



## Studying the Anti-Diabetic Basis of Ayurvedic Formulations–Avipattikara Churna and Triphala Churna

Dixit Praveen K<sup>\*1</sup>, Nagarajan K<sup>2</sup>, Kumar Sokindra<sup>3</sup>

<sup>1</sup>Department of Pharmacology, KIET School of Pharmacy, KIET Group of Institutions, Delhi-NCR, Ghaziabad, Affiliated to Dr APJ Abdul Kalam Technical University, Lucknow, UP, India

<sup>2</sup>Department of Pharmaceutical Chemistry, KIET School of Pharmacy, KIET Group of Institutions, Delhi-NCR, Ghaziabad, Affiliated to Dr APJ Abdul Kalam Technical University, Lucknow, UP, India

<sup>3</sup>Department of Pharmacology, Kharvel Subharti College of Pharmacy, Swami Vivekanand Subharti University, Meerut, UP, India

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### ABSTRACT

Diabetes mellitus (DM), belongs to the class of metabolic diseases having the primary symptom associated with this disease is high sugar levels in the blood for an extended period. It can be categorized to the world's major diseases considering that affects the high population on the earth and presents two main types I and II. The prevalence of diabetes for all age-groups world-wide was estimated to be 2.8% in 2000 and 4.4% in 2030. Diabetes complications include possible blindness, amputation of a lower limb, renal failure, and cardiac arrest or stroke. There are twenty types of Pramehas (Kaphaja-10 Pittaja-6, and Vataja-4) have been mentioned in the Ayurveda. 'Prameha' and 'Diabetes' are synonymous. Diabetes is one of the 'Prameha' which consists of two words, 'Pra' meaning abundant, and 'Meha' meaning passing of large quantity of Urine. Incidentally, the term diabetes has been derived from the Greek term 'Diabainein' to mean 'to cross through a siphon' meaning the continuous free flow of water and applied to mean the elimination of large quantity of Urine. Till now, various kinds of synthetic and herbal formulations were made, and many are more frequently used to achieve desirable treatment. Patients prefer oral anti-diabetic medications since they are more comfortable to be administered, and for this reason, researchers focus their studies in this direction. This review aimed to explore the possibility of anti-diabetic treatment from herbal sources well mentioned in Ayurvedic Formulary of India that is Avipattikara Churna, Triphala Churna.



### \*Corresponding Author

Name: Dixit Praveen K

Phone: +91 8192026467

Email: [praveendixit87@gmail.com](mailto:praveendixit87@gmail.com)

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### INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia, hyperlipidemia and polyurea resulting from defects in insulin secretion, or action, or both. Metabolic abnormalities in carbohydrates, lipids, and proteins metabolism occur from the importance of insulin as an anabolic hormone. Low levels of insulin to achieve an adequate response or insulin resistance of target tissues, mainly skeletal muscles, adipose tissue, and to a lesser extent, liver, at the level of insulin receptors, signal transduction system, or

