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Potential of Botanicals in Preventing and Treating Diabetes

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Abstract: *Diabetes is an endocrinochronic condition caused by absence of insulin production of relative lack of insulin as a result of impaired insulin secretion and action. The clust characteristics are symptomatic glucose intolerance resulting in hyperglycemia and alterations in tipit and protein metabolism. In the long term, these metabolic abnormalities onuses development of complications like cardiovascular disease (CVD), retinopath nephropathy, and neuropathy and risk of cancer. Genetically, etiologically, and clinically diabetes is a heterogeneous group of disorders. Diabetes mellitus are type 1 or type 2 diabetes. The term gestational diabetes mellitus (GDM) is glucose intolerance that has its onset during pregnancy, Glucose intolerance causes includes Genetically defective insulin receptors or specific genetic defects in cell function Diseases of the exocrine pancreas.*

Keywords: Diabetes

I. INTRODUCTION

Diabetes mellitus (DM) is a serious, chronic, and complex metabolic disorder of multiple a etiologies with profound consequences, both acute and chronic.[1]Diabetes is divided by chronic hyperglycemia with disturbances inthe macromolecules' metabolism as a result of impairments in insulin secretion, insulin action, or both.Diabetes causes long-term damage, dysfunction, and failure of various organ systems (heart, bloodvessels, eyes, kidneys, and nerves), leading to disability and premature death00167[2]There are several classes of oral hypoglycemic drugs that exert antidiabetic effects through different mechanisms, namely sulfonylureas, biguanides, α-glucosidase inhibitors, thiazolidinediones,and non-sulfonylureas secretagogues. Oral sulfonylureas, such as glimepiride and glyburide, act to reduce blood sugar, mainly by elevating insulin release from islets of Langerhans. This is achieved through binding with the sulfonylurea receptor onβcells resulting in adenosine triphosphate-dependent potassium channels closure. As a result, the cell membrane depolarizes and the following calcium influx accompanied by secretion of stored insulin from secretory granules within the cells takes place.This mechanism works only in the presence of insulin[3]. Another important class of oral hypoglycemic agents is the thiazolidinedione's (TZDs), such as pioglitazone and rosiglitazone, of which the mechanism of action primarily includes improving muscle and adipose tissue sensitivity to insulin and, to a smaller extent, reducing liver glucose production.TZDs also are potent and selective agonists to the nuclear peroxisome proliferator-activated receptor gamma (PPARγ) present in liver, skeletal muscle, and adipose tissue. Activation of PPARγ receptors controls the transcription of insulin-responsive genes involved in the regulation of transportation, production, and glucose use. Also, TZDs have been reported to augment β-cell function by lowering free fatty acid levels that ultimately lead to β-cell death[4]. For centuries, many plants have been considered a fundamental source of potent antidiabetic drugs. In developing countries, particularly, medicinal plants are used to treat diabetes to overcome the burden of the cost of conventional medicines to the population[5]Discovery of the new natural antidiabetic drugs could be great promise due to minimal efficacy and safety concerns of current antidiabetic drugs for the hundreds of millions of individuals which are currently seeking better management of diabetes[6]

Alovera :Various earlier studies of Aloe vera extract suggested that Aloe can act as a hypoglycemic agent through the potent inhibit the activity of pancreatic amylase . As lysis starch offers glycemic control [7] Due to presence of flavonoid , Aloe vera methanol extract (AVM) show inhibitory activity in the formation of methylglyoxal and arginine.[8] In the treatment of diabetes Alovera is strongly act due to the hypoglycemic elements like Cr, Zn, and Mn. Alovera used in various countries as anti diabetic agent [9]

