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Review Article

A REVIEW ON AYURVEDIC PROSPECTIVE AND CURATIVE HERBS FOR TYPE II DIABETES

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ABSTRACT

Diabetes is a metabolic disorder which is affecting million people all over the world. Maharishi *Charak* described *Prameharoga* (20 types) ; and its one type is "*Madhumeha* " having almost identical clinical feature of diabetes type II. Author taken detail review of available data for more than 2000 herbs and has collected various references/research work done by various scientist for pharmacological screening of anti-diabetic herbs through latest available In-vivo studies. And concluded 53 herbs have significant anti diabetic activity in different pharmacological in vivo model. Further for validation of modern research outcome authors had done extensive survey of most applicable herbal text book of Auyrveda" *Bhavprakash Nighantu*" and Ayurvedic pharmacopeia of India part I volume I to VIII that has widely used by various stake holders of Ayurvedic industry, academia and students. Authors sorted about 25 Ayurvedic single drugs from reference mentioned above for their "*Pramehaghna* activity". There is ample scope to trace out other single and compound drugs for cure of diabetes mellitus type II. Author's also mentioned here some selected famous Ayurvedic compound and single drug that has been successfully used by Ayurvedic physicians in last 5 decades. Research community need to explore possibility to invent new drugs for management DM Type II like currently AYUSH 82 (Developed by CCRAS & it has marketed in various trade name like right sugar, Diavit 82, DB6, IME 9) and BGR 34 (Developed by CSIR/NBRI) proven as very effective drug in the treatment of DM type II; hence research community of *AYUSH* system of medicines may explore the new era for NPD (new drug Development).

INTRODUCTION

The diabetes capital of the world with as many as 50 million people suffering from type-2 diabetes, India has a challenge to face. However, medical experts feel that timely detection and right management can go a long way in helping patients lead a normal life. Diabetes might be one of the most talked about diseases across the world and especially in India, but awareness about the same can well be estimated by the fact that India today has more people with type-2 diabetes (more than 50 million) than any other nation [1].

Diabetes[2], considered still as a mystery disease, is fast becoming a global problem. Diabetic population according to the statistical evaluation till 1974 shows that there are 130 million known diabetics all over the world. While quoting on incidental rate of diabetic population, in India, figure of known diabetics exceed 10 million undetected cases of diabetics in addition. In other countries like Japan and Canada the rate of incidence is 50 out of 1000, while in U.K it is 15 out of 1000. In U.S.A there are about 5 to 6 million diabetics. Moreover about 6 percentage of the population is subjected to the attack of the disease annually.

Diabetes is rapidly increasing worldwide and affecting all parts of the world· It is a metabolic disorder which is affecting million people all over the world. There are biguanides and sulphonylureas etc. are available in synthetic medicines but due to side effects herbal drugs are preferred over synthetic medicines. Many herbs possess remarkable antidiabetic property. A wide range of herbs are described below:

Prameha **[3]:** Maharishi *Charak* described *Prameha roga* (20 types); and its one type "*Madhumeha* " having almost identical clinical feature of diabetes type II.

The word '*Prameha'* consist two sub-words. i.e., '*Pra'* and '*Meha*'. The word *Meha* is derived from the root "*MihSecane* by adding '*Lue' Pratyaya* to it "*Mehati, Sinchati Mutraretansi*" which means to excrete (Halayudhakosha). *Rigveda* mentioned this word first is *Mehanadthanam Karanallium*. The commentator of Rigveda. Shayanacharya interpreted the word *Mehana* as *Medhra*, which denotes to *Shishna* (male genital organ). In Sanskrit literature The '*Mih*' is used to denote, to make water, to wet, to emit semen in reference to disease of human body, so this root '*Mih*' is added to prefix *'Pra'* which mean the passing of urine in excess by in both term quantity and frequency and it becomes '*Prameha'*

Types *Prameha* are 20 in number.

