

ROLE OF *TINOSPORA CORDIFOLIA* ON GESTATIONAL DIABETES - A COMPREHENSIVE REVIEW

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ABSTRACT

Gestational diabetes mellitus (GDM) is increasing in prevalence in tandem with the dramatic increase in the prevalence of overweight and obesity in women of childbearing age. Diabetes mellitus is becoming fastest considerable disease in the world. Overweight and obese women have an increased risk of developing GDM leading to complications during pregnancy, birth and neonatal. The clinical management of obese pregnant women and women with GDM is a challenge and puts additional stress on the healthcare system. If newly proposed criteria are adopted universally a significantly growing number of women will be diagnosed as having GDM, implying new therapeutic challenges to avoid foetal and maternal complications related to the hyperglycemia of gestational diabetes. The main causative factor is said to be sedentary lifestyle and food habits. Ayurveda offers comprehensive safe and effective approaches to manage such conditions. Various *Ayurveda classics* and studies published in journals related to effect of *Tinospora cordifolia* on GDM will be reviewed and analyzed. Evidences from various studies show that phytochemicals obtain from *Tinospora cordifolia* are potential therapeutics that act as anti-diabetic drug in the prevention and treatment of GDM. Analysis of classical references and various experimental studies of *Tinospora cordifolia* used to cure GDM by regulating level of blood glucose and it act as anti-diabetic drug through explanatory oxidative stress, promoting insulin secretion by inhibiting gluconeogenesis and glycogenolysis.

KEYWORDS: Hyperglycemia, Gestational diabetes mellitus, *Tinospora cordifolia*

INTRODUCTION

Sedentary life style and stressful mental conditions nowadays have called for many life style disorders, foremost amongst them being GDM. GDM occurs in about 5% of pregnancies but figures vary considerably depending upon the criteria used and demographic characteristics of the population. The prevalence is expected to

increase as the epidemic of obesity continues¹. Pregnancies affected by GDM impose a risk for both mother and child as the risk of cesarean and operative vaginal delivery, macrosomia, shoulder dystocia, neonatal hypoglycemia and hyperbilirubinemia is increased². Women with a history of GDM are also at an increased risk

of developing type 2 diabetes mellitus (T2DM) in the years following their pregnancy and their children have a higher risk of developing obesity and T2DM early in life³. For those reasons it is important to pay rigorous attention to GDM and the purpose of this review is therefore to cover a wide range of clinical issues related to GDM, including the challenges of epidemiology, diagnostic criteria and screening, the pathophysiology of GDM, the treatment and prevention of GDM and the long and short term consequences of GDM for both mother and child. A recent report from the International Diabetes Federation estimated that worldwide 16% of live births in 2013 were complicated by hyperglycemia during pregnancy⁴ and it is most likely that the prevalence of GDM will increase due to the increase in risk factors like obesity and physical inactivity. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study reported that a higher prepregnant BMI and the BMI at 28 week are strongly correlated to increased insulin resistance at 28 week⁵.

MATERIAL AND METHODS

Various Ayurveda classics and studies published in journals related to effect of *Tinospora cordifolia* on GDM are reviewed and analyze.

In present scenario many Ayurveda herbal drugs used as a supportive treatment in treating diabetes mellitus which are along with their antidiabetic property, also have multifactorial functions such as Nephro-protective, Immunomodulatory, *Rasayana* etc useful in treating GDM and its secondary complications also. In Ayurveda classic various drugs are mentioned for the treatment of diseases related to *Mutravaha*

srotas (Urinary system), among them *Tinospora cordifolia* one of ancient drug which is traditional used as an antidiabetic drug in treatment of GDM.

Plant description

Tinospora cordifolia is a slow growing, perennial, woody climber, distributed throughout India, in dry forests upto 600 m height. It is mainly present in the tropical forest of the Central and Southern India.

The leaves are opposite, usually elliptic or ovate (1.25-2.0 inch × 0.51-1.25 inch). Flowers are inches in length. The calyx-lobes are long, ovate, obtuse and pubescent; corolla is pale Yellow Campanulate, Valvate, and Corona single, with 5 fleshy scales. Scales adnate to throat of corolla tube between lobes; anther connective produced into a membranous tip, pollinia 2, erect, carpels 2 unilocular; locules many ovuled⁶.

Geographical distribution

Tinospora cordifolia is native to the tropical forests of Central and Southern India, had wider distribution and it grows in the plains from the coast, in scrub jungles and in thickets at an attitude ranging from 300-700 m⁷.

