Indian Journal of Pharmacy and Pharmacology 2023;10(1):7–11

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Indian Journal of Pharmacy and Pharmacology

Journal homepage: https://www.ijpp.org.in/

Review Article

A review on potential anti-diabetic herbs and polyherbal formulations concept

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ARTICLE INFO

Article history:
Received 06-09-2022
Accepted 27-09-2022
Available online 09-03-2023

Keywords:
Diabetes mellitus
Phutochemical constituents
Polyherbal formulation
Antihypergycemic agent

ABSTRACT

Multifactorial diseases, for diabetes develop various complication like hepatic toxicity, retinopathy, neuropathy, nephropathy and immunodeficiency etc. Numerous medicinal herbs have been used for the diabetes mellitus in traditional systems of medicine worldwide as they are a great source of phytochemical constituents and many of them are known to be effective against diabetes. Medicinal herbs with antidiabetic activities are being more desired, to lesser side effect and low cost. The efficacy of antihyperglycemic herbs is achieved by increasing insulin secretion, enhancing glucose uptake, activate GLP and inhibiting glucose production. The antidiabetic herbs contains many phytochemical constituents they single herb use produce mild effect when the combining of two — three herbs which having different chemical constituent and pharmacological action and produce synergistic effect and avoid repeated dose and achieve the efficacies therapeutic effec.

1. Introduction

Diabetes mellitus has been defined by American Diabetes Association Expert Committee in their 1997 advice as a group of metabolic diseases characterized by increase the glucose level in blood, altered metabolism of lipids, carbohydrates & proteins resulting from fault in insulin secretion, insulin action or both. The chronic hyperglycemia is associated with long damage, dysfunction & failure of v organs especially the eyes, kidneys, nerves, heart & blood vessels thus covering a wide range of heterogeneous disease contains more number of phytochemical substance like various proteins, calcium, carbohydrate etc.[1–5]"

In severe forms, ketoacidosis or a non–ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death. The long–term effects such as progressive development of retinopathy with potential blindness and nephropathy that may lead to renal failure, and/or neuropathy with risk of foot ulcers, amputation, Charcot joints, and features of autonomic dysfunction, including sexual dysfunction, and increased risk of cardiovascular, peripheral vascular and cerebrovascular disease."

1.1. Types of diabetes mellitus

Type I diabetes mellitus results from immune mediated destruction of the β cells of the pancreas, resulting in eventual absolute insulin deficiency. Roughly 5-10 % of people with diabetes have type I disease. Patients of type I disease is more likely to develop ketoacidosis than are people with type II diabetes."

Type II diabetes mellitus has usually some degree of insulin resistance with variable insulin secretion. Insulin secretion is said to be relatively deficient because many patients may have normal to elevated level to insulin;

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https://doi.org/10.18231/j.ijpp.2023.003

however, their blood sugars remain elevated because of tissue resistance to the action of insulin. Many patients with type II diabetes can survive without insulin.[6–9]"

2. Antidiabetic Effect of Folklore Medicinal Plants

2.1. *Momordica charantia (bitter melon)*

Momordica charantia are also called as vegetable insulin. It conatin various phytochemical constituents like polypeptide-p, Momordicoside S, Momordicoside T, Conjugated linolenic acid, linoleic acid, conjugated linoleic acid, karavilagenine E, Oleanolic acid, Trehalose, Momordin and 9c, 11t, 13t conjugated linolenic acid. Different chemical constituents having a different pharmacological action to inscrease the insulin level and decrease the blood glucose level via utilization of glucose. *Momordica charantia* ethanol extract having more amount of saponin fraction and cucurbitane triterpenoids like, momordicine I, momordicine II, 3-hydroxycucurbita-5,24-dien-19-al-7,23-di-O-glucopyranoside, and kuguaglycoside G are increase the insulin secretion in vitro and in vivo model. The *Momordica charantia* contain protein parts which having potential antioxidant properties and activate the GLUT4 transporter potentiate the glucose uptake. It contains the Oleanolic acid which prevents cartilage degeneration in diabetic mice via PPARY associated mitochondrial stabilization.[10–15]"

2.2. *Tinospora cordifolia (Guduchi)*

Tinospora cordifolia are highly appreciated in ayurveda for curing most all dieasease. It contains Alkaloids like Magnoflorine, Isocolumbin, Tembetarine, Berberine, trtahydopalmatine and Glycoside like syringing, tinocordiside, Cordifolioside A. The aqueous extract of *Tinospora cordifolia* stem are the b-cell regenerative efficacy in pancreases to increase the secretion of insulin. It contains berberine which Modulation of glucagon-like peptide-1 release by In vivo and in vitro studies. It contains Borapetoside C which improves insulin sensitivity in diabetic rats. The alkaloid which is decrease the blood glucose level. The Magnoflorine from *Tinospora cordifolia* stem inhibits a-glucosidase in rats.[16–21]"

