Potential anti diabetic herbs and polyherbal formulation concept

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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 contain 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 effect.

Keywords: Diabetes mellitus, Antihypergycemic agent, Phytochemical constituents.

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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 hyperglycaemia is associated with long damage, dysfunction & failure of v organs especially the eyes, kidneys, nerves, heart and blood vessels thus covering a wide range of heterogeneous disease contains a greater number of phytochemical substances like various proteins, calcium, carbohydrate etc. In severe forms, ketoacidosis or a non-kenotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death [1]. 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.

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 [2]. 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; 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 (Table 1).

Table1: *Medicinal plants having antidiabetic activity.*

S.No	Plant name	Family	Parts used	Ref
1	Caesalpinia digyna	Caesalpiniaceae	Root	[1]
2	Cassia occidentalis	Fabaceae	Whole plant	[1]
3	Cassia auriculata	Fabaceae	Whole plant	[1]
4	Acacia arabica	Leguminosae	Gum	[1]
5	Acacia senegal	Leguminosae	Gum	[1]
6	Pithecellobium bigeminum	Fabaceae	Seed	[1]
7	Rhizophora mucronata	Rhizoporaceae	Whole plant	[1]

8	Kandelia rheedei	Rhizoporaceae	bark	[1]
9	Eugenia jambolana	Myertaceae	Seed	[1]
10	Casearia escalenta	Salicaceae	Root	[1]
11	Pterocarpus marsuupium	Fabaceae	Wood	[1]
12	Glycyrrhiza glabra	Leguminosae	Root	[1]
13	Casearia escalenta	Salicaceae	Root, stem	[1]
14	Syzygium cumini	Myrtaceae	Seed,bark	[1]
15	Asparagus racemosus	Asparagaceae	Whole plant	[1]
16	Boerharia diffusa	Nyctaginaceae	Leaf	[1]
17	Sphaeranthus indicus	Asteraceae	Whole plant	[1]
18	Tinospora cordifolia	Menispermaceae	Stem,roots	[1]
19	Swetia chirata	Gentianaceae	Bark,leaf	[1]
20	Stevia rebudiana	Asteraceae	Leaf	[1]
21	Tribulus terrestris	Zygophyllaceae	Leaf,Fruit	[1]
22	Phyllanthus amarus	Phyllanthaceae	Leaf	[1]
23	Gmelina arborea	Verbenaceae	Fruit, bark	[1]
24	Gossypium herbaceum	Malvaceae	Leaf,seed	[1]
25	Berberis aristata	Berberidaceae	Bark,stem,root	[1]
26	Aloe vera	Asphodelaceae	Juice	[1]
27	Commiphora wightii	Burrseraceae	Gum	[1]
28	Ocimum sanctum	Lamiaceae	Leaf	[1]
29	Abutilon indicum	Malvaceae	Whole plant	[1]
30	Rumex maritimus	Polygonaceae	Aerial parts	[1]
31	Coccinia Indica	Cucurbitaceae	Fruit,Leaf	[1]
32	Emblica officinalis	Phyllanthaceae	Fruit,Leaf,Root	[1]
33	Aegle marmelos	Rutaceae	Fruit	[1]
34	Limonia acidissimia	Rutaceae	Stem bark, Fruit	[1]
35	Ceratonia siliqua	Fabaceae	Seed Leaf	[1]
36	Pinus sylvestris	Pinaceae	Bark	[1]
37	Glycine max	Fabaceae	Seed	[1]
38	Pisum sativum	Fabaceae	pericarp of pods	[1]
39	Bougainvillea glabra	Nyctaginaceae	Flower, Leaf	[1]
40	Bougainvillea spectabilis	Nyctaginaceae	Flower	[1]
41	Scclerocarrya birrea	Anacardiaceae	Stem bark	[1]
42	Annona squamosa	Annonaceae	Root	[1]
43	Polyalthia longifolia	Annonaceae	Bark	[1]