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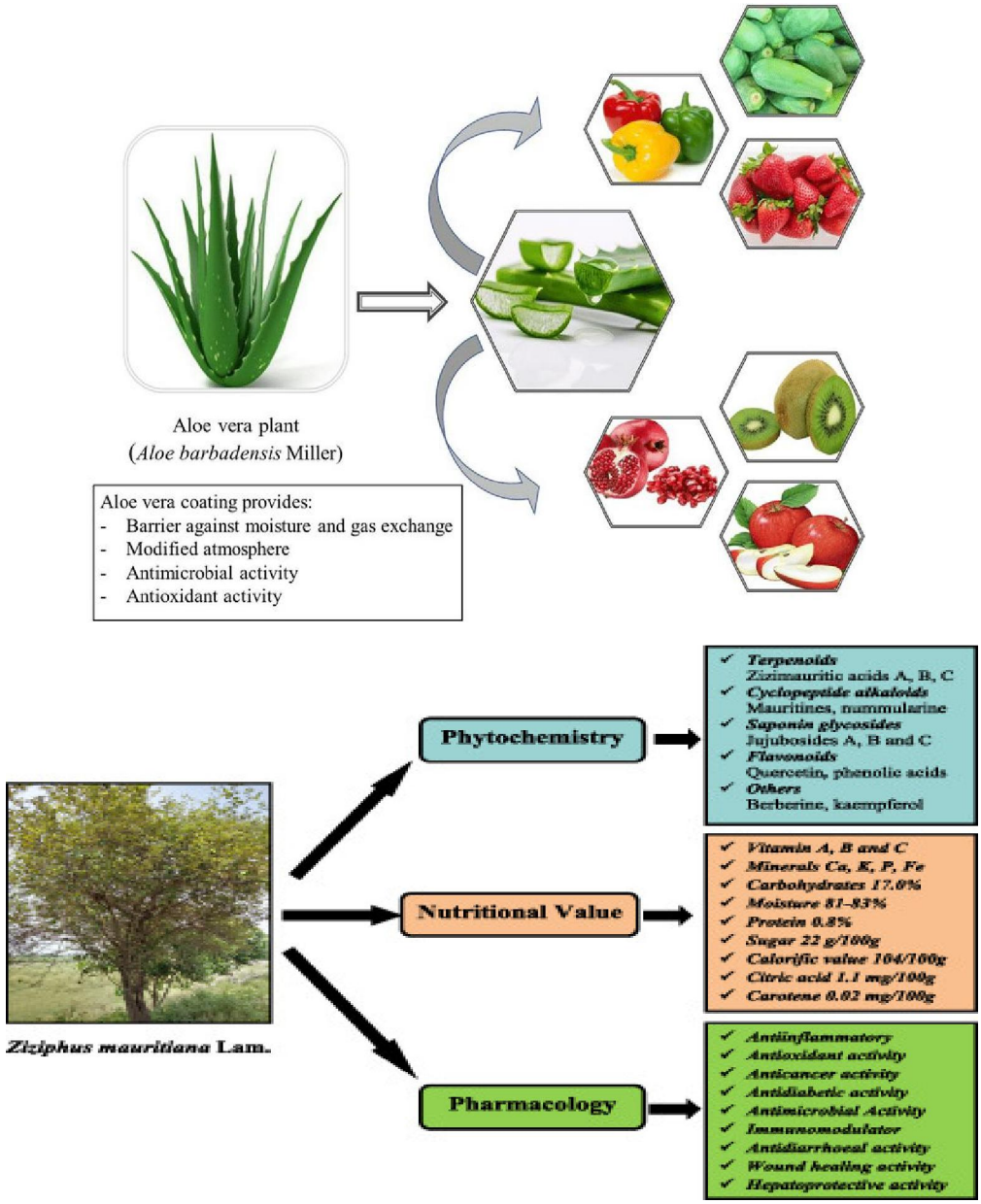

Zizyphus mauritiana (Rhamnaceae) :

Aqueous extract of Zizyphus mauritiana putting for seven days increase the parameters glucose, creatinine, High density level, Low density level, hemoglobin,[12]

Ziziphus mauritiana leaves have possess antidiabetic potential . The antihyperglycemic activity of aqueous leaf extracts of Ziziphus mauritiana have also been reported.[13]

Ginseng:

In diabetic model rats, GPS has used to increase the relative abundance of Firmicutes.[14]The phylum level in diabetic rats, upregulate the relative abundance of Bacteroidetes,restore the entire gut microbiota potentiate the hypoglycaemic effects of ginsenosides[15]

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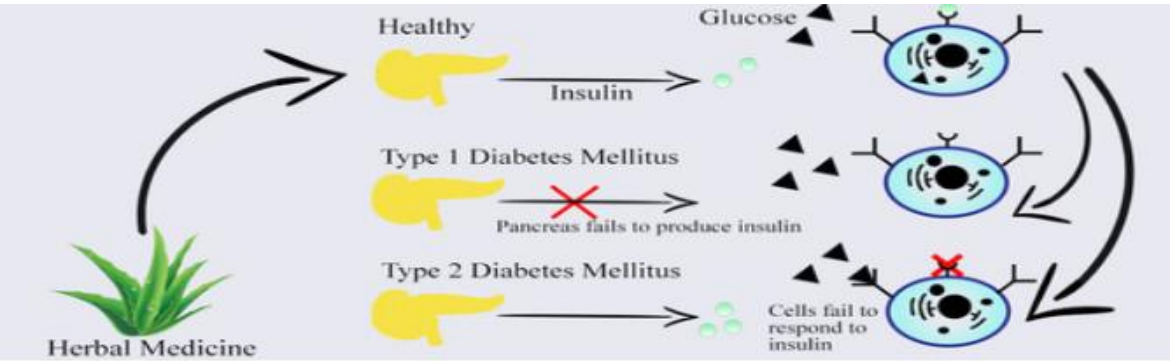
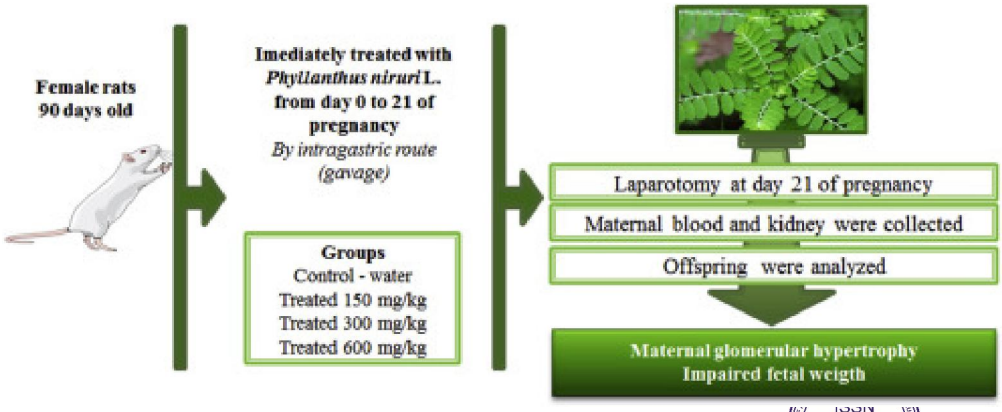


Cinnamon Cassia

Cinnamon has a ancient antidiabetic agent. Research has shown that adding cinnamon to the diet can help to lower the glucose level, but results from trials involve the supplements of cinnamon amongst patients with diabetes and insulin-resistant patients, particularly the ability to reduce blood glucose levels and to inhibit Amadori reaction.[16]Cinnamomum Cassia bark extracts significantly fall down blood glucose concentration. Also, extracts of cinnamon significantly increased the utilization of extracellular glucose in insulin, suggesting an insulin sensitivity improvement in mice .[17]

Phyllanthus niruri (Euphorbiaceae)

The methanol extract of aerial parts of Phyllanthus niruri was evaluated in alloxan-induced diabetic rats . The results of this study showed a significant reduction of blood glucose, TC, and TG levels in a dose-related manner. Moreover, histological analyses showed that that extract had imparted cell regenerative power. In another study was observed that a Phyllanthus niruri leaf aqueous extract improves kidney functions; ameliorates kidney oxidative stress, inflammation, fibrosis, and apoptosis; and enhances kidney cell proliferation in adult male rats with diabetes[18]



