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Dayanand Reddy Gaddam

Department of Pharmacology, Siddha Central Research Institute, Arumbakkam, Chennai, Tamilnadu, India

Rama Devi Bhogireddy

Department of Pharmacology, Siddha Central Research Institute, Arumbakkam, Chennai, Tamilnadu, India

Dasari Pitchaiah

Department of Pharmacology, Siddha Central Research Institute, Arumbakkam, Chennai, Tamilnadu, India

Vijaya Narasimha Kumar Godlaveti

Drug Standardisation Unit, Dr D. P. Rastogi Central Research Institute Homoeopathy, Central Council for Research in Homeopathy, Sector 24, Noida, AYUSH Ministry, Govt. of India

Correspondence:

Dayanand Reddy Gaddam

Department of Pharmacology, Siddha Central Research Institute, Arumbakkam, Chennai, Tamilnadu, India
Email: dayanand01[at]gmail.com

A Comprehensive Review on Anti-Diabetic Formulations Employed in Siddha System of Medicine

Dayanand Reddy Gaddam, Rama Devi Bhogireddy, Dasari Pitchaiah, Vijaya Narasimha Kumar Godlaveti

ABSTRACT

Background: Diabetes mellitus (DM) is a carbohydrate metabolic disorder; Siddha system of medicine is providing several effective preparations with minimal side effects compared with allopathic system of medicine to treat diabetes mellitus. **Methods:** The information on Siddha anti-diabetic formulations were acquired from pre-historic Siddha books and by literature searching in electronic databases such as Science direct, Pub Med, Pub Med Cochrane and Google-Scholar for publications up to August 2018. **Results:** Seven effective and clinically used anti-diabetic Siddha formulations have been identified and 34 references have been cited. **Conclusion:** The current review presents the detail background of composition, dose and folklore uses of Siddha anti-diabetic preparations, particularly focusing on scientific validation of these formulations in the treatment of diabetes.

Keywords: Anti-diabetic formulations, Herbo-mineral, Madhumegam, Siddha, Traditional medicine.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder which is characterized by polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger). Traditional Systems of medicines are playing a key role in meeting the global health care needs. India has seven familiar systems of medicine; Ayurveda, Siddha, Unani, Yoga, Naturopathy, Homoeopathy and Sowa-Rigpa [1]. Among all the alternative medicinal systems, Siddha system of medicine is unique and has originated from Tamil language and culture [2]. Literally the word “Siddha” means “established truth” [3].

Diabetes mellitus (DM) is a carbohydrate metabolic disorder which is characterized by elevated blood sugar levels over a prolonged period [4]. Conventionally, diabetes has been divided into three types namely: Type 1 DM or insulin-dependent diabetes mellitus (IDDM) in which human body fails to produce sufficient quantity of insulin for its needs, and the person requires injecting insulin from external sources. Type 2 DM or non insulin-dependent diabetes mellitus (NIDDM), results from insulin resistance, a condition in which cells fail to use insulin properly, with or without an absolute insulin deficiency. The third main type is gestational diabetes which occurs when women without a previous history of diabetes develop a high blood glucose level during the period of pregnancy [5].

Diabetes in Siddha

In Siddha system of medicine diabetes mellitus is called by different names such as *neerizivunoi* (neer means urine and izhivu means excessive discharge), *madhumegam* (madhu means sweet and megam means venereal disease) and *neerperukkal noi* (polyuric condition) [6]. Siddha system of medicine is claimed to alleviate the root cause of the diseases by maintaining the ratio of tridoshas; *Vatham*, *Pitham* and *Kapham* [7]. These unique humors operate constantly between environment and individual and are required to maintain the integrity of a living system. Siddhars, fathers of Siddha system of medicine grouped the diabetes mellitus under Pitha disorders of “Mega” disease. Mega disease means excessive discharge of urological secretions and excretions from the body [6].