2.3. *Trigonella foenum graecum (Fenugreek)*

Trigonella foenum graecum seeds are contains more amount of 4-hydroxisoleucine. 4-hydroxisoleucine nonproteinogenic aminoacid is the potent antidiabitic properties. It's stimulating glucose dependent insulin secreation from pancreatic β cell, reduced hepatic and renal glucose-6-phosphate and fructose-1,6 biphosphatase, direct stimulating effect on β cell function, inhibiting α-amylase enzyme and reduced insulin resistance in muscle and liver by activating insulin receptor associate phosphoinositide 3 kinase activities. *Trigonella foenum graecum* seeds are contains Galactomannan polysaccharide. Its glucose uptake by peripheral cells and tissue, increase in glycogen content in liver and increase glycogenesis and decrease in glcogenolysis. *Trigonella foenum graecum* seeds are contains Trigonelline alkaloid which improvement in hepatic and muscle glucogen content.[22–26]"

2.4. *Stevia rebudiana*

Stevia rebudiana having the sweetening properties and also having the antidiabitic properties. Its containg mainly glycoside like stevioside. Stevioside is natural sweetner and the increase the insulin sensitivity.

3. Polly Herbal Formulation Concept

Drug formulation in Ayurveda is based on two principles: Use as a single drug and use of more than one drugs, in which the latter is known as poly herbal formulation (PHF).[27–31]

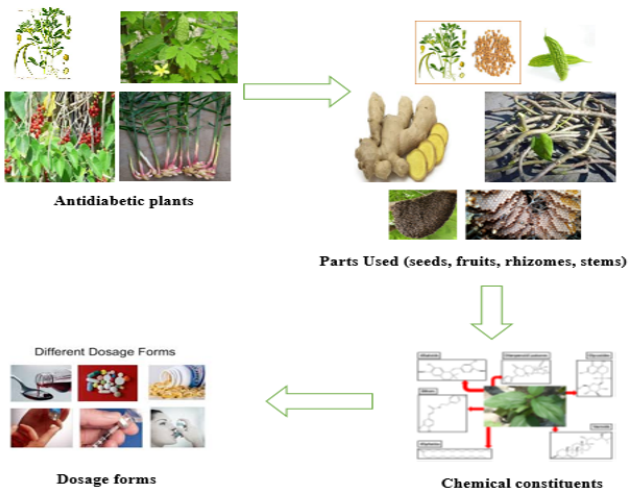

Fig. 1: Polyherbal formulation concept

This key therapeutic herbal master plan utilize the merging of medicinal herbs to achieve extra therapeutic effectiveness, usually known as poly pharmacy or poly herbalism. Based on the nature of the interaction, there are two mechanisms on how synergism acts (i.e., pharmacodynamics and pharmacokinetic). "In terms of pharmacokinetic synergism, the capacity of herb to facilitate the absorption, distribution, metabolism and elimination of the other herbs. Pharmacodynamics synergism on the other hand, studies the synergistic effect when active constituents with similar therapeutic activity are targeted to a homogeneous receptor or physiological system. Other than that, it is believed that abundance of factors and difficulty cause diseases in most of the cases, leading to both visible and invisible symptoms. Here, mixing of herbals

Table 1: Medicinal plants having antidiabetic activity [1]