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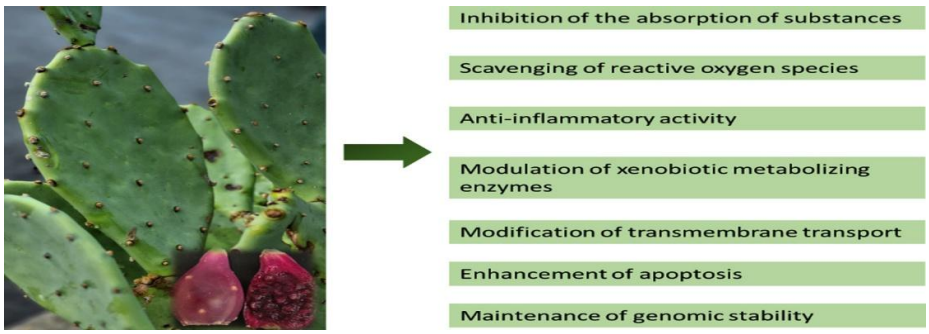
Opuntia ficus-indica (Cactaceae)

Various extracts from edible Opuntia ficus-indica (petroleum ether, ethyl acetate, butanolic, aqueous, and water parts) and a standard drug as a positive control (dimethyl biguanide, 100 mg/kg) were tested in streptozotocin-induced diabetic mice [926]. The results of this study showed that all extracts
tested significantly decreased blood glucose levels and maintained body weight, except the aqueous extract. Mainly, the petroleum ether extract showed a remarkable decrease in blood glucose levels.[20]



Antidiabetic Drugs and Their Side Effects

There are several classes of oral hypoglycemic drugs that exert antidiabetic effects through different mechanisms, namely sulfonylureas, biguanides, α-glucosidase inhibitors, thiazolidinediones,and non-sulfonylureas secretagogues. Oral sulfonylureas, such as glimepiride and glyburide, act to reduce blood sugar, mainly by elevating insulin release from islets of Langerhans. This is achieved through binding with the sulfonylurea receptor onβcells resulting in adenosine triphosphate-dependent potassium channels closure. As a result, the cell membrane depolarizes and the following calcium influx accompanied by secretion of stored insulin from secretory granules within the cells takes place.

This mechanism works only in the presence of insulin.

Another oral hypoglycemic drug, the biguanides, acts to reduce hepatic gluconeogenesis and to replenish peripheral tissues' sensitivity to insulin, actions that are achieved through elevation of insulin-stimulated uptake and use of sugar. Nevertheless, biguanides are ineffective in insulin absence.

Phytochemicals with Antidiabetic Potential

The discovery of new natural antidiabetic drugs holds great promise for improving the management of diabetes, especially considering the substantial number of individuals seeking better treatment options. Current antidiabetic medications, while effective for many, may come with various side effects and efficacy concerns for others.

Natural compounds offer potential advantages such as fewer side effects, better tolerability, and potentially novel mechanisms of action. Additionally, natural products often have a long history of traditional use, providing a foundation for further investigation.

Research into natural antidiabetic agents could lead to the development of safer, more effective treatments, offering hope for better management of diabetes for millions of people worldwide.[21]

Flavonoids

Flavonoids represent a large class of plant secondary metabolites found in a wide range of fruits, vegetables, and herbs. Due to the presence of hydroxyl groups and aromatic rings of the flavonoid structures, they can play as natural antioxidants. Flavonoid-containing products are commonly used in antidiabetic diets. Many flavonoids such as catechins, fisetin, kaempferol, luteolin, naringenin,Quercetin, rutin, morin, silymarin, chrysin, baicalein, icariin, isoliquiritigenin, diosmin, isoangustone A, genistein, and others were tested for their antidiabetic properties. For instance, the current work of Den Hartogh and Tsiani. [22]

