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REVIEW ARTICLE

A REVIEW ON ANTI-DIABETIC HERBS IN SIDDHA MEDICINE

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ABSTRACT

D*iabetes mellitus is a metabolic disorder in which a person has high blood sugar, either because the pancreas does not produce enough insulin or because cell does not respond to the insulin that is produced. The symptoms related with diabetes are polyuria [frequent urination], polydipsia [increased thirst], polyphagia [increased hunger] and loss of weight. IDDM treated with a combination of regular and NPH insulin or synthetic insulin. The oral hypoglycemic agents [OHAs] like Metformin used for NIDDM all around world widely. In present days world's focus turns to the herbal medicine because of the side effect of modern drugs. Many herbs have anti-diabetic, anti- hyperglycemic activity. Siddha medical system is very powerful system of Indian system of medicine. It is treating the diseases using herbs, inorganic substances and animal products. Many of the siddha medicinal plants possess the anti- diabetic property. Siddha medicine has better remedies for treatment and management of diabetes. This article reviews the anti-diabetic activity of the most common herbs in siddha medicine. This review may be supportive for the researchers; academician and clinician about the promising siddha herbs have anti-diabetic activity. This review has offered the recent advancement of herbs in siddha medicine has an anti- diabetic activity, with the vision to support the further research and also give the permanent resolution for the society.*

Keywords: *Anti- diabetic, hypoglycemic activity, Indian system of medicine, siddha herbs.*

INTRODUCTION

Siddha medicine is one of the oldest medicine system known to mankind and they get medication from siddha system more than 10000 years ago [1]. Herbs are the main source of the siddha medicines and also used inorganic substance and animal products. Many drugs contain herbal ingredients and it has been said that 70-80 percentage of world population relies on some form of non-conventional medicine [2]. Many Indian medicinal plants are reported to be useful in diabetes. However, search for new anti-diabetic drugs continue. [3].Herbal medicine is used to treat many conditions such as asthma, eczema, premenstrual syndrome, arthritis, migraine, hypertension, diabetes, cancer among others. Siddha formulation are presented in the books of GUNAVAGADAM [siddha pharmacology] quoted by siddhars. Various Siddha formulations are offered for the treatment of DM. Advanced researches are going in Siddha Pharmacology to prove the efficacy of the siddha drugs for various chronic non-communicable diseases and also in communicable diseases [4]. In India, a number of plants are mentioned in ancient literature in siddha for the cure of diabetic conditions. Diabetes mellitus is a non curable metabolic disorder in decreased anabolic effects.DM divided into two type 1-IDDM, 2-NIDDM. Diabetes has emerged as a major healthcare problem in India. According to Diabetes Atlas published by the International Diabetes Federation [IDF], there were an estimated 40 million persons with diabetes in India in 2007 and this number is predicted to rise to almost 70 million people by 2025. The countries with the largest number of diabetic people will be India, China and USA by 2030. Much of the heart disease and stroke in these estimates was linked to diabetes. WHO estimates that diabetes, heart disease and stroke together will cost about $ 333.6 billion over the next 10 years in India alone [5]. IDDM [type1] is a slowly progressive T-Cell mediated autoimmune disease said that destruction of the insulin-secreting cells in the pancreatic islets takes place. Hyperglycemia accompanied by the classical symptoms of diabetes occurs only when 70-90% of beta cells have been destroyed. NIDDM [type2] is a combination of resistance to the actions of insulin in liver and muscle together with impaired pancreatic beta cell function leading to relative insulin deficiency. [6]

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RISK FACTORS [7]

People who develop diabetes are more likely to have the following characteristics:

a. age 45 or older
b. overweight or obese
c. physically inactive
d. parent or sibling with diabetes
e. family background
f. history of giving birth to a baby weighing more than 9 pounds
g. history of gestational diabetes
h. high blood pressure—140/90 or above—or being treated for high blood pressure
i. high-density lipoprotein (HDL), or good, cholesterol below 35 milligrams per deciliter (mg/dL), or a triglyceride level above 250 mg/dL
j. polycystic ovary syndrome, also called PCOS
k. Acanthosis nigricans, a condition associated with insulin resistance, characterized by a dark, velvety rash around the neck or armpits
l. history of CVD

