INTRODUCTION

Siddha System of Medicine is an integrated part of Indian System, which is very potent and unique system when compared with other traditional systems in existence. Siddha Medicine is contributing much to the health care of human beings and Siddha Vaidya could be considered as the crown of all the traditional arts of the ancient world owing to its richness and simplicity. Siddha medicine, one of the medical systems legally recognized and supported by the Government of India, is, however, little known outside Tamil Nadu and its practice limited mainly to the Tamil populations of India and overseas. Moreover, it has received scant attention from the social sciences to date. The WHO has documented that the vast majority of people (75-80%) mostly living in the "developing countries", and significant number in the "developed industrialized nations, prefer and resort to Alternate (Traditional) Medicine for treating common ailments and chronic diseases.

Diabetes Mellitus is a chronic endocrine disorder caused by an absolute or relative lack of insulin and/or reduced insulin activity that results in hyperglycemia and abnormalities in carbohydrate, fat and protein metabolism. Diabetes has emerged as a major healthcare problem in India. A national urban survey in 2005 observed that the prevalence of diabetes in urban India in adults was 15.1%. Recent data have illustrated the impact of socio-economic transition occurring in rural India. The transition has occurred in the last 15 years and the prevalence has risen from 2.4% to 6.4%. Type 2 Diabetes is one of the major health problems all over the world.

The management of diabetes is considered a global problem. The modern drugs including insulin and oral hypoglycemic agents control the blood sugar level as long as they are regularly administered, and also produce a number of undesirable side effects. The treatment of diabetes has been attempted with different indigenous plants and polyherbal formulations. Pre-clinical toxicity studies are essential for determining a safe dose for human trials.²

Many studies have confirmed the benefits of medicinal plants with hypoglycemic effects in the management of diabetes mellitus. The effects of these plants may delay the development of diabetic complications and even assist in correcting the metabolic abnormalities. Moreover, during the past decade and especially in last few years some of the new bioactive drugs isolated from hypoglycemic plants showed anti-diabetic activity with more efficacy than synthetic oral hypoglycemic agents. Therefore, plants, as folk remedies, are widely used to treat diabetes mellitus.

In modern science of medicine, however, their role is limited to the use of natural polymers like guar gum, gum acacia, gum arabic, etc. The therapeutic benefit of gums derived from natural origin resides in their ability to reduce the calorific value of consumed diet by reducing absorption of carbohydrates from the gastrointestinal tract. Therefore, search for a novel anti-diabetic drug from plants, plant parts and their aqueous or alcoholic extracts should be advocated, since they have well been recognized as an important source of providing new drugs.³
Ingredients of Atthippattaiyathi kasayam

Atthippattaiyathi kasayam, a polyherbal anti diabetic Siddha formulation containing 22 ingredients of plants origin, their specific and individual locality names and siddha medicinal uses are tabulated below in Table 1.