Diabetes mellitus prevalence is increasing rapidly and affects more than 6% of population worldwide (100 million people) [7]. According to WHO held on 27 January 2017, diabetes is the 6th leading cause of death globally [8]. India currently represents 49% of the world’s diabetes burden and every year nearly 1 million deaths were noted in Indians due to diabetes [9]. Pertaining to Tamil Nadu, has the highest death rate (53 deaths per 100,000 populations) contribution in the country and it is higher than the national average [9].

Though many siddha formulations are currently employed in the management of diabetes in India, the usage of these formulations among public is minimal due to unfamiliarity and lack of scientific validation.

Thus the current review aims to explore about anti-diabetic formulations used in Siddha system of medicine with emphasis on their composition, method of preparation, traditional uses, safety and pharmacological studies done on these anti-diabetic formulations.

LITERATURE REVIEW STRATEGY

The literature for the present review was collected from two ways, one is from ancient Siddha related books and another one is literature searching in electronic data bases. Articles published only in English and Tamil language were included in the review. Furthermore, original research articles were only recruited for the purpose of review precludes review articles and theoretical research. The studies which did not fall in these categories were excluded from the review. Key words used for the purpose of this literature review include “Anti-diabetic formulations”, “Herbomineral” “Safety, “Siddha” and Traditional medicine.

Seven distinct Siddha anti-diabetic formulations have been studied in this context which includes *Triphala churnam*, *Madhumega churnam*, *Seenthil churnam*, *Abraka chenduram*, *Rasa chenduram*, *Avarai kudineer churnam* and *Nilavembu kudineer*.

Anti-diabetic formulations in siddha system of medicine

The formulations mentioned below are anti-diabetic Siddha preparations which are widely using clinically currently.

1. *Triphala churnam*
2. *Madhumega churnam*
3. *Seenthil churnam*
4. *Abraka chenduram*
5. *Rasa chenduram*
6. *Avarai kudineer churnam*
7. *Nilavembu kudineer*

1. *Triphala churnam* (TC)

Triphala (tri = three and phala = fruits), is the mixture of dried fruits of *Terminalia bellirica*-Bibhitaki (Combretaceae), *Terminalia chebula*-Haritaki (Combretaceae) and *Phyllanthus emblica*-Amla (Phyllanthaceae). Haritaki is good for vata dosha, bibhitaki is good for kapha dosha and amala is good for pitta dosha that govern the human life [10].

Composition: The ingredients of *Triphala churnam* are as follows [11].

Table 1: Ingredients of *Triphala churnam*

S.No.	Name of the Ingredient		Quantity (%)
	Siddha name	Scientific name	
1.	<i>Kadukkai</i>	<i>Terminalia chebula</i>	33.33
2.	<i>Nellivattal</i>	<i>Phyllanthus emblica</i>	33.33
3.	<i>Thandrikkaithol</i>	<i>Terminalia bellirica</i>	33.33

Method of preparation: The dried fruits from all above plants were powdered separately and mixed. Then stored the powder in air tight container and labeled as *Triphala churnam* [12].

Dose: *Triphala churnam* at a dose of 1-3gm with water, honey or ghee, 2-3 times per day after food is advisable [11].

Traditional uses: *Triphala churnam* is used as anti-diabetic, anti-cancer, anti-inflammatory, anti-hyperlipidemic and anti-microbial agent [1]. It can also acts as immunomodulator. *Triphala churnam* can ensure clearer bowel movements and relieves flatulence. *Triphala churnam* is used to treat arthritis, and gout. It can stimulate and improves the blood circulation and eyesight [12].

Earlier scientific data published on anti-diabetic activity of *Triphala churnam*

1. Sowmya S Rajan *et al.* evaluated the hypoglycemic effect of *Triphala churnam* in selected non insulin dependent diabetes mellitus subjects. 5 gm of *Triphala churnam* with buttermilk daily two hours after dinner for a period of 45 days significantly decreases the fasting blood glucose levels in diabetic patients [13].

