

Review On Anti Diabetic Herbal Drugs Inayurveda

C.R. Doijad^{1*}, S.Psathvane², P.C. Meshram³

Maharashtra Institute of Pharmacy, Betala, Bramhapuri, Maharashtra, India
Corresponding Author: C.R. Doijad

Date of Submission: 10-1-2021

Date of Acceptance: 22-01-2021

ABSTRACT- Diabetic Mellitus is a multifactorial chronic metabolic ailment can high blood glucose level. Antidiabetic drug from Modern science can treat this disorder but at the cost of heavy side effect. According to reaserch various traditional medicine are used as antidiabetic and 50% of the traditional remedies has been studied experimentally. This review focused on Ayurvedic formulation like Trivanga Bhasma, Eugenia Jambolona, Triphala Churna, Terminalla Chebula and Pharmacological Activity of drug like Kalmrgh, Kadujire, Chirata, Kutaki, Punarneva, Gulwel.

KEYWORDS: Diabetes mellitus, Ayurveda, Herbal,

I. INTRODUCTION

Diabetes mellitus is a disease characterized by improper metabolism of altered carbohydrate, protein and lipid metabolism. Diabetes can be regulated by insulin causes a rise of fasting and postprandial blood glucose levels or the disorder. That can be characterized by an increased concentration of blood glucose level due to derangement in carbohydrates metabolism and improper secretion of insulin. Diabetes is an important multi-factorial chronic metabolic disorder, which has widespread complications; it associated with a lifetime damage, dysfunction and failure of various organs. It is the world's major endocrine disease linked by increased morbidity and mortality rates. Although it is a non-communicable disease, it is considered one of the five primary causes of death worldwide^[1,3]. Recently the search for appropriate ant hyperglycemic agents has been focused on plants because there are a number of advantages associated with using herbal medicines as opposed to pharmaceutical products, such as, reduced risk of side effects, effectiveness in chronic conditions, lower cost and widespread availability^[1].

Types of diabetes mellitus:

The World Health Organization (WHO) distinguishes three main forms of diabetes mellitus:

IDDM, NIDDM and gestational diabetes (occurring during pregnancy); all have similar symptoms, signs, and consequences, but different reasons and population distributions. Eventually, all occurs due to the β -cells of the pancreas being incapable to generate adequate amount of insulin to prevent hyperglycemia.^[1,2]

A) Insulin dependent diabetes mellitus (IDDM)

IDDM is generally occurs due to autoimmune damage of the pancreatic β -cells, those produce insulin. It is caused by an auto-immune reaction where the body's defense system destroys the insulin-producing β - cells. Population with type 1 diabetes produce very little or no insulin. The disease usually occurs at younger age. Patients totally depend on the exogenous insulin to manage the levels of glucose in their blood. Genetic factors are supposed to be the major cause of it.^[1,4]

B) Non-Insulin Dependent diabetes mellitus (NIDDM)

NIDDM is illustrated by tissue-wide insulin resistance, but destruction of β cell function is essential for its growth. About 90% of all cases of diabetes mainly belong to this category. It is characterized by insulin resistance and deficiency. This happens because of loss of functional β - cells. Type 2 diabetes is related with very serious life ceasing complications.^[4]

ANTIDIABETIC PLANTS IN TRADITIONAL MEDICINES

The aim of this review is to collect the data available on medicinal plants showing hypoglycemic activity either via increasing secretion of insulin from pancreas or by acting similarly. According to research, various Traditional Medicines are used as antidiabetics, and some 50% of these traditional remedies have been studied experimentally, such as kalmegh, kadujire, chirata, Picrorhiza, Punarneva.^[1,5]

Ayurvedic Formulations in Antidiabetic

Diabetes is a challenge for every medical faculty. There are many Ayurvedic formulations, herb, minerals found for the treatment of diabetes (Madhumeha) herbal medicine are gaining popularity both in developing and developed countries because of their natural origin and less side effect. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter. Madhumeha is Ayurvedic term for Diabetes Mellitus.