<table>
<thead>
<tr>
<th>Common name Tamil/English</th>
<th>Botanical name/ Family</th>
<th>Phytochemistry</th>
<th>Actions</th>
<th>Uses in Siddha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aththi/ Fig</td>
<td>Ficus recemosa/ Moraceae</td>
<td>Sterols, Lanosterol, tannins, flavonoids, gluonol acetate, β-sitosterol</td>
<td>Astringent</td>
<td>Improves cordial blood, Laxative, Anti-vatha</td>
</tr>
<tr>
<td>Sarak konrai/ Golden shower tree</td>
<td>Cassia fistula/ Fabaceae</td>
<td>lupeol, β-sitosterol and hexacosanol</td>
<td>Laxative</td>
<td>Increases body weight, Piles, Leucorrhrea, anemia</td>
</tr>
<tr>
<td>Avarai/ Senna</td>
<td>Cassia auriculata/ Caesalpiniacae</td>
<td>α-Tocopherol-β-D-mannoside, Resorcinol, n-Hexadecanoic acid, 13-Octadecenal,</td>
<td>Astringent</td>
<td>UTI, cures eye diseases, Constipation, Leucorrhrea</td>
</tr>
<tr>
<td>Kadalazhinjil/ Salacia, Salaretin</td>
<td>Salacia reticulate/ Celastraceae</td>
<td>mangiferin, epicatechin, epigallocatechin, Polyphenols</td>
<td>Astringent</td>
<td>Diabetes, Rheumatoid arthritis, Bronchial asthma</td>
</tr>
<tr>
<td>Ilupai/ Mahua</td>
<td>Madhuca longifolia/ Sapotaceae</td>
<td>Saponis, β-amyrin acetate, 21-Hydroxy-3-oleanyl myricitate, Ursolic Acid.</td>
<td>Astringent, Stimulant, Tonic</td>
<td>Cough, Thirst, Wheezing, Orchitis</td>
</tr>
<tr>
<td>Pulli/ Indian date</td>
<td>Tamarindus indica/ Fabaceae</td>
<td>Heptadecanoate, Hexadecanoic acid, n-Nonadecanoate, n-Octadecanoic</td>
<td>Refrigerant</td>
<td>Anaemia, Eye diseases, Vomiting, improves digestion</td>
</tr>
<tr>
<td>Marutham/ Arjuna</td>
<td>Terminalia arjuna/ Combretaceae</td>
<td>Tannins, flavonoids, sterols, Amino acids</td>
<td>Tonic</td>
<td>Cardiac diseases, Giddiness, Leucorrhrea</td>
</tr>
<tr>
<td>Nannari/ Sarasaparilla</td>
<td>Hemidesmus indicus/ Apocynaceae</td>
<td>glycosides, flavonoids, tannins, sterols, volatile oils</td>
<td>Tonic</td>
<td>Fever, Thirst, Head ache</td>
</tr>
<tr>
<td>Sirkeerai/ Joseph’s Coat</td>
<td>Amaranthus tricolor/ Amaranthaceae</td>
<td>phenols, coumarins, lignans</td>
<td>Tonic, Anti oxidant, anti inflammatory</td>
<td>Eye diseases, UTI, Vatha diseases</td>
</tr>
<tr>
<td>Neerpoola/ sour grapes</td>
<td>Phyllanthus reticulatus /Euphorbiaceae</td>
<td>lupeol acetate, stigmasterol, lupeol</td>
<td>Diuretic, anti diabetic, anti oxidant.</td>
<td>Malaria, dysentery.</td>
</tr>
<tr>
<td>Katralai/ Aloes</td>
<td>Aloe barbadensis/ Xanthorrhoeaceae</td>
<td>aloemodin, aloin A, elgonica dimer A</td>
<td>Tonic</td>
<td>Laxative, Stomach ulcer(APD), eye diseases</td>
</tr>
<tr>
<td>Koral kilangu/ Nut grass</td>
<td>Cyperus rotundus/ Cyperaceae</td>
<td>terpenoids, cyproten, cyperene, rotundene, valencene, cyperol</td>
<td>Astringent, Stimulant, Tonic</td>
<td>Worm infestation, Tri-dosa, Laxative, Blood pressure.</td>
</tr>
<tr>
<td>Seenthil/ Guduchi</td>
<td>Tinospora cordifolia/ Menispermaceae</td>
<td>Giloin, tinosporone, tinosporic acid, cordifolisides A to E</td>
<td>Alterative</td>
<td>Anti-vatha, Improves immunity, Cough, vomiting, Spleenomegaly.</td>
</tr>
<tr>
<td>Inji / Ginger</td>
<td>Zingiber officinal/ Zingiberaceae</td>
<td>Aldehyde, Gingerol, Shogaol, Paradol</td>
<td>Carminative, Stomachic, Sialogogue, Digestive, Stimulant, Rubefacient</td>
<td>Pitha Diseases, Tridosha diseases, Cough, Cold, Nausea, Diarrhoea,</td>
</tr>
<tr>
<td>Milagu / Black Pepper</td>
<td>Piper nigrum/ Piperaceae</td>
<td>alpha-tocopherol, amide, feruperine</td>
<td>Carminative, Antiperiodic, Rubefacient, Stimulant, Antidote</td>
<td>Vatha, Pitha, Kapha Diseases, Cold, Fever, Anemia, Jaundice, Diarrhoea, Ulcer, Indigestion</td>
</tr>
</tbody>
</table>

Table 1: Information about the Ingredients
Anti diabetic activity of herbs in Atthippattaiyathi kasayam

The efficacy of all the ingredients of Atthippattaiyathi kasayam was proved through the following In-vivo studies.