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Alkaloids

The following alkaloids—berberine, boldine, lupanine neferin, oxymatrine, piperine, sanguinarine—are studied for their antidiabetic activity. Christodoulou et al. discussed the antidiabetic impact of certain alkaloids, with special reference to their molecular targets throughout the insulin-signaling pathway: in vitro and in vivo evidence support the effects of berberine, trigonelline, Piperine, oxymatrine, vindoneline, evodiamine, and neferine on insulin-signaling and related cascades in β cells, myocytes, adipocytes, hepatocytes, and other cells; the authors concluded that in-depth Alkaloids The following alkaloids—berberine, boldine, lupanine neferin, oxymatrine, piperine, and sanguinarine—are studied for their antidiabetic activity. Christodoulou et al. [949] discussed the antidiabetic impact of certain alkaloids, with special reference to their molecular targets throughout the insulin-signaling pathway: in vitro and in vivo evidence support the effects of berberine, trigonelline, piperine, oxymatrine, vindoneline, evodiamine, and neferine on insulin-signaling and related cascades in β cells, myocytes, adipocytes, hepatocytes, and other cells; the authors concluded that in-depth molecular studies are needed as well as large clinical trials to assess their potential as antidiabetic agents studies are needed as well as large clinical trials to assess their potential as antidiabetic agents[23]

Diterpenoids

Triptolide is a diterpenoid with three epoxide groups, isolated from Tripterygium wilfordii. Triptolide reduced the levels of phosphorylated protein kinase B and phosphorylated inhibitor of kappa B and increased caspases 3, 8, and 9. Triptolide treatment is accompanied by alleviated glomerular hypertrophy and podocyte injury [24]

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REFERENCES

[1] Soumya, D.; Srilatha, B. Late stage complications of diabetes and insulin resistance. J. Diabetes Metab. 2011, 1000167.
[2] Salsali, A.; Nathan, M. A review of types 1 and 2 diabetes mellitus and their treatment with insulin. Am. J.2006, 13, 349–361. [CrossRef]
[3] DeFronzo, R.A. Pharmacologic therapy for type 2 diabetes mellitus. Ann. Intern. Med. 1999, 131, 281–303.[CrossRef] [PubMed]
[4] Inzucchi, S.E. Oral antihyperglycemic therapy for type 2 diabetes—Scientific review. JAMA 2002, 287,360–372. [CrossRef] [PubMed].
[5] Koski, R. Oral antidiabetic agents: A comparative review. J. Pharma. Pr. 2004, 17, 39–48. [CrossRef].
[6] Arumugam, G.; Manjula, P.; Paari, N. A review: Anti diabetic medicinal plants used for diabetes mellitus. J. Acute Dis. 2013, 2, 196–200. [CrossRef].
[7] Mancha-Ramirez, A.M.; Slaga, T.J. Ursolic acid and chronic disease: An overview of ua's effects on prevention and treatment of obesity and cancer. In Advances in Experimental Medicine and Biology. Anti-Inflammatory Nutraceuticals and Chronic Diseases; Gupta, S.C., Prasad, S., Aggarwal, B.B., Eds.; Springer International Publishing: Cham, Switzerland, 2016; Volume 928
[8] A. Mourad, H. Abo-Youssef, B. Anwar, and S. Messiha, "Beneficial effects of Aloe vera in treatment of diabetes: comparative in vivo and in vitro studies," Bulletin of Faculty of Pharmacy, vol. 51, no. 1, pp. 7–11, 2013.
[9] B. Benzidia et al., "Chemical composition and antioxidant activity of tannins extract from green rind of Aloe vera (L.) Burm. F.," Journal of King Saud University-Science, vol. 31, no. 4, pp. 1175–1181, 2018.
[10] Mohamed EA (2011) Antidiabetic, antihypercholestermic and antioxidative effect of Aloe vera gel extract in alloxan induced diabetic rats. Aust J Basic Appl Sci 5(1):1321–1327

