

Formulation and Evaluation of Polyherbal Syrup with Anti-diabetic activity

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ABSTRACT:

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia and altered metabolism of carbohydrates, lipids and proteins. It is a condition that impairs the body's ability to process blood glucose as

result of this increased blood glucose level occurs in our body, which causes a diabetes mellitus. The present

study reveals the development of a polyherbal anti-diabetic herbal syrup by using an extract of the leaves of *Gymnema sylvestre* and dried seeds of *Syzygium cumini*. Three formulations of herbal syrup were formulated (F1, F2, F3). Herbal plants used in the formulations show a potent anti-diabetic action over synthetic ones. F1, F2, F3 formulations were prepared and evaluated. Evaluation parameters of these formulations were found to be within the standard limits and *in vitro* studies were performed for detection of anti-diabetic activity.

KEYWORDS: Polyherbal syrup, Diabetes mellitus, *Gymnema sylvestre*, *Syzygium cumini*.

I. INTRODUCTION:

Diabetes mellitus is a group of chronic metabolic disorders caused due to high blood sugar levels over a prolonged period. Diabetes is caused by either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced.

Blood glucose level :

Fasting blood glucose level : 90 – 130 mg/dl

Blood glucose level after 2 hours of meal greater than or equal to 150 mg/dl

SIGNS AND SYMPTOMS:

- Weight loss
- Polyuria (Increased urination)
- Polydipsia (Increased thirst)
- Polyphagia (Increased hunger)
- Loss of vision

- Slow healing of wounds
- Itchy skin
- Fatigue

TYPES:

Type 1- Insulin Dependent Diabetes mellitus

Type 2 - Non- Insulin Dependent Diabetes mellitus

Type 3 – Gestational Diabetes mellitus

Type 1 : Insulin Dependent Diabetes mellitus [IDDM] is an autoimmune disorder, in which antibodies destroy

the beta cells of the islets of Langerhans in the pancreas, causing an insulin deficiency. In other words, the pancreas fails

to produce enough insulin.

Type 2 : Non-insulin Dependent Diabetes mellitus [NIDDM] is an adult onset diabetes, most of the patients are obese. There is a reduced sensitivity of tissues to insulin and impaired insulin secretion.

Type 3 : Gestational Diabetes mellitus, which occurs around 20-24 weeks of pregnancy during which placental hormones are raised and responsible for insulin resistance.

PATHOPHYSIOLOGY:

- Insulin is a principal hormone that regulates the uptake of glucose from the blood into the cells of the body, it plays an important role in balancing glucose levels in the body.
- Insulin is released into the blood by beta cells of the islets of Langerhans present in the pancreas.
- Decreased insulin release from the beta cells results in the breakdown of glycogen to glucose. Due to insulin insufficiency, glucose will not be absorbed properly by the body cells, which results in poor protein synthesis, high blood glucose levels. Increased osmotic pressure of the urine causes an increased fluid loss, due to the fluid loss in other body compartments, leading to dehydration (polydipsia).

SYRUP :

Syrup is viscous, concentrated or nearly saturated aqueous solution of sucrose containing 66.7 % w/w of sugar.

Medicated syrup : Medicated syrups are nearly saturated solution of sugar in water in which medicaments and drugs are dissolved. It is intended for oral use.

Herbal syrup : An herbal syrup is prepared by mixing an concentrated decoction with either honey or sugar or alcohol. It is intended for oral use. Herbal syrups shows an more potent action then other types of syrup.

Advantages :

- Good patient compliance.
- They are more palatable .
- Disguised the bad taste of medication.

Disadvantages :

- During storage it causes an crystallization of the sugar within the screw cap.
- Not suitable in emergency and unconscious patients .
- Delayed onset of action because absorption takes time.

INGREDIENTS USED IN HERBAL SYRUP :

Following ingredients are used in Polyherbal anti-diabetic syrup are listed below;

GYMNEMA SYLVESTRE: [Meshashringi]

Leaves of Meshashringi have an potent hypoglycemic effect on diabetic patient . Consumption of these leaves improves insulin level and glucose metabolism. The active components of Meshashringi leaves is Gymnemicacid , which helps to control blood glucose level. It also blocks the sugar receptors on our taste buds. It can be used in the treatment of both type 1 and type 2 diabetes.

SYZYGIUM CUMINI : [Indian Black Jamun]

Dried Black Jamun seeds are used to treat diabetes. Active ingredient present in jamun seeds are jamboline and jambosine that slows down the rate of sugar released into the blood and increases the insulin level.

PLANT PROFILE:

Table 1: Plant Profile of Polyherbal anti-diabetic syrup

S.N O	Plants	Biological sources	Chemical Constituents	Uses
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PROPYLENE GLYCOL: [Stabilizer]

It is viscous , colorless liquid, odorless and has faintly sweet taste. It is commonly used as food additive and drug stabilizer , it helps to preserve moisture in the formulation. Used in medications and cosmetic products.