**Ficus racemosa**

In a study oral administration of *Ficus racemosa* Ethanolic extract 400 mg/kg, showed the significant decrease in the blood glucose level in alloxan induced diabetic rats. In another study oral administration of 300 mg/kg ethanolic extract of *Ficus racemosa* bark to alloxan induced diabetic rats restored the status of blood glucose, lipids and lipoproteins to near normal range. These effects were much comparable to that of the standard reference drug, glibenclamide.

**Terminalia arjuna**

The *Terminalia arjuna* bark ethanolic extract containing 250 and 500 mg/kg, showed the significant decrease in the blood glucose level and a decrease in the activities of glucose-6-phosphatase, fructose-1, 6-diphosphatase, aldolase and an increase in the activity of phospho gluco isomerase and hexokinase in tissues of alloxan induced diabetic rats.

**Tinospora cordifolia**

In a study oral administration of 250 mg/kg of the methanol extract of *Tinospora cordifolia* stem significantly reduces the fasting blood glucose level and significantly decreases the glycosylated hemoglobin level, reduced glucokinase and increased glucose-6-phosphatase activity were reversed significantly and the insulin and C-peptide levels were improved in streptozotocin induced diabetic rats.

**Madhuca longifolia**

Oral administration of 100 and 200 mg/kg of the methanolic extract of *Madhuca longifolia* bark, a significant reduction was observed in the blood glucose level of streptozotocin induced diabetic rats. The extract was highly effective in managing the complications associated with diabetes mellitus, such as hypercholesterolemia and impaired renal function. Srirangam Prashanth et al study indicated that, the ethanolic bark extract of Madhuca longifolia at a dose of 100 and 200 mg/kg to be a potential antidiabetic and antioxidant properties and the extract also exhibited significant free radical scavenging activity and superoxide scavenging activity.

**Salacia reticulate**

Chandrashekar CN, et al reported that *salacia reticulata* extract of bark or core root alone are more effective in decreasing blood glucose level in alloxan induced diabetic rats. *In vitro* studies confirmed scavenging activity of free radicals, superoxide and hydrogen peroxide.

**Cassia auriculata**

In a study oral administration of methanolic extract of *cassia auriculata* bark of 250 mg/kg showed a significant reduction was observed in the blood glucose level of streptozotocin induced diabetic rats. Mahendra Shiradkar et al reported that, the methanolic extract of...
Cassia auriculata bark were found to possess promising anti-diabetic, antimutagenic and anti-fertility activities in streptozotocin induced diabetic rats.12

Cassia fistula

Ethyl acetate fraction of total alcoholic extract of the bark of Cassia fistula at the dose of 200 mg/kg body weight possesses significant antidiabetic activity in alloxan induced diabetic rats. It was also found effective in normalizing blood lipids like total cholesterol and total triglyceride.13 M. Ashraf Ali et al experimental animal study indicate that, Cassia fistula stem bark ethanolic extract have analgesic activity in mice by acetic acid induced writhing test method and antihyperglycemic activity in alloxan induced diabetic rats. Diclofenac and Metformin were used as reference drugs for comparison.14

Cyperus rotundus

Oral daily administration of 500 mg/kg of the Cyperus rotundus extract significantly lowered the blood glucose level in alloxan induced diabetic rats. This antihyperglycemic activity can be attributed to its antioxidant activity as it showed the strong DPPH radical scavenging action in vitro.15

Phyllanthus reticulatus

The petroleum ether and ethanolic extracts of roots of the Phyllanthus reticulatus orally tested at 500 and 1000 mg/kg for hypoglycemic effect in alloxan induced diabetic mice. It shows very good hypoglycemic activity at the dose of 1000 mg/kg.16

Hemidesmus indicus

2-Hydroxy 4-methoxy benzoic acid (HMBA) isolated from the root of Hemidesmus indicus was administered 500 µg/kg orally to STZ-induced diabetic rats. After administration of HMBA, the levels of Glycosylated hemoglobin, total cholesterol, triglycerides, LDL-cholesterol were normalized. It also reversed the elevated levels of AST, ALT, ALP, γ- GT and CK to near normal level.17