2. *Madhumega churnam* (MC)

Madhumega churnam is a poly herbal preparation which contains seven herbal extracts. They are *Murraya koenigii* (Rutaceae), *Terminalia chebula* (Combretaceae), *Emblica officinalis* (Phyllanthaceae), *Tinospora cordifolia* (Menispermaceae), *Syzygiumcumini* (Myrtle), *Cyperus rotundus* (Sedges) and *Phyllanthus niruri* (Phyllanthaceae) [14].

Composition: The ingredients of *Madhumega churnam* are as follows [14].

Table 2: Ingredients of *Madhumega churnam*

S.No.	Name of the ingredient		Quantity (g)
	Siddha name	Scientific name	
1.	<i>Kadukkai</i>	<i>Terminalia chebula</i>	2
2.	<i>Karuveppilai</i>	<i>Murraya koenigi</i>	2
3.	<i>Nellikai</i>	<i>Emblica officinalis</i>	2
4.	<i>Arugadam</i>	<i>Eugenia jambolana</i>	1
5.	<i>Shindilakodi</i>	<i>Tinospora cordifolia</i>	1
6.	<i>keelanelli</i>	<i>Phyllanthus amaras</i>	1
7.	<i>koraikilangu</i>	<i>Cyperus rotundus</i>	1

Method of preparation: No literature survey was found for the method of preparation of *Madhumega churnam*.

Dose: 1 -2 capsules/ tablets or 1 teaspoonful of MC twice a day or as directed by the Siddha physician [14].

Traditional uses: MC has good anti-diabetic, anti-hypertensive and anti-hyperlipidemic activities [14]. Due to the presence of high content of phenolic compounds it is also acts as a good anti-oxidant [15].

Earlier scientific data published on anti-diabetic activity of *Madhumega churnam*

1. Anti-diabetic activity of MC was evaluated by Vadivelan R *et al.* in alloxan induced diabetic rats. Oral administration of MC for 14 consecutive days at 100 mg/kg/day and 200 mg/kg/day significantly reduces the fasting blood glucose levels and triglyceride levels in diabetic rats [16].
2. Chidambaram Saravana Babu *et al.* evaluated the anti-diabetic activity of phenolic portion and non phenolic portions of MC in high fat diet induced diabetic rats and concluded that phenolic portion of MC at 100mg/kg significantly reduces glucose-6-phosphatase and fructose-1,6-bis phosphatase and increases glucokinase and glycogen levels when compared with vehicle treated animals. Non phenolic portion of MC did not reveal such effects [15].

3. Seenthil churnam (SC)

The principal ingredient of the *Seenthil churnam* is whole plant extracts of *seenthil* or *Tinospora cordifolia* (Menispermaceae) and it also contains *Eclipta prostate* (Asteraceae) and the dried powder form of Earthworm (Lumbricidae) [17].

Composition: The ingredients of *Seenthil churnam* are as follows [17].

Table 3: Ingredients of Seenthil churnam

S. No.	Name of the ingredient		Quantity (%)
	Siddha name	Scientific name	
1.	<i>Seenthilsatthu</i>	<i>Tinospora cordifolia</i>	NA
2.	<i>Karisalaichurnam</i>	<i>Eclipta prostate</i>	NA
3.	<i>Poonagachurnam</i>	Earthworm	NA

NA= Not available

Method of preparation: No literature survey was found for the method of preparation of *Seenthil churnam*.

Dose: For children 250 mg to 1.5 gm and for adult 1 gm to 3gm of SC twice daily after meal with ghee or warm water is advisable [17].

Traditional uses: SC has potential anti-diabetic, hepatoprotective and anti-inflammatory activities [18]. It is also used to treat rheumatism, orchitis, bronchitis, asthma, tuberculosis (TB), cough and various skin diseases [17]. SC with honey is also used in the management of sinusitis and ulcers in the nasal passages [11]. SC along with sufficient quantity of sugar will reduce dandruff and alopecia [17]. It is effectively employed in the treatment of various fevers and in the treatment of splenomegaly [11].

