

## Anti-diabetic potential of the fruits of the members of Solanaceae collected from Gedamalai, Namakkal district, Tamil Nadu, India.

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### Abstract

In the present study ethno medicinal plants were documented which were used for curing various ailments such as diabetes, hypertension, dysentery, jaundice, leprosy, chicken pox, cancer, rheumatoid arthritis, and respiratory problem, by local traditional healers in Gedamalai, Namakkal District, Eastern Ghats, Tamilnadu, India. A total of 28 plant species (trees, herbs, climber and shrubs), belonged to 23 genera and 18 families were used for medicinal purposes by the local inhabitants. The fruits of the member of the family Solanaceae were used for the control of diabetic. The presence of phytochemical constituents such as alkaloid, glycosides, carbohydrates, saponin, sterol, tannin and fixed oil in Solanaceae family fruits have been attributed to the anti-diabetic activity.

**Keywords:** Ethno medicinal plants, Gedamalai, Solanaceae, Anti-diabetic activity.

### INTRODUCTION

Medicinal plants are the source of many potent and powerful drugs (Anu Shrivastava and Shikha Roy, 2013). The plant derived drugs are healthier and safer alternate to the synthetic drugs. Different parts of medicinal plants like root, stem, flowers, fruits, seeds, etc. are used to obtain pharmacologically active constituents. Medicinal activities of plants can be attributed to the secondary metabolites such as alkaloids, flavonoids, glycosides, tannins and terpenoids present in these plants. These active principles are isolated for direct use as drugs, lead compounds and or pharmacological agents (Sivasangari *et al.*, 2014)

It has been reported that for more than 80% of Asia's populations (WHO) medicinal plants are easily accessible, affordable and culturally appropriate sources of primary health care (Anu Shrivastava and Shikha Roy, 2013). Poor and marginalized, who cannot afford formal health care systems, are especially dependent on their culturally familiar and technically simple traditional health care practices (Singh, 2009).

#### Fruits as a potential source of drug

The ovules of the flowers after fertilization are converted into seeds, whereas the ovary wall develops further to form the protective covering of the seeds, which is known as fruit. In botany this particular coating is called pericarp which consists of three different layers epicarp, mesocarp and endocarp.

Medicinally important phytoconstituents obtained from fruits of the members of the family Solanaceae namely *Solanum nigrum* L., *Solanum lycocarpum* A.St.-Hil., *Withania cogulans* (Stocks) Dunal., *Lycium barbarum* L., *Withania somnifera* (L.) Dunal., *Capsicum annum* L., *Solanum indicum* L., *Solanum surattense* Burm L. exerted a wide range of pharmacological activity against diabetes. A brief description of phytoconstituents, dose and pharmacology of various extracts obtained from anti-diabetic fruits have been given below in table 1.

Screening of medicinal plants is one of the alternative and valid approaches in the drug development process because they contain diverse phytoconstituents which may give new drug leads and may be effective and safe in the treatment of diabetes. In India, traditionally numbers of plants are used to manage the diabetic conditions and their active principles were isolated but few plants have been scientifically studied.

#### Anti-Diabetic Activity

Plant-based medicine has been proved to be cost-effective worldwide to treat diabetes. In fact, in many parts of the world, especially poor countries, this may be the only form of therapy available to treat diabetic patients. There are several reviews by different authors about anti-diabetic herbal plants. Ayurveda and other traditional medicinal systems for the treatment of diabetes describe a number of plants used as herbal drugs. Insulin and oral hypoglycemic agents like sulphonylureas and biguanides are still the major players in the management, but there is quest for the development of more effective anti-diabetic agents (Baby Joseph and Jini, 2013).

Natural plant drug are frequently considered to be less toxic with lower side effects than synthetic ones.

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In spite of presence of large number of medicines in the pharmaceuticals market remedies with medicinal plants have been successfully demonstrated. A large number of plants and plant- parts have been investigated for their beneficial role and anti-diabetic properties. Indian traditional medicinal system Ayurveda and Unani in particular claim to cure diabetes with the use of natural substances. To survey of Ethno medicinal plant of Solanaceae family Fruits Gedamalai, Namakkal District. To Study the Anti-Diabetic activity of Solanaceae family Fruits. To analyse the phytochemical work on Solanaceae family Fruits.