Increased Kapha Dosha and adipose tissue Medo Dhatu are the important factor which cause D. M. according to Ayurveda. According to Modern medicine obesity leads to D. M. and obesity is the disease of Meda Dhatu (adipose tissue) according to Ayurveda.^[6]

Trivanga bhasma

For this study 36 patients had enrolled having age more than 30-year signs and symptoms of diabetes mellitus were noted and blood sugar taste was done. Fasting & post prandial blood sugar were done before starting the treatment. The drug was given for three months duration and follow up was taken every after 15 days. The Dose of Trivanga Bhasma was 1tds with lukewarm water (Each tablet of 125mg)^[6]

Eugenia jambolana (Indian Gooseberry, Jamun)

The extract of Jamun pulp showed the hypoglycaemic activity in streptozotocin Induced diabetic mice within 30min of administration while seed od the same fruit required 24 hr. The oral administration of the extract resulted in increase in serum insulin levels in diabetic rats. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibit insulin activity from liver and kidney.^[7]

Triphala Churna (powder)

A comparative study of Honey(madhu) and lukewarm water (ushnodak) as Anupana (vehicle) with powder of Triphala choorna in Diabetes Mellitus. For This study research design was single blind randomised comparative 60 patients of diabetes were selected and divided into two group.

Group A – 30 patients treated with Triphala powder with Honey.

Group B – 30 patients treated with Triphala powder with lukewarm water. Dose of Triphala powder was Decided as 5gm twice a day divided dose and duration of treatment was 90 days.^[8]

Terminalia chebula (Haritaki Churna)

In this double-blind clinical study 100 patients of diabetes mellitus were selected randomly. Which were randomly divided into four groups. Powder of Terminalia chebula in the dose of 10 gm twice per day was administered in Group 1, 2 with Jala and in Group 2 with honey. Effect of Terminalia chebula powder vehicle with a water and honey in both fasting and post prandial state in urine and blood sugar is satisfactory. The drug with water has useful role in the therapy as far as urine and BSL, fasting and post prandial are concerned it is also cost effective.^[6]

Aloe vera and Aloe barbadensis

Treatment of chronic but no single dose of exudates of Aloe barbadensis leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of Aloe vera and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells.^[6]

Table: ANTIDIABETIC PLANTS IN TRADITIONAL MEDICINES

Sr. No.	Drug	Synonym	Biological Source	Use
1.	Kalmegh	Andrographis paniculata, Bhuinim	Andrographis paniculata Nees, Family: Acanthaceae	Antidiabetic, Antipyretic, Antimalarial. Appetiser.

2.	Kadujire	Kalijiri, worm seed fleabane, somaraaj, chittilai	Centratherum anthelminticum kuntze, Family: Asteraceae	Antidiabetic, Antipyretic. Appetiser.
3.	Chirata	Chirayata, East indian Balmomy	Swertia chirata buch Ham, Family: Gentianaceae	Antidiabetic, Antipyretic. Appetiser
4.	Kutaki	Kutki, Indian gentian, Picrorhiza	Picrorhiza kurroa, Family: Scrophulariaceae	Antidiabetic, Antipyretic, Antimalarial. Appetiser, Immuniser
5.	Punarnava	Rakta Punarnava, Hog weed.	Boerhaavia diffusa linn, Family: Nyctaginaceae	Antidiabetic, Antipyretic, Antimalarial. Appetiser, Immuniser
6.	Gulwel	Gulanha, Tinospora, Gulwel, Amrita, Guduchi, Amudom,	Tinospora cordifolia (wild) Miersb, Family: Menispermaceae	Antidiabetic, Antipyretic, Antimalarial. Appetiser, Immuniser

Pharmacological Activity

KALMEGH

Antidiabetic activity

Umamaheswari et al reported that oral administration of Ilogen-Excel (an Ayurvedic formulation fortified with this plant, 50 mg/kg and 100 mg/kg) for 60 days results in significant lowering of blood glucose and increasing levels of plasma insulin, hepatic glycogen and total hemoglobin. It decreases the levels of glycosylated hemoglobin, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin and vitamin E in diabetic rats. The ethanolic extract of whole plant has been found to be effective for antihyperglycaemic property and reduces oxidative stress in diabetic rats. Reyes et al studied the effects of plant on estrous cyclicity of alloxan-induced diabetic rats and found that the antidiabetic potential of kalmegh could restore impaired estrous cycle in alloxan-induced diabetic rats. Oral treatment of andrographolide decreases the plasma glucose concentrations of streptozotocin-induced diabetic rats in a dose-dependent manner.