Prameha can be classified According to *Doshas* under:

1. *Kaphaja* (10)
2. *Pittaja* (6)
3. *Vataja* (4)

***Madhumeha*:** one type of *Vataj meha* known as *Madhumeha*. It can be consider diabetes mellitus type II as per similarity in clinical picture of both disease. Acharya *Charaka* explained that the roughness of aggravated *Vata dosha* transforms the sweet taste (of *Ojas*) into astringent taste and expels out along the urine. Thus, causes *Madhumeha*. Urine with astringent mixed sweet taste, pale colour and unctuousness are the features of this condition. *Acharya Vagbhata* opines that all *Pramehas* if neglected or not treated properly, ultimately they reach the terminal stage -*Madhumeha*. *Acharya Charak & Vagbhat* described it with the name of *Madhumeha* and *Maharishisushruta* mentioned it as *Kshadrameha.*

Chikitsa*: "Sarvatha kriya yoge nidanam parivarjanm"- Acharya vagbhatt.*

- *Nidana-Parivarjana*
- *Sthula, Balavana Pramehi: Samshodhana*
- *Krisha, Durbala Pramehi: Samshamana*

Herbs Screened by Pharmacologically for Anti diabetic activity.

Author has searched about the in-vivo research activity of various herbs available as secondary data in various research portals and journals and done extensive compilation which is shown below.

1. *Aegle marmelos*

Studies shows that aqueous extract of leaves of Bel improves digestion and reduces blood sugar and urea, serum cholesterol in alloxan induced diabetic rats as compared to control.[4]

2. *Allium cepa*

This herb showed hypoglycemic activity in diabetic rabbits. Some studies shows that the activity lies in sulphur containing amino acid of onion.[5,6,7]

3. *Allium sativum*

Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells. S-allyl cystein sulfoxide the precursor of allicin and garlic oil, is a sulfur containing amino acid, which controlled lipid peroxidation better than glibenclamide and insulin. It also improved diabetic conditions.[8]

4. Aloe vera and Aloe barbadensis

Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats[9] Treatment with exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxan induced diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats.

5. Azadirachta indica

Hydroalcoholic extracts of this plant showed hypoglycemic activity in streptozotocin treated rats and this effect is due to increase in glucose uptake and glycogen deposition in isolated rat cells.[10,11]

6. Biophytum sensitivum (Oxalidaceae)

Leaf extract of the *Biophytum sensitivum* stimulates pancreatic beta cells to release insulin in diabetic male rabbits thus exerts hypoglycemic activity.[12]

7. Boerhaavia diffusa (Nyctaginaceae)

Chloroform extracts of leaves of *Boerhaavia diffusa* showed antidiabetic activity in streptozotocin induced diabetic rats which mainly act by reducing blood glucose level and increasing insulin sensitivity.[13]

8. Bougainvillea spectabilis (Nyctaginaceae)

The blood glucose lowering potential of ethanolic leaf extract of *Bougainvillea spectabilis* in streptozotocin-induced type I diabetic albino rats was due to increased glucose uptake by enhanced glycogenesis in the liver and also due to increased insulin sensitivity.[14]

9. Brassica nigra (Cruciferae)

Oral administration of aqueous extract of *Brassica nigra* for two months decreased serum glucose level, which was due to the release of insulin from pancreas.[15]

10. Caesalpinia bonducella

The aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. These extracts also increased glycogenesis thereby increasing liver glycogen content.[16]

11. Capparis decidua

This is found throughout India, especially in dry areas. Hypoglycemic effect was seen in induced diabetic rats when the rats were fed with 30% extracts of *Capparis decidua* (*C. decidua*) fruit powder for 3 weeks. This extract also reduced alloxan induced lipid peroxidation significantly in erythrocytes, kidney and heart. *C. decidua* was also found to alter superoxide dismutase and catalase enzyme levels to reduce oxidative stress.[17]

12. Coccinia indica

Dried extracts of *Coccinia indica* (*C. indica*) (500 mg/kg body weight) were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipoprotein lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics.[18]