## MATERIALS AND METHODS

### Study Area

The present study was under taken in the Gedamalai located in Namakkal District, Southern Eastern Ghats of Tamil Nadu, India. The vegetation of Gedamalai hill ranges from evergreen to dry deciduous type. Gedamalai is at 1145 MSL and the highest point is the Gedamalai. It is lying between 11°54' 13" North latitude and 78° 26' 74" East longitude of Eastern Ghats. The temperature varies between 26 °C to 33 °C; annual mean rainfall 70 mm; and relative humidity 82 to 93 per cent with an elevation range of 370 - 975 m. The area has a predominant red soil impregnated with organic matter and granite bed rock is overlaid with shallow, sandy loam.

### Data Collection

Detailed survey was made for gathering information regarding the use of plants as medicine during August 2015 to December 2015. Usually, the survey in each locality started with the interview of elderly and experienced members of Malayali tribals (Anu Shrivastava and Shikha Roy, 2013). Besides, this the common people of the surveyed localities who themselves have used these plant based remedies for health treatments were interviewed to prove veracity of the curative features of plants.

### Phytochemical screening

Preliminary phytochemical analysis was carried out for the extracts of the fruits of 10 plants namely *Solanum anguivi* Lam., *Solanum torvum* Sw., *Solanum nigrum* L., *Solanum lycocarpum* A.St.-Hil., *Withania cogulans* (Stocks) Dunal., *Lycium barbarum* L. *Withania somnifera* (L.) Dunal. *Capsicum annum* L., *Solanum indicum* L., *Solanum surattense* Burm L. following the standard methods described by Brain and Turner (1975) and Trease and Evans (1996).

### Preparation of extract

Crude fruit extracts were prepared by soxhlet extraction method. About 10 gm of powdered plant material was uniformly packed into a thimble and

extracted with 150ml of solvents of methanol (80% methanol). The process of extraction was continued for 24 hours or till the solvent in siphon tube of extractor became colourless. After that the extract was taken in a beaker and kept on hot plate and heated at 30-40° C till all the solvent got evaporated. Dried extract was kept in refrigerator at 4° C for future use.

### Detection of alkaloids

Extracts were dissolved individually in dilute hydrochloric acid and filtered. The filtrate was used to test the presence of alkaloids. Mayer's test: Filtrate were treated with few drops of yellow cream precipitate which indicated the presence of alkaloids.

### Detection of flavonoids

#### H<sub>2</sub>SO<sub>4</sub> test:

Extracts (0.5g) were treated with few drops of H<sub>2</sub>SO<sub>4</sub>. Formation of orange colour indicated the presence of flavonoids.

### Detection of steroids

#### Liebermann-Burchard test:

2ml of acetic anhydride was added to 0.5g of the extracts, each with 2ml of H<sub>2</sub>SO<sub>4</sub>. The colour changed from violet to blue or green in the samples indicated the presence of steroids.

### Detection of terpenoids

#### Salkowski's test:

0.2g of the extract of the sample was added carefully and mixed with 2ml of chloroform and concentrated H<sub>2</sub>SO<sub>4</sub> (3ml) until a layer was formed. Formation of a reddish brown colour in the inner face indicated the presence of terpenoids.

### Detection of anthraquinones

#### Borntrager's test:

About 0.2g of the extract was boiled with 10% HCl for few minutes in a water bath. It was filtered and allowed to cool. Equal volume of CHCl<sub>3</sub> was added to the filtrate. Few drops of 10% NH<sub>3</sub> were added to the mixture and heated. Formation of pink colour indicated the presence anthraquinones.

### Detection of phenols

#### Ferric chloride test:

Extracts (0.5g) were treated with few drops of 5% ferric chloride solution. Formation of bluish colour indicated the presence of phenol.