Tamarindus indica

The alloxan induced diabetic rats treated with ethanolic extract of bark of Tamarindus indica at a dose of 200 mg/kg caused reduction in blood glucose level and produced a significant decrease in peroxidation products, viz., thiobarbituric acid reactive substances. The effect of ethanolic extract at 200 mg/kg was more effective than glibenclamide.18

Piper longum

Oral administration of ethanolic extract of Piper longum dried fruits has shown significant anti-hyperglycemic, anti-lipid peroxidative and antioxidant effects in alloxan induced diabetic rats. It also corrected the metabolic alteration observed by the activities of several carbohydrates metabolizing enzymes.19

Syzzygium aromaticum

Clove (Syzzygium aromaticum flower buds) EtOH extract significantly suppressed an increase in blood glucose level in type 2 diabetic KK-A(y) mice. In vitro evaluation showed the extract had human peroxisome proliferator-activated receptor (PPAR)-γ ligand-binding activity in a GAL4-PPAR-γ chimera assay.20

Ferula asaefetida

The aqueous extract of Ferula asaefetida, administration at dose of 50 mg/kg has shown the hypoglycemic activity in streptozotocin-diabetic rats. This effect can be explained at least in part by the presence of the phenolic acid (ferulic acid) and tannins in the extract.21 The Asaefetida extract stimulate the changes of the functional state of pancreatic β-cells. At the same time the capacity of the organism to produce and secrete insulin is increasing, the glucose level in blood is decreasing.22 Ferula asaefetida treatment led to a significant improve in hyperglycemia, hypo insulinema, decreased liver glycogen and increased percentage of body weight change caused by alloxan.23

Aloe barbedensis

The ethanolic extracts of Aloe vera were caused significant reduction in the fasting serum glucose levels of the rats. These extracts exhibited high DPPH scavenging activities and FRAP values, indicating the potential of this plant to be used as an antioxidant.24

Amarnathus tricolor

In a study oral administration of 400 mg/kg of the Amarnathus tricolor aqueous extract significantly reduced serum glucose, serum triglyceride, total cholesterol, low density lipoprotein and very low density lipoprotein, but elevated high density lipoprotein in alloxan induced diabetic rats.25

Zingiber officinale

Treatment with juice of Zingiber officinale produced a significant increase in insulin levels and a decrease in fasting glucose levels.26 In an oral glucose tolerance test, treatment with Z. officinale was found to decrease significantly the area under the curve of glucose and to increase the area under the curve of insulin in STZ-diabetic rats. Treatment with Z. officinale also caused a decrease in serum cholesterol, serum triglyceride and blood pressure in diabetic rats.27 Fresh juice of Z. officinale produced a time dependent decrease in blood glucose level significantly compared to both Glibenclamide and metformin.28

Piper nigrum

Shubham atal, et al suggest that sub acute (14 days) oral administration of Piperine, the chief alkaloid present in Piper nigrum at dose of 20 mg/kg has significant blood glucose lowering effect in alloxan induced diabetic rats.29
Myristica fragrans

Macelignan, a natural compound isolated from Myristica fragrans, as a dual agonist for PPARα/γ. Macelignan enhanced insulin sensitivity and improved lipid metabolic disorders by activating PPARα/γ and attenuating ER stress, suggesting it has potential as an anti diabetic agent for the treatment of type 2diabetes.30

Spermacoce hispida

Spermacoce hispida was investigated and reported to have hypoglycemic activity in an animal model of diabetes upon subcutaneous administration. The oral administration of Spermacoce hispida in alloxan induced diabetic rats showed significant hypoglycemic effect. Recently, it was observed that chronic BQ use is associated with a higher risk of type 2 diabetes mellitus and metabolic syndrome.71

CONCLUSION

Herbal treatments are the most popular form of Traditional medicine, and are highly lucrative in the International marketplace. In ancient literature, it is said that the ingredients present in this formulation ‘Atthippattaiyathi kasayam’ has effectiveness in the treatment of Diabetes etc. Based on the evidence of Siddha literature, the modern scientific research studies also provide supporting results of anti diabetic, anti oxidant, anti-lipid of each ingredient. Thus, Atthippattaiyathi kasayam provides solid benefits in the treatment and management of lifestyle disorders like Diabetes and Obesity.

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