Earlier scientific data published on anti-diabetic activity of *Seenthil churnam*:

1. Ushakanthan S. has done a great job on SC and conducted toxicity and efficacy studies (anti-diabetic, anti-inflammatory and hepato protective) of SC. Daily oral administration of *Seenthil churnam* at 200 and 400 mg/kg for 28 days significantly reduces the fasting blood glucose levels in streptozotocin (STZ) induced diabetic rats and also reduces the elevated urea levels in diabetic control rats [18].

4. Abraka chenduram (AC)

Abraka chenduram is a herbo mineral formulation, over dosage may cause severe side effects and should be taken under medical supervision only.

Composition: The ingredients of *Abraka chenduram* are as follows [11].

Table 4: Ingredients of Abraka chenduram

S.No.	Name of the ingredient		Quantity (%)
	Siddha name	Scientific name	
1.	<i>KaruppuAppirakkam</i>	Biotita	33.33
2.	<i>Vediyuppu</i>	Potassium nitrate	33.33
3.	<i>Panaivellam</i>	<i>Borassus flabellifer</i>	33.33
4.	<i>Erukkampaal</i>	<i>Calotropis gigantean</i>	Q.S.
5.	<i>Manjalkarisaalai saaru</i>	<i>Wedelia calendulaceae</i>	Q.S.

Q.S.= Quantity Sufficient

Method of preparation: No literature survey was found for the method of preparation of *Abraka chenduram*.

Dose: 65-130 mg of AC should be taken along with 4 gm of mixture of *Tanner cassia* (4 parts), *Withania somnifera* root (4parts) and seeds of *Cuminum cyminum* (1part) with cow's butter milk twice daily [11].

Traditional uses: AC is used to treat Madhumeagam (Diabetes mellitus) and hot flush [11].

Earlier scientific data published on anti-diabetic activity of *Abraka chenduram*:

1. Arunachalam K *et al.* evaluated the anti-diabetic activity of *Ayakantha abraka chenduram* in STZ induced diabetic rats and concluded that oral administration of 25mg/kg of *Ayakantha abraka chenduram* significantly reduces the elevated blood glucose levels in rats. On 14th day both *Ayakantha abraka chenduram* and glibenclamide had shown similar anti-diabetic activity [19].

5. Rasa chenduram (RC)

Rasa chenduram is a mineral/metal Siddha formulation.

Composition: The ingredients of *Rasa chenduram* are as follows [20].

Table 5: Ingredients of Rasa chenduram

S. No.	Name of the ingredient		Quantity (g)
	Siddha name	Scientific name	
1.	<i>Iracam</i>	Mercury	140
2.	<i>Kantakam</i>	Sulphur	35
3.	<i>Talakam</i>	Yellow arsenic	8

Method of preparation: Mercury and Sulphur were grounded with *Ocimum sanctum* in a mortar and subjected to the sand bath process of sublimation for 9 hours (3 hours tipakkani, 3 hours kamalakkani and 3 hours katakkini). Continued the process until the smell of sulphur came out, then yellow arsenic was added. The setup was cooled after the completion of sublimation and grounded them into fine powder [20].

Dosage: *Rasa chenduram* should be taken at a dose of 50-100 mg once in a day for 10 days along with sufficient amount of honey or ghee after food. *Amukkara chooranam* is also used as adjuvant for RC [20].

Traditional uses: RC is known to be effectively employed in the treatment of diabetes and piles [20].

Earlier data published on anti-diabetic activity of *Rasa chenduram*: No earlier scientific data was found for the anti-diabetic activity of *Rasa chenduram*.

6. Avarai kudineer churnam (AKC)

Avarai kudineer churnam is an effective traditional Siddha formulation to treat diabetes mellitus.

Composition: The ingredients of *Avarai kudineer churnam* are as follows [11].