### Detection of saponins

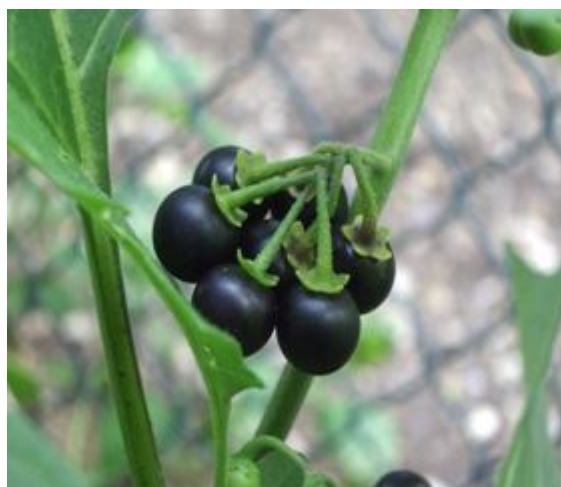
#### Froth test:

About 0.2g of the extract was shaken with 5ml of distilled water. Formation of frothing (appearance of

**Table –1.** Preliminary phytochemical screening of various extracts of *Solanaceae* Fruits.

S.No	Methanolic Extract of Fruit	Alkaloid	Flavonoids	Steroids	Terpinoids	Anthroquinones	Phenols	saponins	Tannins	Carbohydrates	Oils and Resins
1	<i>Solanum anguivi</i> Lam.	+	+	+	+	-	+	-	+	+	+
2	<i>Solanum torvum</i> Sw.	+	+	+	+	-	-	-	-	+	+
3	<i>Solanum nigrum</i> L.	+	-	+	-	-	-	+	+	+	+
4	<i>Solanum lycocarpum</i> A.St.-Hil.	+	+	+	+	-	-	+	-	+	+
5	<i>Withania coagulans</i> (Stocks) Dunal.	+	+	+	-	+	-	+	+	+	+
6	<i>Lycium barbarum</i> L.	+	-	+	-	-	+	-	+	+	+
7	<i>Withania somnifera</i> (L.) Dunal.	+	+	-	-	+	+	-	-	+	+
8	<i>Capsicum annum</i> L.	+	+	+	+	-	-	+	+	+	-
9	<i>Solanum indicum</i> L.	+	+	-	+	+	-	-	-	+	-
10	<i>Solanum surattense</i> Burm L.	+	+	+	-	-	+	+	+	+	+

+ Presence of compounds. - Absence of compounds

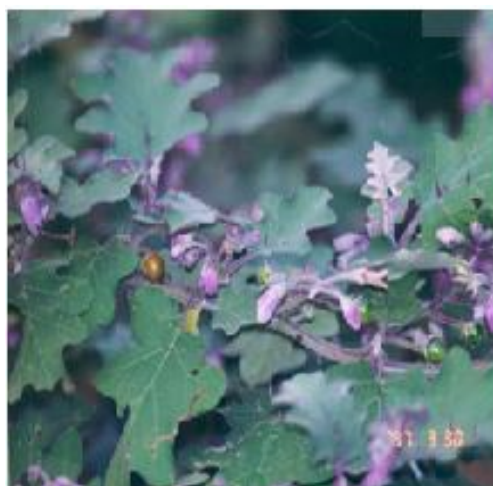
**PLATE – 1. Anti-Diabetic potential in Solanaceae Fruits***Withania coagulans* (Stocks) Dunal*Solanum anguivi* Lam*Solanum nigrum* L.*Capsicum annum* L.



**PLATE – 2. Anti-Diabetic potential in Solanaceae Fruits**



*Lyceum barbarum* L.



*Solanum surattense* Burm L.



*Solanum lycocarpum* A.St.-Hill



*Solanum indicum* L.

**PLATE – 3. Anti-Diabetic potential in Solanaceae Fruits**



*Solanum torvum* Sw.



*Withania somnifera* (L.) Dunal.