Andrographolide at the effective dose (1.5 mg/kg) significantly attenuated the increase of plasma glucose induced by an intravenous glucose challenge test in normal rats. Andrographolide can increase the glucose utilization to lower plasma glucose in diabetic rats lacking insulin. However, Borhanuddin et al reported the significant ($P < 0.001$) hypoglycaemic effect of water extract (10 mg/kg body weight) on experimental rabbits. [10,11]

KADUJIRE

Anti-diabetic activity

Activity of *C. anthelminticum* on α -glucosidase, α -amylase and PTP-1B: The anti-hyperglycemic effect of *C. anthelminticum* was evaluated against key enzymes important for gluconeogenesis. Different concentrations of aqueous methanol- acetone extract were tested on the activity of α -glucosidase (PNP-G hydrolysis, sucrose and maltase).

The IC_{50} values for the *C. anthelminticum* extract on disaccharide substrates PNP-G, sucrose

and maltose were 500.5, 34.1 and 62.2 μg , respectively. This result shows that *C. anthelminticum* extract is a potent sucrose and maltase inhibition agent compared to PNP-G hydrolysis. In contrast, the synthetic drug, acarbose showed high affinity towards sucrase only. This data indicates that *C. anthelminticum* will be a better alternative for diabetic treatment because it reduces hydrolysis of the disaccharides via sucrase and maltase inhibition, resulting in lower blood glucose level. They further validated the findings by administering maltose and different dosages of extract orally into rats. These investigations proved the potentiality of *C. anthelminticum* in suppressing maltose digestion and absorption.

In contrast, the results of human salivary α -amylase test showed less inhibition by the extract compared to standard, acarbose, with IC_{50} values of 185.5 and 17.4 μg , respectively. Although *C. anthelminticum* showed lower inhibitory effect on α -amylase, a report by Krentz and Bailey (2005) indicates that lower inhibitory effect on α -amylase and higher inhibitory effect on α -glucosidase will be a better formulation for management of type 2 diabetes condition. This is important as α -amylase catalyzes the digestion of dietary starch to disaccharides and trisaccharides, which act as a source of glucose to the human body. Protein Tyrosine Phosphatase-1B (PTP1B) is an intracellular phosphatase, which negatively regulates the insulin signaling pathway. PTP1B-deficient mice have significantly reduced body weight and lower adiposity despite being given high fat diet compared to the wild-type control. In view of these protective effects, PTP-1B has emerged as a new target in tackling diabetes and other associated metabolic syndromes. Recently, we found that the methanolic fraction of *C. anthelminticum* seeds inhibited PTP-1B enzyme at IC_{50} 38+5.8 μM , compared to standard drug, RK-682 (4.1+0.6 μM). In contrast, *C. anthelminticum* leaves were less effective (64+5.8 μM), possibly due to lower total flavanoid, phenolic, tannin content in the leaves.

CHIRATA

Anti-Diabetic Activities

The ethanolic extract of *S. chirayita* exhibits hypoglycemic activity. The hexane fraction containing swerchirin, the main hypoglycemic principle, induced a significant fall in blood sugar in albino rats. The compound may have clinical application in control of diabetes. It also possesses anti-microbial activity against gram-

negative and gram-positive bacteria. An herbal antiseptic and antifungal Veterinary ointment Melicon V are prepared from the herb. The extract of the plant exhibits a significant anti-inflammatory activity. The plant extract shows antileishmanial activity against *Leishmania donovani* in golden hamsters.

Laboratory tests with animals having excessive baseline blood sugar levels have demonstrated diminished blood sugar levels following healing with chirata. On the contrary, animals do not demonstrate such decrease in the blood sugar levels provided they already have low levels to begin with. This difference in results in treatment with chirata provides an indication that the herb may perhaps be beneficial in regulating blood sugar levels without the perils of developing hypoglycemia owing to any excessive dosage of the herbal medication. Additional animal studies with chirata have discovered that this herb is more effectual in regulating blood sugar levels compared to the regular anti-diabetic drug Orinase (Tolbutamide)⁽¹³⁾.

KUTKI

Antidiabetic activity

The pharmacological properties of *Picrorhiza kurroa* Royle ex Benth. include anti-microbial, hepatoprotective, antioxidant, anti-bacterial, anti-mutagenic and anti-cancer activities. Rhizomes of *Picrorhiza kurroa* Royle ex Benth., when phytochemically screened showed the presence of bioactive components, which have been linked to antimicrobial properties. Numerous chemical experiments and TLC studies revealed the occurrence of sterols, glycosides and phenolic compounds when tested on various extracts of rhizomes of *P. kurroa*. The main chemical components found in *P. kurroa* include iridoid glycosides and cucurbitacins (triterpenoids). The effects of aqueous and methanolic extracts on pathogenic fungal (including *Candida albicans*, *Aspergillus niger*, *Pseudomonas aeruginosa*) and bacterial strains (including *Staphylococcus aureus*, *Bacillus subtilis*, *Micrococcus luteus*, *Escherichia coli*) indicated that the plant part can be used to treat infections caused by these bacteria and fungi. The aqueous and methanolic extracts showed antibacterial activity but the significant antimicrobial activity was shown by methanolic extract only, against *P. aeruginosa* and *S. aureus*. The aqueous extract was not much effective for anti-microbial activity and also it showed no activity against fungal strains. The efficacy of the