S. No	Plant name	Family	Parts used
1	*Caesalpinia digyna*	Caesalpiniaceae	Root
2	*Cassia occidentalis*	Fabaceae	Whole plant
3	*Cassia auriculata*	Fabaceae	Whole plant
4	*Acacia arabica*	Leguminosae	Gum
5	*Acacia senegal*	Leguminosae	Gum
6	*Pithecellobium bigeminum*	Fabaceae	Seed
7	*Rhizophora mucronata*	Rhizoporaceae	Whole plant
8	*Kandelia rheedei*	Rhizoporaceae	bark
9	*Eugenia jambolana*	Myertaceae	Seed
10	*Casearia escalenta*	Salicaceae	Root
11	*Pterocarpus marsuupium*	Fabaceae	Wood
12	*Glycyrrhiza glabra*	Leguminosae	Root
13	*Casearia escalenta*	Salicaceae	Root, stem
14	*Syzygium cumini*	Myrtaceae	Seed, bark
15	*Asparagus racemosus*	Asparagaceae	Whole plant
16	*Boerharia diffusa*	Nyctaginaceae	Leaf
17	*Sphaeranthus indicus*	Asteraceae	Whole plant
18	*Tinospora cordifolia*	Menispermaceae	Stem, roots
19	*Swetia chirata*	Gentianaceae	Bark, leaf
20	*Stevia rebudiana*	Asteraceae	Leaf
21	*Tribulus terrestris*	Zygophyllaceae	Leaf, Fruit
22	*Phyllanthus amarus*	Phyllanthaceae	Leaf
23	*Gmelina arborea*	Verbenaceae	Fruit, bark
24	*Gossypium herbaceum*	Malvaceae	Leaf, seed
25	*Berberis aristata*	Berberidaceae	Bark, stem, root
26	*Aloe vera*	Asphodelaceae	Juice
27	*Commiphora wightii*	Burrseraceae	Gum
28	*Ocimum sanctum*	Lamiaceae	Leaf
29	*Abutilon indicum*	Malvaceae	Whole plant
30	*Rumex maritimus*	Polygonaceae	Aerial parts
31	*Coccinia Indica*	Cucurbitaceae	Fruit, Leaf
32	*Emblica officinalis*	Phyllanthaceae	Fruit, Leaf, Root
33	*Aegle marmelos*	Rutaceae	Fruit
34	*Limonia acidissimia*	Rutaceae	Stem bark, Fruit
35	*Ceratonia siliqua*	Fabaceae	Seed Leaf
36	*Pinus sylvestris*	Pinaceae	Bark
37	*Glycine max*	Fabaceae	Seed
38	*Pisum sativum*	Fabaceae	pericarp of pods
39	*Bougainvillea glabra*	Nyctaginaceae	Flower, Leaf
40	*Bougainvillea spectabilis*	Nyctaginaceae	Flower
41	*Scclerocarrya birrea*	Anacardiaceae	Stem bark
42	*Annona squamosa*	Annonaceae	Root
43	*Polyalthia longifolia*	Annonaceae	Bark
44	*Ferula asfoetida*	Umbbelliferae	Resin
45	*Cathranthus roseus*	Apoocynaceae	Leaf
46	*Ichnocarpus frutescene*	Apocynaceae	Leaf
47	*Acanthopanax senticosus*	Araliaceae	Stem bark
48	*Caralluma sinaica*	Apocynaceae	Root, aerial parts
49	*Terminalia bellerica*	Combretaceae	Fruits
50	*Costus speciosus*	Costaceae	Rhizome

Table 1 Cont...

51	*Vacccinium bracteatum*	Ericaceae	Leaf
52	*Jatropha curcas*	Euphorbiaceae	Leaf
53	*Secrinega virosa*	Phyllanthaceae	Leaf
54	*Trigonella foenum graecum*	Fabaceae	Seed, leaf
55	*Zingiber officinale*	Zingiberaceae	Rhizome
56	*Momardica charatina*	Cucurbitaceae	Ripe and Unripe Fruit, Leaf
57	*Senna auriculata*	Caesalpinioideae	Leaf
58	*Ougeinia aojeinensis*	Fabaceae	Bark
59	*Cinnamonum zeylanicum*	Lauraceae	Bark
60	*Allium cepa*	Amaryllidaceae	Fruit
61	*Strychonous potatorum*	Loganiaceae	Whole plant
62	*Adansonnia digitata*	Malvaceae	Stem bark
63	*Acorus calamus*	Acoraceae	Rhizome
64	*Cassia glauca*	Fabaceae	Bark, leaf

may act on more targets at the same time to provide a thorough relief. No disease has just one single symptom. Also in the pathogenesis of a disease different factors or at work. The common cold causes cough, headache, runny nose, nausea, fatigue. Likewise, we need non-identical medicines (plants) to resolve the signs and symptoms of a disease. The plants in a poly-herbal medicine may: rise the effectively and potency of the formulation, reduce unwanted effects, make the formulation more palatable, and increase its lifespan. Due to synergism, poly herbalism confers some benefits not available in single herbal formulation. It is evident that superior therapeutic effect can be reached with a single multi-constituent formulation. For this, a beneath dose of the herbal preparation would be needed to achieve advantageous pharmacological action, thus reducing the risk of side-effects. Besides, PHFs bring to improved convenience for patients by eliminating the need of taking more than one different single herbal formulation at a time, which indirectly leads to better compliance and therapeutic effect. All these benefits have resulted in the popularity of PHF in the market when collate to single herbal formulation.

4. Conclusion

Diabetes is a clinical syndrome characterized by the insulin deficiency, insulin resistance in human beings. Hyperglycemia leads to glycation of body proteins, fat and carbohydrate that in turn causes secondary complication the affecting eyes, neurons, kidney and liver. However, Multifactorial diseases to require multi drug formulation consisting of medications from different pharmacological actions to prevent their complication use of two-three herbs mixture (polyherbarisum) may overcome this problem and help to prevent complication still need of new well polyherbal formulation to achieving the avoid the society problem.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Cite this article: Kher JD, Patel HH. A review on potential anti-diabetic herbs and polyherbal formulations concept. *Indian J Pharm Pharmacol* 2023;10(1):7-11.