13. Cinnamon zeylaniucm (Lauraceae)

In vitro incubation of pancreatic islets with cinnamaldehyde isolated from *Cinnamon zeylaniucm* resulted in enhanced insulin release. The insulinotropic effect of cinnamaldehyde was due to increase in the glucose uptake through glucose transporter (GLUT4) translocation in peripheral tissues.[19,20]

***14.* Caffeine**

Treatment with 0.01% caffeine solution in 90% diabetic rats (pancreas removed) for 12-week reduced body weight, fats, and decreased insulin resistance. At the same time caffeine also enhanced glucose-stimulated first- and second-phase insulin secretion and beta-cell hyperplasia.[21]

15. Camellia sinensis (Theaceae)

Epigallocatechin gallate, present in *Camellia sinensis* increases insulin activity and prevents oxidative damages in streptozotocin induced diabetic rats[13]. Lower dose of *Camellia sinensis* on rats fed with high fat diet for 2 weeks showed insulinotropic effect in experimental condition.[22]

16. Capsicum frutescens (Solanaceae)

Capsicum frutescens increased serum insulin concentration in a high-fat (HF) diet-fed streptozotocin induced type 2 diabetes rats after 4 weeks treatment. The data of this study suggest that 2% dietary *Capsicum frutescens* is insulinotropic rather than hypoglycemic in the experimental methods[23]

17. Catharanthus roseus (Apocyaceae)

Dichloromethane-methanol extract of leaves and twigs of *Catharanthus roseus* in carbohydrate metabolism, showed to enhance secretion of insulin. The extract was also found to be helpful in prevention of damage caused by oxygen free radicals.[13]

18. Citrullus colocynthis (Cucurbitaceae)

Citrullus colocynthis pulp extract at 300 mg/kg, p.o. was found to significantly increase insulin and decrease plasma glucose levels in alloxan induced diabetic rats. Immunohistochemistry procedure showed that the amount of insulin in beta-cells of the islets of Langerhans is greater in *Citrullus colocynthis* treated-diabetic rats in comparison to the control group.[24]

19. Coccinia indica (Cucurbitaceae)

Oral administration of dried extract of *Coccinia indica* at 500 mg/kg, p.o. for 6 weeks significantly increased insulin concentration in a clinical study. The plant extract showed to exert beneficial hypoglycemic effect in experimental animals and human diabetic subject possibly through an insulin secreting effect or through influence of enzymes involved in glucose metabolism.[25]

20. Cornus officinalis (Cornaceae)

Methanol extract and its fractions had potent insulin mimic activity on phosphoenolpyruvate carboxykinase expression. The ability of fractions to protect beta-cell against toxic challenge, and to enhance insulin secretion strengthens trole of *Cornus officinalis* in diabetes therapy.[26]

21. Elephantopus scaber (Asteraceae)

The acetone extract of *Elephantopus scaber* showed a significant decrease in blood glucose level by improving insulin sensitivity, augmenting glucose dependent insulin secretion and stimulating the regeneration of islets of Langerhans in pancreas of STZ-induced diabetic rats.[27]

22. Enicostemma littorale (Gentianaceae)

Aqueous extract of *Enicostemma littorale* induced serum insulin levels in alloxan-induced diabetic rats at 8 h was associated with potentiation of glucose-induced insulin release through K^+-ATP channel dependent pathway.[28]

23. Ephedra distachya (Ephedraceae)

The alkaloids of *Ephedra distachya* herbs and l-ephedrine have shown antihyperglycemic effect in diabetic mice due to regeneration and restoration of atrophied pancreatic islets that induces the secretion of insulin.[29]

24. Eriobotrya japonica (Rosaceae)

Aqueous extract of *Eriobotrya japonica* and the compounds cinchonain Ib, procyanidin B-2, chlorogenic acid and epicatechin, were tested for insulin secretory activity in INS-1 cells, showed significantly increase of insulin secretion from INS-1 cells in dose-dependent manner.[30]