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[11] Jarald, E.E.; Joshi, S.B.; Jain, D.C. Antidiabetic activity of extracts and fraction of Zizyphus mauritiana. Pharm. Biol. 2009, 47, 328–334.
[12] Cisse A, Nadiaye A, Lopez-Sall P, Seck F, Faye B (2000): antidiabetic activity of Zizyphus mauritiana Lam. Dakar Med45
[13] Li J, Li R, Li N, Zheng F, Dai Y, Ge Y, Yue H, Yu S. Mechanism of antidiabetic and synergistic Effects of ginseng polysaccharide and ginsenoside Rb1 on diabetic rat model. J Pharm Biomed Anal 2018; 158: 451-460 [PMID: 30032757 DOI: 10.1016/j.jpba.2018.06.024
[14] Wang J, Hou Y, Jia Z, Xie X, Liu J, Kang Y, Wang X, Jia W. Metabonomics Approach To comparing the Antistress Effects of Four Panax ginseng Components in Rats. J Proteome Res 2018
[15] Kirkham, S.; Akilen, R.; Sharma, S.; Tsiami, A. The potential of cinnamon to reduce blood glucose levels in patients with type 2 diabetes and insulin resistance. Diabetes Obes. Metab. 2009
[16] Lu, Z.; Jia, Q.; Wang, R.; Wu, X.; Wu, Y.;Huang, C.; Li, Y. Hypoglycemic activities of A- And B-type procyanidin oligomer-rich Extracts from different cinnamon barks.Phytomedicine 2011, 18, 298-302.
[17] Giribabu, N.; Karim, K.; Kilari, E.K.; Salleh, N. Phyllanthus niruri leaves aqueous extract improves kidney Functions, ameliorates kidney oxidative stress, inflammation, fibrosis and apoptosis and enhances kidney Cell proliferation in adult male rats with diabetes mellitus. J. Ethnopharmacol. 2017, 205, 123–137.
[18] Shabeer, J.; Srivastava, R.S.; Singh, S.K. Antidiabetic and antioxidant effect of various fractions of Phyllanthus Simplex in alloxan diabetic rats. J. Ethnopharmacol. 2009, 124, 34–38.
[19] Giribabu, N.; Karim, K.; Kilari, E.K.; Salleh, N. Phyllanthus niruri leaves aqueous extract improves kidney functions, ameliorates kidney oxidative stress, inflammation, fibrosis and apoptosis and enhances kidney cell proliferation in adult male rats with diabetes mellitus. J. Ethnopharmacol. 2017, 205, 123–137.
[20] Mancha-Ramirez, A.M.; Slaga, T.J. Ursolic acid and chronic disease: An overview of ua's effects on prevention And treatment of obesity and cancer. In Advances in Experimental Medicine and Biology. Anti-Inflammatory Nutraceuticals and Chronic Diseases; Gupta, S.C., Prasad, S., Aggarwal, B.B., Eds.; Springer International
[21] Den Hartogh, D.J.; Tsiani, E. Antidiabetic properties of naringenin: A citrus fruit polyphenol. Biomolecules 2019, 9, 99
[22] Christodoulou, M.; Tchoumtchoua, J.; Skaltsounis, A.; Scorilas, A.; Halabalaki, M. Natural alkaloids intervening the insulin pathway: New hopes for anti-diabetic agents? Curr. Med. Chem. 2019.
[23] Huang, S.H.; Lin, G.J.; Chu, C.H.; Yu, J.C.; Chen, T.W.; Chen, Y.W.; Chien, M.W.; Chu, C.C.; Sytwu, H.K.Triptolide ameliorates autoimmune diabetes and prolongs islet graft survival in nonobese diabetic mice. Pancreas 2013, 42, 442–451
[24] DeFronzo, R.A. Pharmacologic therapy for type 2 diabetes mellitus. Ann. Intern. Med. 1999, 131, 281–303. Inzucchi, S.E. Oral antihyperglycemic therapy for type 2 diabetes—Scientific review. JAMA 2002, 287,360–379