SYMPTOMS [8]

Symptoms are similar in both types of diabetes but they vary in their intensity. Symptoms develop more rapidly in type 1 diabetes and more typical. The symptoms include polyuria, polydipsia, polyphagia, weight loss, fatigue, cramps, constipation, blurred vision, and candidiasis. Longstanding type 1 DM patients are susceptible to micro vascular complications; and macro vascular disease (coronary artery, heart, and peripheral vascular diseases).

Symptoms in type 2 DM are similar but insidious in onset. Type 2 DM caries a high risk of large vessel atherosclerosis commonly associated with hypertension, hyperlipidaemia and obesity. Most patients with type 2 -diabetes die from cardiovascular complications and end stage renal disease. Geographical differences exist in both the magnitude of these problems and their relative contributions to overall morbidity and mortality.

COMPLICATIONS [9]

Acute

a) Diabetic ketoacidosis (DKA)
b) Hyperglycemic hyperosmolaris syndrome (HHS)
c) Hypoglycemia
d) Metformin associated lactic acidosis, MALT

Chronic

a) Nephropathy
b) Retinopathy
c) Neuropathy
d) Macro vascular diseases (CHD, peripheral vascular disease, stroke)

SIDE EFFECT OF ORAL HYPOGLYCEMIC AGENTS [10]

a. Hypoglycemia
b. Weight gain
c. Gastro-intestinal disturbance
d. Nausea, Vomiting
e. Diarrhea
f. Rashes
g. Renal impairment

There are many siddha formulary drugs for diabetes which has no side effect such as madhumega Chooranam, aavarai kudineer, naval kottai chooranam, seenthil chooranam, elavanga elagam, thetran kottai elagam and sengkottai elagam etc. Siddha medicinal plants which are most effective and the most commonly studied in relation to diabetes are *Citrus bergamia*, *Eugenia jamolana*, *Ferrula asafoetida*, *Helicteres isora* ,*Murraya koenigi* ,*Syzygium cumini*, *Tinospora cordifolia* ,*Terminalia arjuna and Gymnema sylvestre* [11]. From this review, it is concluded that siddha herbal plants which have anti- diabetic activity.

S. No	Botanical Name	Family	Siddha/ Tamil Name	Parts Used	Ref. No
1.	*Acacia catechu*	Fabaceae	Karunkaali	Bark	15
2.	*Cassia auriculata*	Caesalpiniaceae	Aavarai	Seed/whole plant	16
3.	*Coccinia grandis*	Cucurbitaceae	Kovai	Root Tuber	17
4.	*Embilica officinalis*	Euphorbiaceae	Nellikkai	Fruit	18
5.	*Euphorbia hirta*	Euphorbiacaea	Amman Patcharisi	Whole Plant	19
6.	*Ferula asafoetida*	Apiaceae	Perunkayam	Resin	20
7.	*Gymnema sylvestre*	Asclepiadaceae	Sirukurinjan	Leaf	21
8.	*Helicteres isora*	Sterculiaceae	Valampurikkai	Root	22
9.	*Hemidesmus indicus*	Asclepiadaceae	Nannari	Root	23
10.	*Hibiscus cannabinus*	Malvaceae	Pulichakeerai	Leaf	24
11.	*Holarrhena anti-dysenterica*	Apocynaceae	Kudasapalai	Bark	25
12.	*Madhuca indica*	Sapotaceae	Ilupai	Bark	26
13.	*Murraya koenigi*	Rutaceae	Karivembu	Leaf	27
14.	*Phyllanthus amarus*	Euphorbiaceae	Kelkaainelli	Leaf	28
15.	*Smilax china*	Liliaceae	Parangipattai	Root	29
16.	*Stereospermum chelonoides*	Bignoniaceae	Padhiri	Bark	30
17.	*Syzygium cumini*	Myrtaceae	Naval	Seed/ Fruit	31, 32
18.	*Terminalia arjuna*	Combretaceae	Marudhu	Stem Bark	33
19.	*Tinospora cordifolia*	Asclepiadaceae	Seenthil	Stem Bark	34
20.	*Trigonella foenum-gracecum*	Fabaceae	Venthayam	Seed	35