**Table 2.** Enthno Medicinal plants recorded in Gedamalai, Namakkal District

S.No.	Botanical Name	Family	Vernacular Name	Parts Used	Disease cured
1	<i>Adhatoda vasica</i> Nees	Acanthaceae	Adhatoda	Leaves	Cold & Cough
2	<i>Vitex negundo</i> L.	Verbenaceae	Chinduvaram	Leaves	Cold and Cough
3	<i>Gymnema sylvestre</i> R.Br.	Apocynaceae	Sirukurinjan	Leaves	Diabetes
4	<i>Aristolochia bractiolata</i> Linn.	Aristolochiaceae	Aduthinna palai	Leaves	Reduces body weight
5	<i>Tridax procumbens</i> C.	Asteraceae	Sanipputan Thalai	Leaves	Antiulcer
6	<i>Centella asiatica</i> (L.) Urban.	Umbelliferae	Vallaarai	Leaves	Jaundice
7	<i>Cassia fistula</i> L.	Caesalpiaceae	Sarakondrai	Flower	Hair growth & colour
8	<i>Solanum anguivi</i> Lam.	Solanaceae	Childrens tomato	Leaves, unripe fruit, stem, rhizome	Anti-diabetic, diuretic, antispasmodic
9	<i>Solanum torvum</i> Sw.	Solanaceae	Shwet brihati	Leaf, fruits	Fever, Insomnia, skin diseases, Anti diabetic activity.
10	<i>Solanum nigrum</i> L.	Solanaceae	Makoy	Fruit	Anti diabetic activity.
11	<i>Solanum lycocarpum</i> A.St.-Hil.	Solanaceae	Gourd	Fruit	Anti - diabetic activity, soften skin dryness, pimple, spots by applying pulp
12	<i>Withania cogulans</i> (Stocks) Dunal.	Solanaceae	Vegetable rennet	Fruit	head ache and arthritis, Anti - diabetic activity.
13	<i>Lycium barbarum</i> L.	Solanaceae	Chirchata	Fruit	diuretic that cleanses kidney and bladder, skin blemishes, Anti - diabetic activity.
14	<i>Withania somnifera</i> (L.) Dunal.	Solanaceae	Winter cherry	Fruit	leaf Burning sensation, dipsia, Anti - diabetic activity, flatulence, colic, Diabetic.
15	<i>Capsicum annum</i> L.	Solanaceae	Chilli pepper	Fruit	diabetic activity.
16	<i>Solanum indicum</i> L.	Solanaceae	Brihad kantkari	Fruit	Diuretic.
17	<i>Solanum surattense</i> Burm L.	Solanaceae	Jangli bhindi	Fruit, root	Rheumatism, diabetic activity.
18	<i>Hybanthus enneaspermus</i> Linn.	Violaceae	Oridhazh tham arai	Leaves	Reduces male sterility
19	<i>Anisomeles malabarica</i> (L.) R.Br.Ex.Sims.	Euphorbiaceae	Peyimarutti	Whole Plant	Body Pain
20	<i>Milletia pinnata</i> L.	Fabaceae	Pungai	Flower	Diabetes
21	<i>Prosopis cineraria</i> L.	Fabaceae	Vannimaram	Bark & Leaves	Snake bite
22	<i>Syzygium cumini</i> (Linn) Skeels.	Myrtaceae	Naval	Fruits, bark	Diuretic, Anthelmintic
23	<i>Ocimum sanctum</i> L.	Lamiaceae	Tulsi	Leaves	Cold & Cough
24	<i>Dodonaea viscosa</i> L.	Sapindaceae	Virali	Leaves	Blood clot
25	<i>Cardiospermum helicacabum</i> C.	Sapindaceae	Mudakathan	Leaves	Rheumatism
26	<i>Aegle marmelos</i> L.	Rutaceae	Vilvam	Leaves & fruit	Antidiabetic, Digestive Laxative
27	<i>Melia azedarach</i> L.	Meliaceae	Malai Vembu	Whole plant	Antiviral, Jaundice, Anthelmintic
28	<i>Mollugo cerviana</i> (L.) Ser.	Aizoaceae	Porpadakam	Aerial part	Fever
29	<i>Alangium Salvifolium</i> (L. f.) Wangerin	Alangiaceae	Ayengel	Aerial part	Antioxidant and antimicrobial activities
30	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Anaikarai	Leaf	Wounds, bruises, ulcer, ophthalmia, odontalgia, diarrhoea and dysentery
31	<i>Annona squamosa</i> L.	Annonaceae	Seetha	Fruits	Intestinal worms.

creamy stable persistent of small bubbles) showed the presence of saponins.