effector enzymes or genes are responsible for these metabolic abnormalities (American Diabetes Association, 2014). The severity of symptoms is due to the type and duration of diabetes. Some of the diabetes patients are asymptomatic especially those with type 2 diabetes during the early years of the disease, others with marked hyperglycemia and especially in children with absolute insulin deficiency may suffer from polyuria, polydipsia, polyphagia, weight loss, and blurred vision (Craig et al., 2009). Uncontrolled diabetes may lead to stupor, coma and if not treated death, due to ketoacidosis or rare from the nonketotic hyperosmolar syndrome (Galtier, 2010). The effect of the diabetes is world-wide and more than 135 million people affected in the whole world (Zang et al., 2017). The disease diabetes having significant symptoms like, increase in blood glucose level, and longterm complication, which is associated with the diabetes are cardiomyopathy, angiopathy, nephropathy etc. Ayurveda, Siddha, Unani and Homeopathy drugs consist of various kinds of formulations prepared from plants, minerals, metals, animal and marine products as raw material. These formulations are prepared after several types of processing with the specific methods prescribed in these systems. These formulations are grouped in various dosage forms according to their mode of preparation, palatability, bioavailability, and therapeutic values accordingly, their terminology is given in texts mentioned in Drugs and cosmetic Act. In the Indian ayurvedic medicine system, the role of formulation, which is known as the Triphala having their values. The formulation of the Triphala Table 2 having the three primary ingredients which are known as *Terminalia chebula*, *Terminalia bellerica*, and *Phyllanthus Emblica* in the equal quantity. The activity of the Triphala in the ayurvedic medicine system is very vast. It posses the various activity like anti-oxidant, improves mental function, weight loss, prameh etc. (Patil and Shah, 2019). In the Indian traditional medicine system, *Avipattikar Churna* Table 1 is used to treat gastrointestinal problems and prameh. The use of the avipattikar churna is also beneficial in other diseases also like to support the digestive tract, treat urinary disorders, gastritis, loss of appetite, kidney stones and diabetes etc. because it contains varieties of active constituents vig. *Zingiber officinale* Rosc., *Piper nigrum* Linn., *Piper longum* L., *Phyllanthus Emblica* L., *Cyperus rotundus (scariosus)* R.Br., *Ammonium chloride*, *Embelia ribes* Burm.f, *Ellettaria cardmomum (L.)Maton*, *Cinnamomum Tamala Nees & Eberm.* *Syzygium aromaticum (L.)Merr*, *Operculina turpenthum (Linn.)*, *Saccharum officinarum (Gyawali*

*et al.*, 2013).

## Description of Constituent Herbs

### *Cinnamomum Tamala (Patra)*

The plant extract (water) of the leaves *Cinnamomum Tamala* showed the anti-diabetic activity in Male Wister albino rats by STZ induced diabetic model at the dose of 125 and 250mg/kg/body weight (Chakraborty and Das, 2010). The oil extracted from the leaves *Cinnamomum Tamala* shows the significant anti-diabetic action in male albino Wistar rats in streptozotocin induced diabetes activity in GC-MS analysis at the concentration of 100 and 200mg/kg. The reference drug glibenclamide (0.6 mg/kg) is used (Kumar et al., 2012). The 95% ethanol extract of the leaves *Cinnamomum Tamala* shows the significant anti-diabetic action which has been proved through the streptozotocin induced diabetic rats at the concentration of 200mg/kg. To compare the anti-diabetic activity of the test drug, the reference drug glibenclamide at the dose of 500µg/kg is used (Bisht and Sisodia, 2011). Alloxan induced diabetic rat model is used to assess the anti-diabetic activity of the leaves extract *Cinnamomum Tamala* extract (water) at the dose of 250 mg/kg body wt./day. Standard drug Tolbutamide (300 mg/kg/wt) in 10 % ethanol solution is used (Pochhi, 2019).

### *Cyperus rotundus (scariosus) (Musta)*

The rhizome ethanolic extract of the plant *Cyperus rotundus* was evaluated for its anti-diabetic activity against the streptozotocin-induced diabetes model at the concentration of 250 and 500mg/kg p.o in swiss albino mice and found useful. The standard group is treated with glibenclamide at 10 mg/kg/day (Singh et al., 2015). Its rhizome hydro-alcoholic extract (30:70) is used to evaluate for its anti-diabetic activity against alloxan-induced diabetes in rats. Where the concentration of the test extract is 200mg/kg, and the reference drug metformin concentration is 450mg/kg (Raut and Gaikwad, 2006). The methanolic extract of the plant rhizome extract has shown the anti-diabetic activity. This activity to be evaluated by the  $\alpha$ -amylase inhibition assay and  $\alpha$ -glucosidase inhibition assay. This comparison is made with the anti-diabetic compound acarbose. The concentration of the test compound is 200 and 500mg/kg (Tran et al., 2014).