1. Acacia catechu

In siddha medicine the herb, *Acacia catechu* [tamil name-karunkali] used for ascites, fistulae, ulcer, leprosy, warm infections diarrhea and menorrhagia [12]. The ethanolic extract and fraction of *A. catechu* were subjected to anti-diabetic study in alloxan-induced diabetic rats at two dose levels, 200 and 400 mg/kg, respectively. Biochemical parameters, including glucose, urea, creatinine, serum cholesterol, serum triglyceride, high density lipoprotein [HDL], low density lipoprotein [LDL], hemoglobin and glycosylated hemoglobin were also assessed. The ethanolic extract of *A. catechu* and the water insoluble fraction of ethanolic extract exhibited significant anti-hyperglycemic activity and produced dose- dependent hypoglycemia in fasted normal rats. Treatment of diabetic rats with ethanolic extract and water-insoluble fraction of this plant restored the elevated biochemical parameters significantly [$p<0.05$] to the normal level. Comparatively, the water insoluble fraction of ethanolic extract was more effective than the ethanolic extract and the activity was comparable to that of the standard, glibenclamide [5 mg/kg] [15].

2. Cassia auriculata

In siddha medicine the herb, *cassia auriculata* [tamil name- aavarai] used for gonococcal infection, urinary tract infection, ring worm, excess thirsty, leucorrhea and burning micturition [12]. A decoction of the whole plant or buds can be used to treat DM [13]. The petroleum ether, chloroform, ethyl acetate, ethanol and aqueous extracts of *Cassia auriculata* seeds, obtained by soxhlet extraction method were evaluated for anti-diabetic activity using alloxan induced hypoglycemic rats on acute and prolonged treatment. The potency of extracts was compared with that of standard tolbutamide [250 mg/kg body weight, p.o.]. Petroleum ether and ethyl acetate extracts showed highly significant [$p<0.001$] anti-diabetic activity in both acute and prolonged treatment studies. The results were comparable to standard drug tolbutamide [16].

3. Coccinia grandis

In siddha medicine the herb, *Coccinia grandis* [tamil name- kovai] used for tetanus, arthritis, asthma, aphthous ulcer, scabies and tinea [12]. It was investigated the anti-diabetic effects of aqueous extracts of leaves of *C. grandis* obtained by decoction method. Graded doses of the aqueous extract were administered to normal and experimental diabetic rats for 10 days. Significant [$p < 0.05$] reduction in fasting blood glucose levels were observed in the normal & in the treated diabetic animals. The changes in body weight, serum lipid profiles, liver glycogen levels were assessed in the

extract treated diabetic rats and compared with diabetic control and normal animals. The extracts of *C. grandis* produced significant changes in the alloxan-induced diabetic rats. The aqueous extracts of *C. grandis* reduced the glucose levels considerably. The prolonged treatment of *C. grandis* extracts on alloxan induced diabetes rats produced consistent reduction in the blood glucose levels [17].