25. Euccalyptus globulus (Myrtaceae)

Aqueous extract of *Euccalyptus globulus* (0.5 g/L of solution) increased peripheral glucose utilization in the mouse abdominal muscle and increased insulin secretion from the clonal pancreatic beta cell line.[31]

26. Eugenia jambolana (Myrtaceae)

Effect of *Eugenia jambolana* seeds extract in isolated pancreatic islet cells of normal and diabetic animals was investigated and found that it enhances insulin secretion from cells. *Eugenia jambolana* extract also inhibited insulinase activity from liver and kidney.[22,31,32]

27. Ficus bengalensis (Moraceae)

The oral administration of the extract of *Ficus bengalensis* caused enhanced serum insulin levels in normoglycaemic and diabetic rats. The increased insulin secretion is mainly due to inhibited insulinase activity from liver and kidney.[34, 35]

28. Fermented unsalted soybeans

Effect of fermented unsalted soybeans in 90% pancreatectomized diabetic rats for 8-week enhanced insulin secretion. In addition, Chungkookjang potentiated insulin/IGF-1 signaling in islets *via* the induction of insulin receptor substrate-2 expression, leading to increased pancreatic duodenal homeobox-1, insulin promoter transcription factor. In parallel with the enhancement of the signaling.[35]

29. *Genistein*

Genistein increases insulin secretion in both insulin-secreting cell lines (INS-1 and MIN6) and mouse pancreatic islets. It was found that genistein directly acts on pancreatic beta-cells, leading to activation of the cAMP/PKA signalling cascade to exert an insulinotropic effect.[36]

30. *Ginkgo biloba* (Ginkgoaceae)

Effect of *Ginkgo biloba* extract in humans and healthy rats shows that *Ginkgo biloba* significantly increased the insulin concentration.[37]

31. Radix glycyrrhizae (Fabaceae)

Radix glycyrrhizae and glycyrrhetinic acid enhanced glucose-stimulated insulin secretion in isolated islets. In addition, they induced mRNA levels of insulin receptor substrate-2, pancreas duodenum homeobox-1, and glucokinase in the islets, which contributed to improve beta-cell viability.[38]

32. Gymnema sylvestre (Asclepiadaceae)

Alcoholic extract of *Gymnema sylvestre* stimulated insulin secretion from the rat islets of Langerhans and several pancreatic beta cell lines. In another study, oral administration of a water-soluble leaves extract of *Gymnema sylvestre* at 400 mg/day, p.o. to 27 IDDM patients on insulin therapy lowered fasting blood glucose and insulin requirements.[39]

33. Helicteres isora (Sterculiaceae)

Antihyperglycemic activity of butanol extracts of root of *Helicteres isora* at 250 mg/kg, p.o. in glucose loaded rats acts through insulin-sensitizing activity. [40]

34. Hordeum vulgare (Gramineae)

The germinant fruits of *Hordeum vulgare* showed hypoglycemic and hyperinsulinemic effects in NIDDM subjects, due to mobilization of insulin in NIDDM, which makes it a suitable cereal for diabetes mellitus.[41]

35.Mangifera indica (Mango)

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of *Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of absorption of glucose. [42]

36. Momordica charantia (Bitter gourd)

Momordica charantia is commonly used as an antidiabetic and antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycemic effect in various animal models. Polypeptide p, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously to langurs and humans.[43]

37. Medicago sativa (Fabaceae)

Aqueous extract of *Medicago sativa* evoked stimulation of insulin secretion from the BRIN-BD11 pancreatic beta cell line *in vitro*. In another study it was found that insulin releasing activity of the methanol and water fractions is mainly due to the cumulative effect of its constituent present in it.[44,45]

38. Mucuna pruriens (Leguminosae)

Blood glucose lowering activity of powdered seeds of *Mucuna pruriens* was observed at 0.5, 1 and 2 g/kg, p.o. in normal rabbits as well as 1 and 2 g/kg, p.o. in alloxan-diabetic rabbits. It possibly acts through stimulation of the release of insulin or by a direct insulin-like action due to the presence of trace elements like manganese, zinc, etc.[46]