extracts was less than ciprofloxacin, which is the conventional antibiotic.

The antimicrobial potential of acetone, aqueous, ethanol, hexane and methanol extracts of rhizome of *P. kurroa* was checked against bacterial strains which belonged to gram positive and gram-negative bacteria. Ethanolic extract of rhizome of *P. kurroa* exhibited high antibacterial activity against *B. cereus*, *E. coli*, *K. pneumoniae*, *S. aureus*, *S. pyogenes* and *S. typhi*. The methanolic extract of rhizome showed greater antibacterial activity against *S. aureus* and *P. aeruginosa*, while hexane and acetone extract showed intermediate activity against *B. cereus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. aureus*, *S. pyogenes* and *S. typhi*. Aqueous extract of rhizome did not show antibacterial activity against the tested bacterial strains.^[13,14]

PUNARNAVA

Antidiabetic activity

The rapidly increasing diabetes mellitus and its associate complications is becoming a serious threat to human health. Various biochemical and chemical agents used for control and treatment of the same. *Boerhavia diffusa* exhibit potent anti-diabetic activity and its leaf extracts with various solvents have shown hypoglycemic activity in normal animals and antihyperglycemic activity in alloxan, streptozotocin or dexamethasone induced models of diabetes. Aqueous solution of *B. diffusa* leaf extracts at a daily oral dose of 200 mg/kg for 4 weeks, has significant change on blood glucose concentration and activity of hepatic gluconeogenic enzymes (increase in hexokinase activity and decrease in glucose-6-phosphate and fructose-1, 6-phosphate activity) in both normal and alloxan induced rats. Chloroform extracts of *B. diffusa* leaves produced dose dependent reduction in blood glucose in streptozotocin induced non-insulin dependent diabetes mellitus in rats. This was probably through rejuvenation of pancreatic β -cells or through extra pancreatic action. In spite of chloroform extracts of *B. diffusa*, methanolic extract and also comparably regenerate beta cells. The root extracts of *B. diffusa* at a daily dose of 150 mg/kg in dexamethasone induced hypoglycemic rats has antiperoxidative, hypoglycemic and cortisol lowering activities. Thus, the *Boerhavia diffusa* has a significant bearing on phytotherapy of diabetes mellitus and its associated complications.^[15,16]

TINOSPORA CORDIFOLIA (GULWEL)

Anti-Diabetic Activities

The stem of this plant is generally used to cure diabetes by regulating level of blood glucose. It has been reported to act as anti-diabetic drug through explanatory oxidative stress, promoting insulin secretion by inhibiting gluconeogenesis and glycogenolysis. The anti-diabetic properties exhibited by this plant species are attributed due to the presence of alkaloids (Magnoflorine, Palmetine, Jatrorrhizine), tannins, cardiac glycosides, flavonoids, saponins, steroids etc. The crude extract of stem in ethyl acetate, dichloromethane, chloroform and hexane inhibits the enzymes like salivary, amylase and glucosidase resulting increase in post-prandial glucose level and shows potential activities against Diabetes mellitus disease. The root extract of this plant has also been reported to have anti-diabetic properties which decrease the level of glycosylated haemoglobin, hydroperoxidase and vitamin E.^[17,18]

II. CONCLUSION

Ancient Ayurvedic Acharyas have very good knowledge about Diabetes Mellitus, i.e. Madhumeha and its treatment. According to research, various traditional medicines are used as Antidiabetics and some 50% of these traditional remedies have been studied experimentally. Pharmacological study of Ayurvedic plant like Kalmegh, Kadujire, Kutaki, Chirata, Punarnava and Gulwel has Antidiabetic properties, which is more economic and effective against Diabetes mellitus. Various formulation like Trivanga Bhasma, Triphala churna Aloe are used as Antidiabetic medication traditionally. Herbs are used to manage different type of diabetes and their complication.