4. Embilica officinale

In siddha medicine the herb, *Embilica officinale* [tamil name- nellikkai] used for sinusitis, constipation, nausea, vomiting, giddiness, anemia, dropsy, hemorrhoids and ascites [12]. Daily intake of *Embilica officinale* juice with fresh bitter-gourd juice will stimulate the pancreas and enable it to secrete insulin [13]. *Emblica officinalis* seed extract was evaluated for the anti- diabetic property on streptozotocin induced Male albino Wistar rats. Diabetic rats were orally administered methanolic seeds extract of *Emblica officinalis* at the dose of 100, 200, 300 and 400 mg/kg, p.o. The effect of *Emblica officinalis* seeds extracts on serum glucose, insulin and biochemical parameters such as total protein, Serum creatinine, and Serum Urea, SGOT, SGPT and lipid profile were examined in control and extracts treated diabetic rats. There was significant reduction in blood glucose level in trial drug treated animals which is comparable with the standard drug Glibenclamide [18].

5. Euphorbia hirta

In siddha medicine the herb, *Euphorbia hirta* [tamil name- amman patcharisi] used for constipation, leucorrhoea, urticaria and paronychia [12]. The ethanolic extracts of *Euphorbia hirta* leaf, flower, and stem were taken to evaluate the anti- diabetic activity against normal and streptozotocin [SIZ] induced diabetic mice at dose levels of 250 and 500 mg/kg. Oral administration of the extracts for 21 days resulted in a significant reduction in blood glucose level. This showed that *E.hirta* has anti-diabetic activity. [19]

6. Ferula asafetida

In siddha medicine the herb, *Ferula asafetida* [tamil name- perunkayam] used for gastritis, ulcer, ascites, laxative, anti-helminthes, carminative, and emmonagogue [12]. It was evaluated for the hypoglycemic activity of the asafetida extract in streptozotocin induced diabetic Male Wistar rats at doses of 50, 100 and 300 mg/kg. Diabetic rats received the asafoetida extract daily in drinking water for 4 weeks. Diabetic rats showed an elevated serum glucose level over those of control rats at weeks 2 and 4 [$P<0.05$] and treatment of diabetic rats with the asafetida extract at dose of 50 mg/kg significantly lowered the serum glucose concentration in comparison to diabetic rats [20].

7. Gymnema sylvestre

In siddha medicine the herb, *Gymnema sylvestre* [tamil name-sirukurinjan] used for Snake bite, fever, asthma and used as emetic, expectorant, and cough [12]. A study was carried out to know the effect of *Gymnema sylvestre* in both normal and alloxan induced diabetic rats. The aqueous leaf extract of *Gymnema sylvestre* at the dose of 400, 600 and 800 mg/kg of body weight was administered orally once a day to the groups for 30 days. The fasting blood glucose, cholesterol, HDL cholesterol and serum triglyceride content were estimated in both normal and alloxan induced diabetic rats. The fasting blood glucose, cholesterol and serum triglyceride content were found to be significantly reduced [$p<0.05$] in treated rats whereas the extract also showed the potent elevation in the level of serum HDL cholesterol. The study revealed that *Gymnema sylvestre* has significant anti-diabetic activity and a hypolipidemic activity in alloxan induced and normal fasting rats [21].

8. Helicteres isora

In siddha medicine the herb, *Helicteres isora* [tamil name- valampurikkai] used for ear diseases, irritating cough, hiccup, fever and gonorrhea [12]. The different extracts of the roots of *Helicteres isora* were tested for anti-diabetic activity, by glucose tolerance test in normal rats and alloxan induced diabetic rats. Aqueous ethanol and butanol extracts had shown significant protection and lowered the blood glucose levels to normal in glucose tolerance test. In alloxan induced diabetic rats the maximum reduction in blood glucose was observed after 3h at a dose level of 250 mg/kg of body weight. In long term treatment of alloxan induced diabetic rats, the degree of protection was determined by measuring blood glucose, triglycerides, cholesterol and urea levels on 0,3,5,7 and 10th day. Finally it was concluded that both the extracts showed a significant anti-diabetic activity & comparable with standard drug glibenclamide [22].