Table no.1 – Showing Taxonomy of *Tinospora cordifolia*⁸

Botanical Name	<i>Tinospora cordifolia</i>
Family	<i>Menispermaceae</i>
Synonyms	<i>Amritavalli, Amrita, Madhuparni,</i>
Hindi Name	<i>Guduchi</i>

Table no.2 – Showing pharmacodynamics of *Tinospora cordifolia*⁹

Rasa	<i>Tikta, Kashaya</i>
Guna	<i>Laghu</i>

Virya	Usna
Vipaka	Madhura
Dosha karma	Tridoshashamak

Phytochemistry

The stem and root of *Tinospora cordifolia*, Berberine, Choline,¹⁰ Tembetarine, Magnoflorine, Tinosporin, Palmetine, Isocolumbin¹¹, Aporphine alkaloids, Jatrorrhizine, Tetrahydropalmatine¹². Stem have glycosides 18-norclerodane glucoside, Furanoidditerpene-glucoside, Tinocordioside, Tinocordifolioside¹³, Cordioside, Cordifolioside Syringin, Syringin-apiosylglycoside, Pregnaneglycoside, Palmatosides¹⁴, Cordifolioside A, B, C, D and E.

CLINICAL AND EXPERIMENTAL EVIDENCES

Various clinical and experimental studies document the antidiabetic effect of the *Tinospora cordifolia*. There are some possible mechanisms by which the stem and root extract of *Tinospora cordifolia* possess its hypoglycemic effects are:

1. It promotes regeneration of islet cells.
2. It increases secretion of insulin.
3. It causes inhibition of glucose absorption from intestine.
4. It increases utilization of glucose as it increases the activities of enzymes responsible for utilization of glucose by insulin dependent pathways. An increase in phosphorylase activity, decrease in gluconeogenic enzymes and sorbitol dehydrogenase.¹⁵

Antidiabetic Effect

The stem of this plant is generally used to cure diabetes by regulating level of blood glucose¹⁶. 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)¹⁷, tannins, cardiacglycosides, flavonoids, saponins, steroids etc.¹⁸.

Anti-HIV Activities

Root extract of this plant has been shown a decrease in the regular resistance against HIV¹⁹.

This anti HIV effect was exposed by reduction in eosinophil count, stimulation of B lymphocytes, macrophages, level of hemoglobin and polymorphonuclear leucocytes²⁰.

Immunomodulatory Activities

T. cordifolia is well known for its immunomodulatory response. This property has been well documented by scientists^{21,22}. A large variety of compounds which are responsible for immunomodulatory and cytotoxic effects are 11- hydroxymuskatone, N-methyle-2-pyrrolidone, Nformylannonain, cordifolioside A, magnoflorine, tinocordioside and syringin²³.

Anti-Toxic Activities

Aqueous extract of this plant has already been reported to show scavenge activity due to the presence of antioxidant against free radicals generated during aflatoxicosis²⁴. Further alkaloids such as choline, tinosporine, isocolumbin, palmetine, tetrahydropalmatine and magnoflorine from *T. cordifolia* showed protection against aflatoxin induced nephrotoxicity²⁵.

Anti-Oxidant Activities

Methanolic extract of stem of *T. cordifolia* has been reported to anti-oxidant activity, by

increasing the erythrocytes membrane lipid peroxide and catalase activity. It also decreases the activity of SOD, GPx in alloxan induced diabetic rats^{26,27}

Anti-Cancer Activities

T. cordifolia shows anti-cancer activity, this activity is mostly shown in animal models. Root extract of *T. cordifolia* has been shown radio protective role due to extensively increase in body weight, tissue weight, tubular diameter. Dichloromethane extracts of TC shows cytotoxic effects owing to lipid peroxidation and release of LDH and decline in GST²⁸.

Anti-Microbial Activities:

Methanolic extract of *T. cordifolia* has been reported against microbial infection²⁹. Antibacterial activity of *T. cordifolia* extract has been bio assayed against *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumonia*, *Proteus vulgaris*, *Salmonella typhi*, *Shigella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacter aeruginosa*, *Enterobacter aerogene*^{30,31}.

DISCUSSION AND CONCLUSION

Worldwide there has been a dramatic increase in the prevalence of overweight and obesity in women of childbearing age. Overweight and obese women have an increased risk of developing GDM leading to complications during pregnancy, birth and neonatal and a lot of new drugs are being synthesized for the same. Many Indian herbs are being used in traditional practices to cure diabetes and gestational diabetes *Tinospora cordifolia*, has an important place among such antidiabetic medicinal plants. *Tinospora cordifolia* extracts have been examined for their antidiabetic properties in

an attempt to recognize alternative treatment strategies that pose less of a hazard for diabetics. It possess hypoglycemic and hypolipidemic activity in long term treatment and is also capable of regenerating β -cells and hence it could be used as a drug for treating GDM. Because it has regenerating ability of β -cells, at least the people in the earliest stages of the disease could be treated to delay or prevent full-blown clinical GDM.

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