39. Nigella sativa oil (Ranunculaceae)

Significant decreases in blood glucose level, and increase in serum insulin level were observed on treatment with *Nigella sativa* oil for 4 weeks. Immunohistochemical staining of pancreas from *Nigella sativa* oil-treated group showed large areas with positive immunoreactivity for the presence of insulin.[47]

40. Ocimum sanctum (holy basil)

It is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. [48]

41. Phyllanthus amarus (Bhuiawala)

It is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly known as Bhuiamala. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. Traditionally it is used in diabetes therapeutics. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats.[49]

42. Pterocarpus marsupium

It is a deciduous moderate to large tree found in India mainly in hilly region. Pterostilbene, a constituent derived from wood of this plant caused hypoglycemia in dogs showed that the hypoglycemic activity of this extract is because of presence of tannates in the extract.[50,51]

43. Panax ginseng (Araliaceae)

Ginseng polypeptides isolated from the root of *Panax ginseng*, when injected subcutaneously at daily doses of 50 and 100 mg/kg for 7 successive days in mice resulted in decreased blood glucose, increased liver glycogen level and stimulated insulin secretion. The aqueous ethanolic extract of Korean red ginseng significantly evoked a insulin release in a glucose-independent manner.[52]

44. Parinari excelsa (Chrysobalanaceae)

Flavonoid of *Parinari excelsa* showed hypoglycemic effect due to the ability of insulin secretory activity in the diabetic animal models.[53]

45. Prunella vulgaris (Labiatae)

Jiangtangsu had been isolated from *Prunella vulgaris* and confirmed to have a remarkable blood sugar lowering effect in diabetic mice. The possible mechanism of Jiangtangsu is to repair cells of pancreatic islet to release insulin.[54]

46. Psidium guajava (Myrtaceae)

Flavonoid glycosides such as strictinin, isostrictinin and pedunculagin are the effective constituents of *Psidium*

guajava, which have been used in clinical treatment of diabetes due to improved sensitivity of insulin.[55]

47. Syzygium cumini (Rutaceae)

Oral administration of pulp extract of the fruit of *Syzygium cumini* to normoglycemic and STZ induced diabetic rats showed hypoglycemic activity in 30 min possibly mediated by insulin secretion and inhibited insulinase activity.[56]

48. Stevia rebaudiana (Asteraceae)

Effect of stevioside in isolated mouse islets and the clonal beta cell line INS-1 was investigated and found that glycoside stevioside exerts antihyperglycaemic, insulinotropic, and glucagonostatic actions in the type 2 diabetic GK rat.[57]

49. Swertia chirayita (Gentianaceae)

Hexane fraction of *Swertia chirayita* at 250 mg/kg, p.o. to normal rats significantly reduced blood sugar and increased plasma insulin without influencing hepatic glycogen content. However, when administered for 28 days, it significantly increased hepatic glycogen content in conjunction with other effects probably by releasing insulin.[58]

50. Trigonella foenum graecum (fenugreek)

It is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans.[59,60]

51. Tabernanthe iboga (Apocynaceae)

The effect of an aqueous extract of *Tabernanthe iboga* augmented glucose-stimulated insulin secretion in a dose-dependent manner. *Tabernanthe iboga* contains water soluble insulinotropic compounds. The insulin secretary effect of *Tabernanthe iboga* might involve the closure of K^+-ATP and the intensification of calcium influx through voltage-sensitive Ca^{2+} channels.[61]

52. Teucrium polium (Lamiaceae)

Aqueous extract of *Teucrium polium* crude extract is able to enhance insulin secretion through enhancing insulin secretion by the pancreas.[62]

53. Tinospora crispa (Menispermaceae)

Antihyperglycaemic effect of *Tinospora crispa* extract is probably due to the stimulation of insulin release *via* modulation of beta-cell Ca^{2+}concentration.[63]

Ayurvedic perspective of above screened drugs

Authors has taken details literature survey regarding find out *Prameghana* drugs (may correlated anti diabetic) properties or uses from Famous *Ayurvedic dravya guna* text book "*Bhavprakash Nighnatu* and Authorized Ayurvedic pharmacopeia of India (API pat I volume I to VIII, Published Ministry of Ayush, Govt of India): which has wildly used by various stack holder of Ayush system of medicines, Industry and academia to find out whether the latest research outcome is mentioned in any form of theses classical books of *Ayurveda*. The following Ayurvedic properties or uses are described in *Ayurveda* for above screened drug list as.