9. Hemidesmus indicus

In siddha medicine the herb, *Hemidesmus indicus* [tami name- pulichakeerai] used for sinusitis, thirsty, fever, nausea diuretic, coolant, and Demulcent [12]. The aqueous extract of the roots of *H. indicus* was evaluated for its hypoglycemic activity at a dosage of 500 mg/kg/day in streptozotocin induced diabetic rats. It exhibited significant anti-diabetic activity. It restores the concentrations of electrolytes, glucose metabolizing enzymes, hepatic microsomal

protein and hepatic cytochrome P-450-dependent mono-oxygenase enzyme systems to near normal level and also corrects the related metabolic alterations in experimentally streptozotocin induced diabetic rats. There was a significant reduction in blood glucose level in experimental animals. The study revealed that *Hemidesmus indicus* has significant anti-diabetic activity in rat models [23].

10. Hibiscus cannabinus

In siddha medicine the herb, *Hibiscus cannabinus* [tamil name- Pulicha keerai] used for vomiting, constipation and abcess [12]. The alcoholic extract of *Hibiscus cannabinus* was studied for anti- diabetic activity in streptozotocin induced diabetic rats by oral administration of extract 400mg/kg body weight for 15 days. The effect was compared with oral dose of 0.5mg/kg Glibenclamide. The result showed the alcoholic extract of *Hibiscus cannabinus* leaves significantly lowered the blood glucose level in hyperglycemic rats. It was accomplished that *Hibiscus cannabinus* leaf extract has significant anti-diabetic activity, which lowered the fasting blood glucose level in Streptozotocin induced diabetic rats which is comparable with the standard drug [24].

11. Holarrhena anti-dysenterica

In siddha medicine the herb, *Holarrhena anti-dysenterica* [tami name- kudasapalai] used for eczema, leucorrhoea, diarrhea, scabies, fever and stomach pain.[12] Bark powder of *H. anti-dysenterica* was subjected to extraction [soxhlet] with various solvents like petroleum ether [40-60°C], chloroform, butanol, butanone and alcohol. Aqueous extract was prepared by cold maceration. All the extracts were evaluated for anti-diabetic activity in alloxan induced diabetic albino rats. All the extracts were given orally at a dose of 250 mg/kg b.w. Glibenclamide was used as standard drug [10 mg/kg b.w. p.o.]. Among all the extracts, alcoholic extract had more significantly reduced the blood glucose level after single dose and nearly equal to standard Glibenclamide after prolonged treatment [25].

12. Madhuca indica

In siddha medicine the herb, *Madhuca indica* [tamil name- ilupai] used as galactagogue, demulcent, refrigerant, and tonic [12]. The anti-hyperglycemic effects of methanolic extract of *Madhuca indica* bark in normal, glucose loaded and streptozotocin induced diabetic rats. All three animal groups were administered the methanolic extract of *Madhuca indica* at a dose of 100 and 200mg/kg body weight [p.o.] and the standard drug glibenclamide at a dose of 500 µg/kg. Serum glucose level was determined on days 0, 7, 14 and 21 of treatment. The extract exhibited a dose dependent hypoglycemic activity in all three animal models as compared with the standard anti-diabetic agent glibenclamide. So it was concluded that the hypoglycemia produced by the extract may be due to the increased glucose uptake at the tissue level and/or an increase in pancreatic β-cell Function or due to inhibition of intestinal glucose absorption [26].

13. Murraya koenigi

In siddha medicine the herb, *Murraya koenigi* [tamil name- karivembu] used for stomach ailments, ageusia, dysentery, chronic fever, vomiting, indigestion and flatulence [12]. The effect of mahanimbine [carbazole alkaloid from *Murraya koenigii* leaves] on blood glucose and serum lipid profiles was studied on streptozotocin-induced diabetic rats. Mahanimbine [50 and 100mg/kg] were administrated as a single dose per week to the diabetic rats for 30 days. In the diabetic rats, the elevated fasting blood sugar, triglycerides, low density lipoprotein, very low density lipoprotein levels were reduced and high density lipoprotein level was increased by mahanimbine at a dose of 50 and 100mg/kg. This study indicated that mahanimbine possess anti- hyperglycemic and anti-lipidemic effects [27].