Table 6: Ingredients of Avrai kudineer churnam

S.No.	Name of the metal		Quantity (%)
	Siddha name	Scientific name	
1.	<i>Avarai samoolam</i>	<i>Cassia auriculata</i>	14.28
2.	<i>Kondrai pattai</i>	<i>Cassia fistula</i>	14.28
3.	<i>Naval pattai</i>	<i>Syzygium cumini</i>	14.28
4.	<i>Koraikizhangu</i>	<i>Cyperus rotundus</i>	14.28
5.	<i>Kostam</i>	<i>Saussurea lappa</i>	14.28
6.	<i>Marutham pattai</i>	<i>Terminalia arjuna</i>	14.28
7.	<i>Kadalalingil ver</i>	<i>Salacia reticulata</i>	14.28

Method of preparation: No literature survey was found for the method of preparation of *Avarai kudineer churnam*

Dose: 5gms of *Avarai kudineer churnam* should be boiled in 300ml of water and reduced the quantity to 30 ml and consumed it twice daily [11].

Traditional uses: *Avarai kudineer churnam* is mainly employed in the treatment of diabetes mellitus and diabetes insipidus. It protects the skin from hot sun and also used in the treatment of skin disorders [11].

Earlier data published on anti-diabetic activity of Avarai kudineer churnam:

1. Yoganandam G *et al.* evaluated the in-vivo anti-diabetic activity of AKC in streptozotocin induced diabetic rats. *Avarai kudineer churnam* at 500mg/kg shown significant hypoglycemic activity, moreover inhibitory effects on biochemical and histological parameters induced by AKC were almost comparable to that of standard drug, glibenclamide (5mg/kg) [20].
2. Bhavanapriya V *et al.* evaluated the anti-diabetic efficacy of AKC in alloxan-induced diabetic rats. AKC significantly reduced the blood glucose levels and reversed the elevated urea, creatinine, cholesterol levels and decreased protein values close to normal levels [21].

7. Nilavembu kudineer (NK)

Nilavembu kudineer is a pure herbal Siddha formulation contains nine

Various anti-diabetic formulations clinically used in Siddha system of medicine

Table 8: Anti-diabetic formulations used in Siddha system of medicine

S.No	Name	Vehicle	Dosage	Earlier work done	Reference
1.	<i>Triphala churnam</i>	Honey, ghee or water is the vehicles for <i>Triphala churnam</i> .	1-3 gm with water, honey or ghee, 2-3 times per day.	1. Clinical Study of ‘Triphala’ – A Well Known Phytomedicine from India.	Pulok K. Mukherjee <i>et al.</i> , 2006.
				2. Mineral content and microbial impurity of <i>Triphalachurna</i> and its raw materials.	Lalla a J K., 2004.
				3. Phytochemical and anti carcinogenic evaluation of <i>Triphala</i> powder extract, against melanoma cell line induced skin cancer in rats.	Nikhlesh Birla., 2016.
				4. Hypoglycemic effect of <i>triphala</i> on selected non insulin dependent diabetes mellitus subjects.	Sowmya S Rajan <i>et al.</i> , 2007.
2.	<i>Madhumega churnam</i>	Water is the ideal vehicle for MC.	1-2 tablets per day.	1. Antidiabetic activity of <i>Madhumega churanam</i> (Siddha formulation) in alloxan induced diabetic rats.	Vadivelan Ret <i>al.</i> , 2011.
				2. Polyphenols in <i>madhumega chooranam</i> , a Siddha medicine, ameliorates carbohydrate metabolism and oxidative stress in type II diabetic rats.	Chidambaram Saravana Babu <i>et al.</i> , 2012.
3.	<i>Seenthil churnam</i>	The suitable vehicle for SC is warm water or ghee or honey.	1-3 g twice daily after meals.	1. Safety and pharmacological profile of <i>Seenthil chooranam</i>	Ushakanthan S., 2016.

herbs in equal proportions.

Composition: The ingredients of *Nilavembu kudineer* are as follows [22].