Anti-diabetic herbs in Ayurvedic Perspective

S.No.	Latin Name of the Medicinal Plant	Sanskrit Name	Bhavprakash Nighantu Properties/ Uses	The Ayurvedic Pharmacopeia of India (API, part I volume I to VIII) Properties/Uses
1.	*Aegle marmelos*	*Bilva*	*Madhumeha*	*NA*
2.	*Azadirachta indica*	*Nimba*	*Prameha*	*Prameha*
3.	*Coccinia indica*	*Bimbi*	*Madhumeha*	*NA*
4.	*Citrullus colocynthis*	*Indravaruni*	*Prameha*	*Prameha*
5.	*Coccinia indica*	*Bimbi*	*Madhumeha*	*NA*
6.	*Elephantopus scaber*	*Gojiva*	*Prameha*	*NA*
7.	*Eugenia jambolana*	*Jamun*	*Madhumeha*	*NA*
8.	*Eugenia jambolana*	*Jamun*	*Madhumeha*	*NA*
9.	*Ficus bengalensis*	*Nygrodha*	*Prameha*	*Prameha*
10.	*Gymnema sylvestre*	*Meshshringi*	*Prameha*	*Prameha*
11.	*Helicteres isora*	*Marodphali*	*Madhumeha*	*NA*
12.	*Hibiscus rosa sinensis*	*Japa*	*Prameha*	*NA*
13.	*Hordeum vulgare*	*Yava*	*NA*	*Prameha*
14.	*Mangifera indica*	*Amra*	*Prameha*	*Prameha*
15.	*Momordica charantia*	*Karbellak*	*Prameha*	*Prameha*
16.	*Momordica charantia*	*Karvellak*	*Prameha*	*Prameha*
17.	*Phyllanthus amarus*	*Bhumyamalki*	*NA*	*Prameha*
18.	*Pterocarpus marsupium*	*Vijaysar*	*Prameha*	*Prameha*

19.	*Pterocarpus marsupium*	*Vijaysara*	*Prameha*	*Prameha*
20.	*Syzygium cumini*	*Jamun*	*Madhumeha*	*Udakmeha, Madhumeha*
21.	*Swertia chirayita*	*Chiraita Karva*	*NA*	*Meha*
22.	*Trigonella foenum graecum*	*Methika*	*Madhumeha*	*Prameha*
23.	*Tinospora cordifolia*	*Guduchi*	*Prameha*	*Prameha*
24.	*Tribuluks terrestris*	*Gokshur*	*Prameha*	*Prameha*
25.	*Trigonella foenum-graecum*	*Methika*	*Madhumeha*	*Madhumeha*

NA- Ref. of such anti diabetic properties not found in selected Ayurvedic text

Single drugs formulations mentioned in *Madhumeha*

1. *Amalaki-Pramehahar param* (Bhav prakash Nighantu)

2. *Suddha shilajeet (Asphalatum punjabicum)- Prameha Naimitik Rasaya* (Maharishi Sushruta).

3. *Nisa* (*Curcuma Longa*) *& Amalaki*- Single drug therapy described by "Acharya/Vagbhat" in "Ashtang sangrah" sutra sthan.