14. Phyllanthus amarus

In siddha medicine the herb, *Phyllanthus amarus* [tamil name - kezhkaainelli] used for eye disease, bleeding dysentery, jaundice, gonorrhea and scabies [12]. A study was evaluated for the anti-diabetic effect of ethanolic leaf extract of *Phyllanthus amarus* in alloxan induced diabetic mice. Blood glucose levels and bodyweights ,activities of liver enzymes such as glucokinase, glucose -6- phosphatase and fructose -1- 6-diphosphatase of control and diabetic mice were monitored. Oral administration of ethanolic leaf extract [400 mg/kg body weight] for 45 days resulted in a significant [$P<0.05$] decline in blood glucose from 310.20 to 141.0 mg/dl and significant recovery in body weight of diabetic mice. There was also a significant [$P<0.05$] reduction in the activities of glucose-6-phosphatase and fructose-1-6-disphosphatase in liver, further there was significant [$P<0.05$] increase in the activity of glucokinase in liver of diabetic mice when compared with that of diabetic control [28].

15. Smilax china

In siddha medicine the herb, *Smilax china* [tamil name- parangi pattai] used for fistulae, hemorrhoids, scabies, skin disease, leucorrhoea, and external ulcer [12]. Dried aqueous, alcoholic, and petroleum ether [60-80°C] extracts of roots of *Smilax china* were subjected for hypoglycemic activity in Wistar rats [150-200 g]. Blood sugar level was determined

using digital glucometer. The oral administration of root extracts at doses of 200 mg/kg lead to a significant blood glucose reduction. The aqueous and alcoholic extracts from *Smilax china* roots [200 mg/kg] orally administered for 7 days produced a significant decrease in the blood glucose level in the model of alloxan-induced diabetes in rats. Petroleum extract exhibited a very weak anti- diabetic activity [29].

16. Stereospermum chelonoides

In siddha medicine the herb, *Stereospermum chelonoides* [tamil name- padhiri] used for eczema, burning of palm and foot, delirium, hiccup, cough, wounds, hemorrhoids, scabies and dropsy [12]. The various extracts of *Stereospermum chelonoids* were evaluated at a concentration of 50gram /liter using in vitro method glucose diffusion inhibitory assay to assess the possible effects on glucose diffusion across the gastro intestinal tract .The movement of glucose into the external solution was determined by using glucose oxidase peroxide diagnostic kit at regular intervals. The ethanolic extract showed a significant glucose Diffusion retardation index [GDRI=1.38±0.05 at 180 min]. It was proved the traditional claim at this stage. Hence, an in-depth research can be established to identify, isolate and characterize the compound having anti- diabetic therapeutic potential [30].

17. Syzygium cumini

In siddha medicine the herb, *syzygium cumini* [tamil name -naaval] used for bleeding dysentery, cough, menorrhagia, eczema, wounds and dyspepsia [12]. *Syzygium cumini* seed [aqueous suspension] was screened for its anti-diabetic activity at the dose levels of 1g, 2g, 4g and 6 g/kg body weight. 4g / kg dose level was found to exhibit maximum hypoglycemic effect [42.64%] in rabbits, 3hr. after medication. An extra pancreatic site of action of the drug cannot be ruled out, since it produced a significant decrease in the blood sugar level [17.04%] in alloxan diabetic rats [31]. And it was investigated that the anti-diabetic activity of *Syzygium cumini* fruits on streptozotocin [STZ] induced diabetic rats. Oral administration of an ethanolic fruits extract at a concentration of 100 mg/kg b.w. for 30 days showed a highly significant decrease in fasting blood glucose and a significant increase in α-amylase activity and insulin level [32].