### *Elettaria cardamomum (Suksmaila)*

The aqueous extract of mano mani chooramam which has one of the active ingredient *Elettaria cardamomum* shows the anti-diabetic activity at the dose of 2000mg/kg body weight p.o. against the streptozotocin assay in female Wistar albino

**Table 1: Constituent Herbs of Avipattikara Churna**

S. No	Ayurveda Name	Hindi Name	Botanical Name	Part Used
1.	Sunthi	Adrak Dry	<i>Zingiber officinale</i> <i>Rosc.</i>	Rhizome
2.	Marica	Kali Mirch	<i>Piper nigrum</i> Linn.	Fruit
3.	Pippali	Long Pepper	<i>Piper longum</i> L.	Fruit
4.	Haritaki	Haritaki	<i>Terminalia</i> <i>chebula</i> Retz.	Plant (Fr)
5.	Bibhitaka	Bahera	<i>Terminalia bel-</i> <i>lirica</i> (Gaertn.) <i>Roxb.</i>	Plant (Fr)
6.	Amalaki	Amla	<i>Phyllanthus</i> <i>emblica</i> L.	Plant (Fr)
7.	Musta	Nut Grass	<i>Cyperus rotundus</i> <i>(scariosus)</i> R.Br.	Rhizome
8.	Vida (Vida Lavana)	Vida Lavana	<i>Ammonium chlo-</i> <i>ride</i>	Salt
9.	Vidanga	Vidanga	<i>Embelia ribes</i> <i>Burm.f</i>	Fruit
10.	Ela (Suksmaila)	Elaichi	<i>Ellettaria cardmo-</i> <i>mum</i> (L.)Maton	Fruit (Seed)
11.	Patra (Tej patra)	Tej patra	<i>Cinnamomum</i> <i>tamala</i> Nees & <i>Eberm.</i>	Leaf
12.	Lavanga	Clove	<i>Syzygium aro-</i> <i>maticum</i> (L.) <i>Merr</i>	Flower bud
13.	Trivrit	Nishoth Kala	<i>Operculina tur-</i> <i>penthum</i> (Linn.)	Root
14.	Sarkara	Gud	<i>Saccharum offi-</i> <i>narum</i>	Gud

**Table 2: Constituent Herbs of Triphala Churna**

S. No	Ayurveda Name	Hindi Name	Botanical Name	Part Used
1.	Pathya (Haritaki)	Haritaki	<i>Terminalia</i> <i>chebula</i> Retz.	Plant (Fr.)
2.	Bibhita (Bibhitaka)	Bahera	<i>Terminalia bel-</i> <i>lirica</i> (Gaertn.) <i>Roxb.</i>	Plant (Fr.)
3.	Dhatri (Amalaki)	Amla	<i>Phyllanthus</i> <i>Emblica</i> L.	Plant (Fr.)

rats. Metformin, at a dose of 100 mg/kg is used as standard (Anandh *et al.*, 2019). The ethanolic extract (96%) of the leaves *Elettaria cardamomum* is to evaluate for their anti-diabetic potential against the alloxan-induced *Sprague Dawley* diabetic rats assay. The dose of the test compound 100mg/kg shows the reduction in blood glucose level (Winarsi *et al.*, 2014). The fruit extract (water and methanol extract) of *Elettaria cardamomum* shows the decrease of blood sugar (anti-diabetic) by in-vitro assay ( $\alpha$ -glucosidase and  $\alpha$ -amylase assay) (Ahmed *et al.*, 2017).

#### ***Embelia ribes (Vidanga)***

The test compound, which is extracted by the solvent 70% ethanol from the plant fruit *Embelia ribes* is shown the significant anti-diabetic activity by using the streptozotocin induce diabetes in rats. The test compound concentration 100 and 200mg/kg/day used and to compare the effect of test compound reference drug metformin (180mg/kg/day) is used (Bhandari *et al.*, 2013). The seed extract of plant *Embelia ribes* are evaluated for their anti-diabetic activity against the in-vitro  $\alpha$ -amylase inhibition assay. To compare the activity of the test compound reference drug glibenclamide (5 mg/kg, p.o.) is used (Nandhakumar *et al.*, 2017). To assess the anti-diabetic activity of the plant fruit extract (90% ethanol) *Embelia ribes* used. The streptozotocin (40mg/kg b.w,i.p) model is used for the induction of the diabetes, and the dose of the reference compound gliclazide and the test compound is (25 mg/kg), and 100 and 200mg/kg used respectively (Bhandari *et al.*, 2007).