Table 7: Ingredients of Nilavembu kudineer

S.No.	Name of the metal		Quantity (%)
	Siddha name	Scientific name	
1.	<i>Nilavembu</i>	<i>Andrographis paniculata</i>	11.11
2.	<i>VilamichaiVer</i>	<i>Plectranthus vettiveroides</i>	11.11
3.	<i>Vetiver</i>	<i>Vetiveria zizanioides</i>	11.11
4.	<i>Chukku</i>	<i>Zingiber officinale</i>	11.11
5.	<i>Milagu</i>	<i>Piper nigrum</i>	11.11
6.	<i>KoraiKizhangu</i>	<i>Cyperus rotundus</i>	11.11
7.	<i>Santanam</i>	<i>Santalum album</i>	11.11
8.	<i>Peyputtal</i>	<i>Trichosanthes cucumerina</i>	11.11
9.	<i>Parpadagam</i>	<i>Mollugo cerviana</i>	11.11

Method of preparation: No earlier scientific data was found for the method of preparation of *Nilavembu kudineer*.

Dose: 10gm of *Nilavembu kudineer* should take with palm candy or honey [11].

Traditional uses: NK has anti-pyretic, anti-inflammatory, anti-viral, anti-diabetic and immunomodulatory actions. It can effectively treat dengue fever and chikungunya. It is also effective for reducing joint pain, joint swelling, muscle pain, headache. NK is also used to treat infertility, irregular periods and white discharge [22].

Earlier data published on anti-diabetic activity of Nilavembu kudineer

1. Ravi K evaluated the anti-diabetic effect of *Nilavembu kudineer* at different dose levels 100, 200 and 400 mg/kg in STZ induced diabetic rats. Oral administration of *Nilavembu kudineer* at dose of 200 mg/kg and 400 mg/kg significantly reduces the blood glucose levels in diabetic rats [23].

4.	<i>Abtrakachenduram</i>	The vehicles for AC are honey and butter milk.	65-130 mg of AC with butter milk, twice daily.	1. Antidiabetic activity of <i>Ayakaandha abraga chendhuram</i> on streptozotocin induced diabetes in rats.	Arunachalam K <i>et al.</i> , 2017.
5.	<i>Rasa chenduram</i>	Vehicles for RC are Honey and ghee.	RC should be taken at a dose of 50-100 mg once in a day after meals for 10 days.	1. Acute and sub acute toxicity study on siddha drug <i>Rasa chendooram</i> .	M. Jayabharathi <i>et al.</i> , 2017.
6.	<i>Avarai kudineer churnam</i>	Suitable vehicles for <i>Avarai kudineer churnam</i> are water and honey	5 gm of AKC twice daily.	1. Antimicrobial Potential of Siddha Polyherbal Formulation <i>Aavarai kudineer</i>	K. Rajalakshmi <i>et al.</i> , 2018.
				2. Potential in-vivo antidiabetic activity of "Avarikudineer formulation" (AKF) in normal and streptozotocin induced type-II diabetic rats.	Prakash Yoganandam G <i>et al.</i> , 2016.
				3. Biochemical studies on hypoglycemic effect of Aavirai kudineer: a herbal formulation in alloxan diabetic rats.	Bhavanapriya V <i>et al.</i> , 2001.
7.	<i>Nilavembu kudineer</i>	vehicles or adjuvants for <i>Nilavembu kudineer</i> are honey and palm candy	Vehicles or adjuvants for NK are honey and palm candy.	1. Clinical study on siddha medicine in the management of "madhumegam" (type II diabetes mellitus).	K. Ravi., 2015.
				2. Antipyretic, anti-inflammatory and analgesic properties of nilavembu kudineer choornam: a classical preparation used in the treatment of chikungunya fever.	Anbarasu K <i>et al.</i> , 2011.
				3. Structural basis for complementary and alternative medicine: Phytochemical interaction with non-structural protein 2 protease-a reverse engineering strategy.	Koushik kumar G <i>et al.</i> , 2015.

CONCLUSION

In present days high stress, amplified automation, junk food consumption and sedentary life style are the incidence factors of diabetes. Medical management and nutritional therapy, increased physical activity are the goals to alleviate the incidence of diabetes. Awareness about Alternative medicine has increased and the role of alternative medicinal systems such as Ayurveda, Siddha and Unani is also finding equal importance like Allopathy. The effort taken in the present review is a progressive step to prove that consistent use of Siddha anti-diabetic formulations that minimizes the incidence and early manifestation of diabetes.

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