### Detection of Tannins

#### Ferric chloride test:

A small quantity of the extract was stirred with water and heated on water bath. The mixture was filtered and 0.1% ferric chloride was added to the filtrate. Formation of dark green colour indicated the presence of tannins.

### Detection of carbohydrates

#### Fehling's test:

0.2g filtrate was boiled on water bath with 0.2ml each of Fehling solutions A and B. Red precipitate indicated the presence of sugar.

**Fehling's solution A:** Copper sulphate (34.66g) was dissolved in distilled water and made up to 500ml using distilled water.

**Fehling's solution B:** potassium sodium tartarate (173g) and sodium hydroxide(50g) were dissolved in water and made up to 500ml.

### Detection of oils and resins

#### Spot test:

Test solution was applied on filter paper, which developed a transparent appearance on the filter paper. It indicated the presence of oils and resins.

## RESULT AND DISCUSSION

The present study was conducted in the Gedamalai range located near Rasipuram of Namakkal district in Tamil Nadu. The present research work is based on the indigenous knowledge on the most commonly used medicinal plant species belonged to Solanaceae. Each medicinal plant species is provided with its scientific name, family name, vernacular name, plant part used, name of the disease cured. Mostly used and uses (Anu Shrivastava and Shikha Roy, 2013).

Phytochemical analyses the fruit extracts of plant species namely *Solanum anguivi* Lam., *Solanum torvum* Sw., *Solanum nigrum* L., *Solanum lycocarpum* A.St.-Hil., *Withania cogulans* (Stocks) Dunal., *Lycium barbarum* L., *Withania somnifera* (L.) Dunal., *Capsicum annum* L., *Solanum indicum* L., *Solanum surattense* Burm L. revealed the presence of phytochemical such as phenols, tannins, flavonoids, saponins, glycosides, steroids, terpenoids, and alkaloids (Table 1).

The phenolic compounds are one of the largest and most ubiquitous groups of plants metabolites. They possess biological properties such as antipoptosis, antiaging, anticarcinogen, antiinflammation, antithrombosis, cardiovascular protection and improvement of endothelial function as well as

inhibition of angiogenesis and cell proliferation activity (Table 2).

Herbs have been used for healing purposes and to promote wellness since from the ancient times and are not categorized as medicines but treated as food since they are natural products. Nowadays, herbal medicines, health and dietary supplements are flooding the markets. The use in the right way provides effective and safe treatment for many ailments and the effectiveness is mostly subjective to the patient. One of the major advantages of the herbal drug is that it is cost effective and easily affordable. When compared to the synthetic drugs they are less toxic and have least side effects. From the ancient times the people of the north-eastern part of India have been using the herbal medicines for curing the diabetes.

The use of medicinal plants in the management of various illnesses is due to their phytochemical constituents and date back antiquity (Anu Shrivastava and Shikha Roy, 2013). The ethnomedicinal knowledge emphasizes the significance of the crude drugs. The north-eastern communities have the ethnic knowledge to use the anti-diabetic plant. They used these plants generously without any scientific modification. So it is utmost necessary to screen these traditional medicines scientifically for proper investigation into their use. It is necessary to keep in mind that most of the medicinal plants have number of allied species that are morphologically similar and are difficult to distinguish. Plant parts used in preparations are usually collected by common people without any attention to botanical authentication. So, there is the possibility of incorporation of wrong plant or parts of the plant with less activity or without any activity. Therefore, it is very essential to evaluate the botanical identity and quality of the plants and parts used in the traditional drug preparation. Pharmacognostic studies are usually adopted for standardization and quality evaluation of botanical drugs.

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