#### ***Operculina turpenthum (Trivrit)***

The dried fresh stem methanolic extract of *Operculina turpenthum* evaluated for their anti-diabetic potential in streptozotocin induced diabetic rats. For the assessment of the extract anti-diabetic activity dose 50 and 100mg/kg has been taken, and for the comparison study, the standard compound 5 mg/kg of glibenclamide was administered (Shankaraiah *et al.*, 2011). The plant *Operculina turpenthum* was evaluated for their anti-diabetic activity. The plant stem and root part extract (methanolic extract) was used to assess diabetic activity using the streptozotocin (STZ)-induced type 2 diabetic model. The dose of the compound was used 100mg/kg, and the reference drug was glibenclamide used (Pulipaka *et al.*, 2012). The methanolic extract of the plant leaf *Operculina turpenthum* showed the anti-diabetic action through the in-vitro  $\alpha$ -amylase inhibitory at the various concentration (12.5, 25, 50, 75 and 100  $\mu$ g/ml) (Jalaj and Anju, 2019).

#### ***Piper longum (Pippali)***

The plant root extract (Hexane, ethyl acetate, methanol and aqueous extracts) of *Piper longum* evaluated for their anti-diabetic activity using the STZ-induced diabetic rats at the dose of the 200 mg/kg.b.w. The animal of the standard group is treated 0.02g glibenclamide/kg b.w. (Nabi *et al.*, 2013). The root powder of the *Piper longum* aqueous extract has the anti-diabetic activity. Their activity is evaluated by the intraperitoneal administration of STZ (single dose of 50 mg/kg b.w.) model on Wistar albino rats at the concentration of 200mg/kg/b.w. To compare the results of the test compound reference drug 0.02g of glibenclamide/kg b.w/day was used (Shaik *et al.*, 2012). The aqueous extract of mano mani chooramam which has one of the active ingredient *Piper longum* showed the anti-diabetic activity at the dose of 2000mg/kg body weight p.o. against the streptozotocin assay in female Wistar albino rats. Metformin, at a dose of 100 mg/kg was used as standard (Anandh *et al.*, 2019). The fresh, dried fruit of the *Piper longum* shows the significant anti-diabetic activity. The 95% methanolic extract was used to evaluate the action against the alloxan-induced diabetes model in the Wistar rats at the 300mg/kg/b.w. The standard (glibenclamide 600 $\mu$ g/kg/b.w) was used to compare the activity between the test and the standard compound, found anti-diabetic potential (Manoharan *et al.*, 2007).

#### ***Piper nigrum (Marica)***

30% ethanolic extract of the plant(leaves) *Piper nigrum* shows the anti-diabetic activity by in-vitro  $\alpha$ -amylase assay. The various concentration was evaluated for the activity like 50, 100, 250, 500 and 1000 $\mu$ g (Kavitha *et al.*, 2018). The aqueous extract of mano mani chooramam which has one of the active ingredient *Piper nigrum* showed the anti-diabetic activity at the dose of 2000mg/kg body weight p.o. against the streptozotocin assay in female Wistar albino rats. Metformin, at a dose of 100 mg/kg is used as standard (Anandh *et al.*, 2019). To evaluate the anti-diabetic potential of the plant seed *piper nigrum* aqueous extract are used in the alloxan-induced diabetic rat model (Kaleem *et al.*, 2005).

#### ***Phyllanthus Emblica (Amalaki)***

The dose of 80mg/kg of the plant fruit extract (70% aqueous ethanol) of *Phyllanthus Emblica* has been shown the anti-diabetic activity. The reference drug glimepiride 20 mg/kg/i.p was used to compare the activity (Bashir *et al.*, 2018). Alloxan induced diabetic rat model was used to evaluate the anti-diabetic activity of the test compound. This diabetic



model is also used to evaluate the aqueous extract from the plant part (fruit) *Phyllanthus Emblica* at the concentration of 150mg/kg. Glipizide (5mg/kg) used as a standard anti-diabetic drug (Mali, 2012).