METHYLPARABEN: [Preservative]

It is commonly used as “ Preservative” in topical, oral medication ,It prevents the germ growth, used as food preservative and antifungal preservative in food and pharmaceutical industries.

PIPPERMINT OIL : [Flavoring agent]

It is an essential oil extracted from the leaves of peppermint plant belongs to mint family, It has sharp odour and refreshing properties and produce coolness feel in our mouth,it is commonly used as flavoring agents in pharmaceutical medications. Concentrated form of peppermint oil can be used for aromatherapy.

ERYTHROSINE : [Coloring agent]

It is an pink dye which is primarily used for food coloring made from coal tar. It is an organic compound containing iodine and sodium. It is used in pharmaceutical industries.

SACCHARIN SODIUM:[sweetener]

Saccharin sodium is an artificial sweetener.It is 500 times sweeter than sugar but no caloric value and be used as a dilute 1% solution. It is stable and non toxic, it is used in preparations for diabetes and in slimming diets.

MATERIALS :

Plant materials:

- Gymnemasylvestre (Meshashringi)
- Syzygiumcumini (Indian black Jamun)

Excipients :

- Propylene glycol
- Methyl paraben
- Peppermint oil
- Erythrosine
- Saccharin sodium
- Purified water

1	Meshashringi	Gymnemasylvestre	Gymnemic acid , Lupeol, Anthraquinone, Flavones, Stigmasterol, Dammarene, Pentatriacontane, Hentriacontane, 5- Deoxyinosital	Used to treat diabetes, metabolic syndrome, cough, malarial fever. Used to reduce weight loss, Antidote for snake bite , It acts as an digestive, stimulant, laxative, appetite suppressant and diuretic.
2	Indian Black jamun	Syzygiumcumini	Ellagic acid, Gallic acid, Myricetin, kaempferol, Oleanolicacid ,Petunidin, Beta – sitosterol, Delphinidin.	Used to treat type 2 diabetes mellitus, worm infection, asthma, diarrhoea, cough and cold. It is an anthelmintic, and also used to treat ulcers, dysentery, bronchitis. It purifies blood.

EXCIPIENT PROFILE:

Table 2: Excipient profile of Polyherbal anti-diabetic syrup

S.No	Excipients	Uses
1	Propylene glycol	<ul style="list-style-type: none"> • Food additive • Drug stabilizer • Preservative
2	Methyl paraben	<ul style="list-style-type: none"> • Preservative • Antifungal preservative • Prevents germ growth
3	Pippermint oil	<ul style="list-style-type: none"> • Flavouring agent • Topical analgesic • Anti pruritic
4	Erythrosine	<ul style="list-style-type: none"> • Coloring agent • Biological stain • Printing ink
5	Saccharin sodium	<ul style="list-style-type: none"> • Artificial sweetener • Low calorie value

METHODOLOGY:

Collection of Herbal plant materials: Meshashringi leaves and Indian black jamun seeds were collected from our locality, Thiruvallur, it is native to Asia, Africa, and Australia. Leaves of Meshashring were dried about a period of one week to remove moisture, jamun seeds were also dried in a sun shade for 3 days Then the dried leaves and dried seeds were crushed

by using a mortar and pestle and it is finely grinded. The finely powdered particles were sieved by using an sieve no 2

Preparation of Polyherbal anti-diabetic herbal syrup:

Formulation of Polyherbal syrup (50 ml)

Formula 1 :

Table 3: formulation of herbal syrup

S.No	INGREDIENTS	QUANTITY
1	MESHASHRINGI LEAF POWDER	10gm
2	PROPYLENE GLYCOL	2.5ml
3	METHYL PARABEN	2.5gm
4	PIPPERMINT OIL	1.5ml
5	ERYTHROSINE	0.1ml
6	SACCHARIN SODIUM	3.3gm
7	PURIFIED WATER	Upto 50ml

Formula 2 :

Table 4: formulation of herbal syrup

S.N	INGREDIENTS	QUANTITY
1	INDIAN BLACK JAMUN SEED POWDER	10gm
2	PROPYLENE GLYCOL	2.5ml
3	METHYL PARABEN	2.5gm
4	PIPPERMINT OIL	1.5ml
5	ERYTHROSINE	0.1ml
6	SACCHARIN SODIUM	3.3gm
7	PURIFIED WATER	Upto 50ml

Formula 3 :

Table 5: formulation of herbal syrup

S.No	INGREDIENTS	QUANTITY
1	MESHASHRINGI LEAF POWDER	5gm
2	INDIAN BLACK JAMUN	5gm
3	PROPYLENE GLYCOL	2.5ml
4	METHYL PARABEN	2.5gm
5	PIPPERMINT OIL	1.5ml
6	ERYTHROSINE	0.1ml
7	SACCHARIN SODIUM	3.3gm
8	PURIFIED WATER	Upto 50ml

Manufacturing Process:

Step 1: Preparation of Decoction:

Take 5 gm of meshashringi leaf powder and 5 gm of Indian black jamun seed powder, then mix it with a 500ml of purified water. Boil the mixture until the volume becomes ¼ of initial volume and then cool the decoction and filter it by using a filter paper. Filtrate obtained from the boiled mixture is used to prepare a final Polyherbal syrup.

