regulate glucose, urea, creatinine, TC, TG, HDL, LDL, hemoglobin, and glycosylated hemoglobin [20].



Figure 9: *Zizyphus mauritiana*

Trigonellafoenum-graecum:

Trigonellafoenum-graecum is locally called asmathi. *Trigonellafoenum-graecum* seed extract is eaten for getting hypoglycemic effect. After extraction with ethanol and hydro-alcohol, this are isolated because Ethanol extract shows significant blood glucose-lowering capacity [21] and hydroalcohol extract improve oxidative stress [22].



Figure 10: Trigonella foenum-graecum.

Tamarindus indica:

Tamarindus indica is commonly called as tatul. From *Tamarindus indica* stem bark is extracted for alcohol extract isolation. This bark show significant antioxidant activity in DPPH, Nitric oxide and hydroxyl radical [23]. After rats test studies shows, the alcohol extract from *Tamarindus indica* significant decrease of blood glucose levels. In another study show, the hydro ethanol seed coat extract of *Tamarindus indica* significantly reduced blood glucose levels [24].

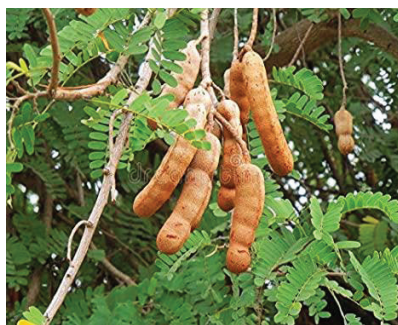


Figure11: Tamarindus indica.

Syzygium jambolana:

Syzygium jambolana is commonly called jam. *Syzygium jambolana* seed are extracted for seen the anti-diabetic effect. This extract may be due to enhanced endogenous insulin production, possibly through pancreatic β -cell regeneration or repair caused by higher insulin levels in the serum [25].



Figure 12: *Syzygium jambolana*.

Moringa oleifera:

Moringa oleifera is locally called as sojna data. For showing the anti-diabetic effect and antioxidant effect methanol extracts from *moringa oleifera* pods [26]. This extract significantly reduces serum glucose and nitric oxide levels, with a concomitant increase in serum insulin and protein levels. Also methanol extracts increased antioxidant levels in pancreatic tissue and concomitantly decreased TBA levels [27].



Figure 13: *Moringa oleifera*.

Momordica charantia:

Momordica charantia is commonly called askorola. Ethanol extracts from *Momordica charantia* pulp to get antihyperglycemic and antioxidative effect [28]. A study show that, the *Momordica charantia* from ethanol extract treatment for 30 days significantly decreased the blood glucose levels and showed antioxidant potential to protect vital organs such as heart and kidney against damage caused by diabetes-induced oxidative stress [29]. *Momordica charantia* fruits contain ethanol which has hypoglycemic effect and decrease body weight [30].



Figure 14: *Momordica charantia*.

Citrullus colocynthis:

Citrullus colocynthis is locally called asrakalsosa. *Citrullus colocynth* is root extract for ethanol isolation which has significant reduction in blood sugar levels. And also the ethanol extract improved body weight and serum creatinine, urea, protein, and lipids and restored levels of total bilirubin, conjugated bilirubin, AST, ALT, and ALP [31].



Figure 15: *Citrullus colocynthis*.

Catharanthus roseus:

Catharanthus roseus is commonly called as noyantara. Dichloromethane-methanol and ethanol extract from *Catharanthus roseus* leaves. This extract significantly reduces blood glucose levels and hepatic enzyme activities of glycogen synthase, glucose 6-phosphate-dehydrogenase, succinate dehydrogenase, and malate dehydrogenase [32].



Figure 16: *Catharanthus roseus*.

Aegle marmelos:

Aegle marmelos is locally known as bal. The methanol extract from *Aegle marmelos* fruit significant decrease in blood glucose level, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin, alpha-tocopherol, and a considerable increase in plasma reduced glutathione, and vitamin C [33].



Figure 17: Aegle marmelos.

Acacia arbica:

Acacia arbica is commonly called as babla. Plant's part bark is use for anti - diabetic drug extraction. The extracted chemical is chloroform; this plant also contains polyphenols, tannins, and flavonoids. The presence of these substances with antioxidant properties is an explanation for anti-diabetic effects of this plant. After extract chloroform from *Acacia arbica* by using *albino mice* with induced alloxan diabetic agent then show decreasing serum glucose level and improve high density lipoprotein (HDL) and decrease low density lipoprotein (LDL) level and increase release of insulin from pancrease[34, 35].



Figure 18: Acacia arbica.

4. DISCUSSION

Plants part use as medicine or dietary supplement, it is pure or no side effect. From above result see the *Achyranthes rubrofusca*, *Aloe barbadensis*, *Azadirachta indica*, *Camellia sinensis*, *Annona squamosal*, *Catharanthus roseus* plants leaf, and *Acacia arbica*, *Tamarindus indica*, *Albizia lebbeck*, *Amaranthus tricolor* plants bark, and *Brassica nigra*,

Cajanuscajan, *Trigonellafoenum-graecum*, *Syzygium jambolana* plants seed *Zizyphus mauritiana*, *Aegle marmelos* plants fruit, *Allium sativum* plant pulp, *Moringa oleifera* plant pods, *Citrullus colocynthis* root, these plants has decrease blood glucose level and increase insulin secretion from pancreases. After a long time use medicine are resistances to the body, but this plants are never resistances to the body mechanism but also increase the pancreases activity and insulin production.

5. CONCLUSION

After the review find several things such as most of the plants leaf contain anti-diabetic activity. Fabaceae family contains many hypoglycemic activity plants. These types of plant not only decrease the blood glucose level but also increase the insulin secretion ability from pancreases. From this plant list many plant people are taken as vegetables but don't know their beneficial effects. If a diabetic patient take this types of food regularly then that patient not only control blood glucose level but also the patient relief from many harmful drug resistances.

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