#### ***Saccharum officinarum (Sarkara)***

The 60% hydro-alcoholic (V/V) portion which was extracted from the plant *Saccharum officinarum* have the significant anti-diabetic activity. The anti-diabetic activity is evaluated by the in-vitro ( $\alpha$ -glucosidase inhibition assay) model and the cell viability assay on the cell Human hepatoma HepG2 (Zheng et al., 2017). The extract which was obtained from the plant leaves of the *Saccharum officinarum* was evaluated for their anti-diabetic activity against the alloxan-induced diabetes model in Wistar rats at the concentration of 400mg/kg/b.w. To assess the anti-diabetic activity of the test compound reference drug glibenclamide (600mg/Kg. b.w) was used to compare the activity between the test and the standard (Ojewunmi, 2013).

#### ***Syzygium aromaticum (Lavanga)***

The ethanolic extract, which was obtained from the flowering buds of *Syzygium aromaticum*, were evaluated for their anti-diabetic activity. The flowering buds of *Syzygium aromaticum* shown their anti-diabetic activity by the PPAR- $\gamma$  ligand-binding activity. The standard drug troglitazone, which creates the main difference between the test and the standard compound, has been used (Kuroda et al., 2012). The essential oil which is obtained from the *Syzygium aromaticum* is used for its anti-diabetic activity. The in-vitro ( $\alpha$ -amylase) assay is performed for the assessment of anti-diabetic activity. The concentration of the test compound was varied from the 1-100 $\mu$ g/ml (Tahir et al., 2016). To evaluate the anti-diabetic activity, streptozotocin induced diabetic model was used. The extract from the flowering buds of *Syzygium aromaticum* using the solvents dichloromethane and ethyl acetate are assessed for their anti-diabetic activity. Similarly, the standard drug acarbose 100mg/kg was used (Khathi et al., 2013). The extract obtained from the buds of *Syzygium aromaticum* is evaluated for their anti-diabetic activity at the different dose (250, 500, 750,1000  $\mu$ g/ml) by using the  $\alpha$  -amylase inhibition (in-vitro model) (Nivetha et al., 2015).

#### ***Terminalia belerica (Bibhitaka)***

*Terminalia belerica* fruits extract (75% methanolic) were used for their anti-diabetic activity against the alloxan-induced diabetic rats at the concentration of 100mg/kg (Sabu and Ramadasan, 2009). The plant *Terminalia bellirica* parts (leaves, fruits, and

bark) are extracted by using the various solvents (petroleum ether, chloroform, and ethanol) to perform their anti-diabetic activity. The anti-diabetic activity was also evaluated against the *In vitro* glucose diffusion inhibitory assay (Das and Devi, 2015).

#### ***Terminalia chebula (Pathya)***

The fruit (*Terminalia chebula*) extracted in 80% methanolic extract to be evaluated at the various concentration (100, 200 and 400 mg/kg orally) for their anti-diabetic activity against alloxan-induced diabetes in Wistar albino rats and this activity to be compared with the reference drug metformin 100 mg/kg (Aung et al., 2017). Alloxan induced diabetic model was used to evaluate the anti-diabetic activity of the plant *Terminalia chebula* extract (ethyl acetate and water extract) at the concentration of 250mg/kg and the reference drug concentration glibenclamide 5 mg/kg (Gupta et al., 2020).

#### ***Zingiber officinale (Sunthi)***

The extract of rhizome *zingiber officinale* at the concentration of 200-600 $\mu$ g/ml against Streptozotocin (STZ)-diabetic rats is evaluated for their anti-diabetic activity (Noipha and Ninla-Aesong, 2018). The aqueous extract of the rhizome *zingiber officinale* at the dose of 500 mg/kg, intraperitoneally are assessed for their anti-diabetic activity against the streptozotocin (STZ)-induced diabetic rats (Al-Amin et al., 2006).

### **CONCLUSION**

Several potential therapies for diabetes are recently being investigated. The current insulin therapy includes subcutaneous injection, which regularly fails to emulate the glucose homeostasis that healthy individuals eventuate. This fact generates numerous experiments to develop a safer and more effective non-invasive route for insulin delivery for the treatment of diabetes. It is widely reported that herbal sources are more useful, having fewer side effects and convenient as far as the administration is concerned. So, the only answers can be explored form the Ayurvedic Polyherbal formulations. In this review, authors are trying to discuss exhaustively the Avipattikara and Triphala churna constituents which have tremendous potential to cure and prevent diabetes.

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## Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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