44	Ferula asfoetida	Umbbelliferae	Resin	[1]
45	Cathranthus roseus	Apoocynaceae	Leaf	[1]
46	Ichnocarpus frutescene	Apocynaceae	Leaf	[1]
47	Acanthopanax senticosus	Araliaceae	Stem bark	[1]
48	Caralluma sinaica	Apocynaceae	Root, aerial parts	[1]
49	Terminalia bellerica	Combretaceae	Fruits	[1]
50	Costus speciosus	Costaceae	Rhizome	[1]
51	Vacccinium bracteatum	Ericaceae	Leaf	[1]
52	Jatropha curcas	Euphorbiaceae	Leaf	[1]
53	Secrinega virosa	Phyllanthaceae	Leaf	[1]
54	Trigonella foenum graecum	Fabaceae	Seed, leaf	[1]
55	Zingiber officinale	Zingiberaceae	Rhizome	[1]
56	Momardica charatina	Cucurbitaceae	Ripe and Unripe Fruit, Leaf	[1]
57	Senna auriculata	Caesalpinioideae	Leaf	[1]
58	Ougeinia aojeinensis	Fabaceae	Bark	[1]
59	Cinnamonum zeylanicum	Lauraceae	Bark	[1]
60	Allium cepa	Amaryllidaceae	Fruit	[1]
61	Strychonous potatorum	Loganiaceae	Whole plant	[1]
62	Adansonnia digitata	Malvaceae	Stem bark	[1]
63	Acorus calamus	Acoraceae	Rhizome	[1]
64	Cassia glauca	Fabaceae	Bark, leaf	[1]

Literature Review

Momordica charantia

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 PPARγ associated mitochondrial stabilization. Tinospora cordifolia are highly appreciated in ayurveda for curing most all dieasease.It contains Alkaloids like Magnoflorine,Isocolumbin,Tembetarine,Berberine,trtahydopal matine 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 [3].

The Magnoflorine from Tinospora cordifolia stem inhibits a-glucosidase in rats.Trigonella foenum graecum seeds are contains more amount of 4-hydroxisoleucine.4-hydroxisoleucine nonproteinogenic aminoacid is the potent antidiabitic properties.Its 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 [4]. 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.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 (Figure 1).

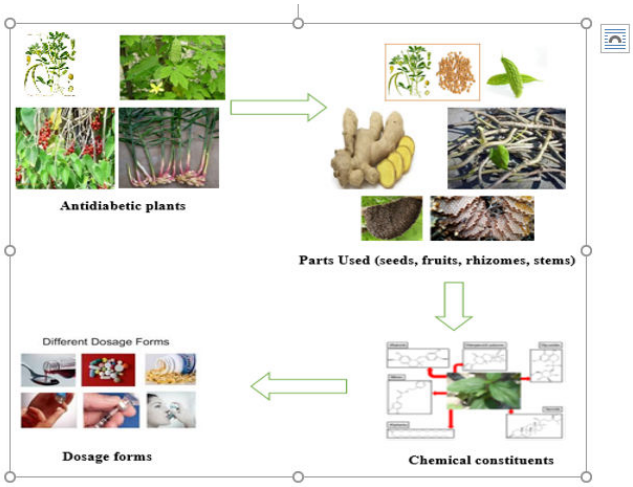

Figure1: *Polyherbal formulation concept.*

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). This key therapeutic herbal master plan utilizes 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 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 [5]. 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.

Conclusion

Diabetes is a clinical syndrome characterized by the insulin deficiency, insulin resistance in human beings. Hyperglycaemia 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.

References

1. Anderson B. Becoming and being hopeful: Towards a theory of affect. Sage. 2006;24:733-52.
2. Fábio D, Ratti C. The impact of autonomous vehicles on cities: A review. J Urban Technol. 2018;25:3-18.
3. Asif F, Kamruzzaman MD, Yigitcanlar T, et al. Understanding autonomous vehicles. J Transp Land Use. 2019;12:45-72.
4. Wilko S, Alonso-Mora J, Rus D. Planning and decision-making for autonomous vehicles. Annu Rev Control. 2018;187-210.
5. Shinpei K, Takeuchi E, Ishiguro Y, et al. An open approach to autonomous vehicles. IEEE Micro 2015;35:60-8.
6. Bajaj RK, Rao M, Agrawal H. Internet Of Things (IoT) In The Smart Automotive Sector : A review. 2018;36-44.
7. Lu Q, Tettamanti T, Hörcher D, et al. The impact of autonomous vehicles on urban traffic network capacity : An experimental analysis by microscopic traffic simulation experimental analysis by microscopic tra ffi c simulation. Transp Lett. 2020;12:540-49.

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