Step 2: Preparation of flavor solution:

1.5 ml of peppermint oil in 2.5 ml of propylene glycol was prepared separately.

Step 3: Preparation of simple syrup with sodium saccharin:

Mix 3.3 gm of sodium saccharin with 10 ml of distilled water to prepare a concentrated solution, and add to mixing vessel.

Step 4: Preparation of polyherbal syrup :

Filtrate was taken and added to mixing vessel containing simple syrup, and stir it thoroughly and add excipients like methyl paraben (2.5gm), and add the flavor solution to the mixing vessel and finally add a coloring agent erythrosine (0.1ml), and then finally make up the volume upto 50 ml with purified water.

EVALUATION PARAMETERS:

Colour:

5 ml of final syrup was taken in a watch glasses and placed under light , and colour is observed by naked eye.

Odour:

2 ml of final syrup was smelled individually and then the odour can be detected.

Taste:

A pinch of final syrup was placed on the taste bud of tongue to identify the taste.

Determination of pH:

Take 5 ml of final syrup in the volumetric flask and make the volume up to 50ml with purified water. Th pH can be determined by using digital pH meter.

Determination of viscosity:

Viscosity of herbal syrup can be determined by using an ostwald viscometer. Ostawald viscometer is thoroughly cleaned with chromic acid or acetone. Visometer should be placed in a vertical position in a suitable stand. Fill the water upto the mark in dried viscometer. Now note the time required for water to flow from mark A to mark B.Repeat the process for 3 times, to obtain accurate reading. Now wash the viscometer and fill it with herbal syrup, and then note the time required for syrup to flow from mark A to mark B.

Formula for viscosity

$$\text{Viscosity} = \frac{\text{Density of syrup} \times \text{Time required to flow syrup} \times \text{viscosity of water}}{\text{Density of water} \times \text{Time required to flow water}}$$

Determination of density:

The density of syrup can be determined by using anpyncometer. Clean the pyncometer(specific gravity bottle) with chromic acid and nitric acid, and rinse with purified water. Note the weight of empty dry bottle (w1). Fill the pyncometer with 10 ml of water and weigh it (w2). Finally note the weight of bottle with 10 ml of syrup (w3).

Formula for density

- w1 - Weight of empty specific gravity bottle
- w2 - Weight of empty specific gravity bottle + 10 ml of water.
- w3 – Weight of empty specific gravity bottle + 10 ml of syrup.

$$\text{Density of syrup} = \frac{w3 - w1}{w2 - w1} \times \text{Density of water}$$

Determination of specific gravity :

Formula for specific gravity

$$\text{Specific gravity} = \frac{w3}{w2}$$

In vitro evaluation for anti-diabetic syrup:

Glucose bound test:

Plant extract was added to 25 ml of glucose solution of increasing concentration (5, 10, 20, 50, 100 m mol/ L).The mixture was stirred well incubated in shaker water bath at 37 °C in a shaker water bath for 6 hours . Centrifuge at 4800rpm for 20 min and the glucose content in the supernatant was determined by using UV spectrophotometer.

II. RESULTS AND DISCUSSION:

Evaluation parameters of herbal syrup and comparsion of test and standard syrup:

Table 5 : Evaluation Parameters of herbal syrup

S.No	Evaluation Parameters	Formulation 1	Formulation 2	Formulation 3
1	Color	Reddish brown	Reddish brown	Reddish brown
2	Odour	Aromatic	Aromatic	Aromatic
3	Taste	Intensity bitter	Lightly bitter	Lightly bitter
4	pH	6.3	6.3	6.2

5	Viscosity	1.05	1.20	1.23
6	Density	1.21	1.16	1.14
7	Specific gravity	1.01	1.05	1.06

**In vitro evaluation for anti-diabetic Polyherbal syrup;
Glucose bound test:**

Table 6: Invitro anti-diabetic activity

S.no	Concentration of glucose	Absorbance			
		Standard	F1	F2	F3
1	5	0.172	0.175	0.179	0.163
2	10	0.163	0.165	0.163	0.153
3	20	0.154	0.163	0.155	0.145
4	50	0.145	0.142	0.143	0.138
5	100	0.135	0.135	0.132	0.122

Conflict of interest: There is no conflict of interest.

III. CONCLUSION:

Herbal medicines are used by 50% of world population, because of their better acceptability, better compatibility with humans. It has lesser side effects than synthetic ones. In this study we prepared an Polyherbal anti-diabetic syrup using an leaf extract of Meshashringi and seed extract of Indian Black jamun, these two herbals possess an potent anti-diabetic effect as referred from the literature study. The prepared syrup undergo various evaluation parameters and it possess the value within the standard limits. Invitro studies for anti-diabetic activity has been done with prepared Polyherbal syrup, it shows an potent anti-diabetic action. Nowadays, increasing demand for herbal medicine has been increased. People may like to accept the herbal medicine due their lesser side effects.

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