18. Terminalia arjuna

In siddha medicine the herb, *Terminalia arjuna* [tamil name marudhu] used for leucorrhoea, leprosy, dyspepsia, warm infections, gastrointestinal diseases, giddiness and heart diseases [12]. It was assessed for the anti-diabetic effect of *T. arjuna* stembark extract and to study the activities of hexokinase, aldolase and phosphoglucoisomerase, and gluconeogenic enzymes such as glucose-6-phosphatase and fructose-1,6-diphosphatase in liver and kidney of normal and alloxan induced diabetic rats. Oral administration of ethanolic extract of bark [250 and 500mg/kg body weight] for 30 days resulted in significant decrease of blood glucose from 302.67±22.35 to 82.50±04.72 and in a decrease in the activities of glucose-6-phosphatase, fructose-1, 6-disphosphatase, aldolase and an increase in the activity of phospho-gluco isomerase and hexokinase in tissues. The study clearly showed that the bark extract of *T. arjuna* possesses potent anti-diabetic activity [33].

19. Tinospora cordifolia

In siddha medicine the herb, *Tinospora cordifolia* [tamil name -seenthil] used for chronic urinary tract infection, fever, skin diseases, spleenomegaly, vomit, DM, loss of weight, cough, cold and jaundice[12]. The stem juice of Tinospora cordifolia is useful in diabetes [14].It was investigated the anti-diabetic activity of *Tinospora cordifolia* [TC] stem extracts [both aqueous and alcoholic] in different dosages [200 and 400 mg/kg b.w.] in streptozotocin diabetic albino rats. The drug was administered orally for 10 days and 30 days in different groups of animal The efficacy of this drug was compared with the Lanti-e Zinc Insulin [6 U/kg b.w. daily,i.p.] treated diabetic rats. TC has significant [$P < 0.05$] anti-diabetic activity in diabetic animals and has an efficacy of 40% to 80% compared to insulin. TC administration in diabetic animals did not cause any increase in serum insulin levels or regeneration of pancreatic β cells but caused increased hepatic glycogen synthase and decreased glycogen phosphorylase activity. Finally it was concluded that the extract of *Tinospora cordifolia* showed a significant anti-diabetic activity & comparable with standard drug Lanti-e Zinc Insulin. [34].

20. Trigonella foenum- gracecum

In siddha medicine the herb, *Trigonella foenum-gracecum* [tamil name- venthayam] used for fever, DM, hypertension, dysentery, whooping cough and leucorrhoea [12]. In the rabbits with alloxan induced diabetes, the elevated fasting blood glucose and glycosylated hemoglobin values were brought down to normal values by treatment with GII purified from the water extract of the seeds of fenugreek seeds [*Trigonella foenum-graecum*] at a dose of 50 mg/kg bodyweight. The serum insulin values which were also less in the untreated diabetic rabbits increased to normal level after treatment with GII. An interesting feature was found that intermittent therapy once a week for 6 weeks in the sub-diabetic and moderately diabetic rabbits with GII at the same dose brought down the FBG values to normal. After stopping the therapy of the sub-diabetic and moderately diabetic rabbits whose FBG values came down to normal after treatment

with GII 50 mg kg b.w, the values remained normal without treatment for 1 week and showed a tendency to increase only after 15 days. [35]

CONCLUSION

Siddha system is one of the ancient system of medicine with full of pride which has more number of medicinal plants used for many specific diseases. In this modern era, most of the people face a common problem known to be diabetes .Hence there are more number of evidences that many siddha medicinal plants have the property of anti-diabetic activity which helps in the management of diabetes. The herbs used in the review are used by siddha practitioners found in the southern region of India and found plenty in the country side. From this review it is proved that there are many herbs have potent anti-diabetic and anti-hyperglycemic activity. And it is assured that siddha system of medicine along with its traditional life style and food habits can challenge to prevent and treat Diabetes on this scientific & modern world.

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