REFERENCES

- [1]. Rani Alka; Arora S. and Goyal A., Research Scholar, "Antidiabetic plants in traditional medicines: a review", *Int. Res. J. Pharm.* 2017, 8 (6)
- [2]. Malecki M; Skupien J, "Problems in differential diagnosis of diabetes types". *Pol Arch Med Wewn.* 2008 Jul-Aug; 118(78):435-40.
- [3]. Kaul K; Tarr JM; Ahmad SI; Kohner EM; Chibber R; "Introduction to diabetes mellitus," *Adv Exp Med Biol.* 2012; 771:1-11.
- [4]. Wong J; Tabet E; "The introduction of insulin in type 2 diabetes mellitus" *Aust Fam Physician.* 2015 May; 44(5):278-83.

- [5]. Giovannini P; Howes MJ; Edwards SE; " Medicinal plants used in the traditional management of diabetes and its sequelae in Central America: A review." J Ethnopharmacol. 2016 May 26; 184:58-71.
- [6]. Ingole R. K.;" Anti-dibetic drug in Ayurveda", Int. Res. J. Pharm. 2013, 4(6). page no. 21-23.
- [7]. "Comparative Study of Asanad & Trivanga Bhasma In the Treatment of Madhumeha", Tilak Ayurved Mahavidyalaya Pune, Pune University, 1997.
- [8]. Acherekar S; Kaklij G.S; Kelkar S.M;"Hypoglycemic activity of Eugenia jambolana and Ficus bengalensis: mechanism of action. In vivo". 1991:5:143-147.
- [9]. Kokate K. C; Purohit P. A.; Gokhale B.S.;" Text book of Pharmacognosy, 50th edition, Nirali prakashan, Drug containing glycosides", Page no.9.103-9.106.
- [10]. Niranjan Abhishek; Tewari SK and Lehri, "Biological activities of Kalmegh and its active principles- A Review", Indian journal of Natural product and resources Vol-I (2) june 2010, page no. 125-135.
- [11]. Prajapati N D.; Purohit SS.; Sharma A. K.; Kumar T.A.;" Handbook of Medicinal plants" 2003. 45-46.
- [12]. Mohmmadjaved Paydar; Bushra A.M.;"Cenratherum anthelminticum Kuntze a Potential Medicinal Plant with Pleiotropic Pharmacological And Biological Activity",International Journal of Pharmacology 2013, 221-226.
- [13]. Sampath Kumar K.P.; Bhomik Debjit; Chiranjib, Biswajit; Chandira Margret;"Swertia chirata: A traditional herb and its medicinal uses" Journal of chemical and pharmaceutical reaserch, 2010, 2(1), 262-266.
- [14]. Aleem Abdul; Kabir Hifzul;"Review on Swertia chirata as traditional use to its phytochemistry and pharmacological activity" Journal of drug delivary and therapeutics, 2018, 73-78.
- [15]. Mahesh AR; Kumar Harish; Ranganath MK and Devkar Raviraj Anand, "Detail Study on Boerhaavia Diffusa Plant for its Medicinal Importance- A Review," Res. J. Pharmaceutical Sci. Vol. 1(1), 28-36, September (2012).
- [16]. Kumar Rajesh; Gautam S; Singh KD; Kumar P; Haque Nilufar; Yadav Vibha; Kumar R; Diwakar RP; Rishikant and Kumar SB, "Pharmacological properties of Boerhavia diffusa: A review",73-80.
- [17]. Mittal Jitendra Sharma; Madan Mohan; Batra Amla;"Tinospora cordifolia: a multipurpose medicinal plant- A review," Journal of Medicinal Plants Studies Year: 2014, Volume: 2, Issue: 2, 32-47.
- [18]. Sharma Abhimanyu; Gupta Asmita; Singh Sakshi; Batra Amla;"Tinospora cordifolia (Willd.) Hook. F. & Thomson - A plant with immense economic potential, J." Chem. Pharm. Res., 2010, 2(5):327-333
- [19]. Kokate K. C; Purohit P. A.; Gokhale B.S.; Text book of Pharmacognosy, 50th edition, Nirali prakashan, "Drug containing glycosides," Page no.9.101-9.102.
- [20]. Dr. Rangari D; Vinod.; Pharmacognosy and Phytochemistry volume-1, page no. 286.
- [21]. The Ayurvedic Pharmacopoeia of India, volume -1, part- I, Page No. 95.