4. Above single drugs 1 to 25 mentioned in table may be used as *Ayurvedic* remedy for *Prameha/ Madhumeha.*

Compound formulations mentioned in *Madhumeha*[64]

1. T. *Chandraprabha*, 500 mg twice a day with water/ milk (S.S.Ma.K.).

2. T. *Vasant kusumakara Ras*, 125 mg twice a day with Honey (R. S. Rasayana Vajikarana Adhikara).

3. *Brihat vangeswara Rasa,* 125 mg twice a day with *Ajadugdha/Godugdha* (B. R. Prameha cikitsa).

4. *Nisamalaki Vati*, 500 mg trice a day with *Triphala Kasaya* (A. H. Prameha Cikitsa).

5. *T. Mehari Ras* (V*angabhasma, parada bhasma and Rasasindura)* - 125 mg twice a day with *Ajadugdha/ Godugdha*.

6. T. *Meghanada Rasa* (Purified *Parada*, *Gandhaka,* oxides of *Kanta loha, Teekshna loha* and *Swarnamakshika*, *Shilajatu, Manashila, Triphala* and *Haridra*. Prepared with *Bhringaraj* juice), 125 mg twice a day with *Ajadugdha/ Godugdha.*

7. *Mauktika Kamadugha*, 125 mg twice a day with *Ajadugdha/ Godugdha.*

8. *Praval bhasma*, 100 mg twice a day.

9. Mehmudgara (BR), 125 mg twice a day.

10. T. *Suvarnamalini vasant ras* (Ay.SS), 125 mg once a day.

11. *Tarakeshwara Rasa* (BR), 125mg twice a day with *Ajadugdha/ Godugdha* (page 65 – Impcops Therapeutic index).

12. T. *Suvarna vangaraja*, 125 mg twice a day (Dr Subhas Rana KC text book).

13. T. *Arogyavardhini,* 500 mg twice a day.

14. *Trivanga bhasma*, 100 mg twice a day.

15. T. *Apurvamalini vasanta,* 100 mg twice a day (BR)

Medicated Ghee

1. *Dhanvantara ghrita* 5 to 10 gm/day (Bhavapraksh page 496).
2. *Dadimadya ghrita* 5 to 10 gm/day (Bhavapraksh page 494).
3. *Sinhamrita ghrita* 5 to 10 gm/day (Bhavaprakash page 496).

Avaleha

1. *Saraleha*: (Bhavaprakash): Prepare decoction of asana (*Pterocarpus marsupium*), *Khadira, Babbula* and *Bakula* (*Mimusops elengi*). During boiling add oxides *of tamra* and *Loha* and powders of *Amalaki, Danti, Lodhra and Priyangu.* This is useful for all types of *Prameha*. Dose: 3to 5 mg / day.

2. *Gokshuradyavaleha* (Bhavaprakash): prepare decoction of Gokshura and add *Trikatu, Nagakeshara, Cinnamon, Ela, Jatipatra and Vamshalochana*. This is also useful in all types of Pramehas. Dose: 3to 5 mg / day.

Ayurvedic *Kwatha* (decoction)

(1)*Darvi, Surahwa, Triphala, Musta.*

(2)*Triphala, Darvi, Vishala, Musta*. Composition of the above two decoctions are same except for one drug. The first contains *Surahwa (Devadaru*) and the second contains *Vishala*. *Vishala* is drastic purgative and so can be used in constipated persons. The dose and duration of therapy, *Pathya– Apathya* (wholesome and unwholesome) may be conveniently decided by the physician on case to case basis on Ayurvedic parameters.

(3) *Phalatrikadi Kwath (Prameha adhikar)*

Research products

1.Ayush -82 (CCRAS) also this product marketed through NRDC with deferent name by the private Ayurvedic drug manufacturing companies by rigorous marketing strategy eg. IME -9, Right Sugar, Diavit etc.

2. BGR 34 developed by CSIR-NBRI marketing by Amil Pharmaceuticals.

3. M Diacare cap developed by IMPCL.

4. *Mammanjak* Capsule Used by CCRAS in NPCDS program.

CONCLUSION

After extensive search from various research portals about the in-vivo activity of herbs against diabetes and after collecting the Ayurvedic references of the same drugs we can conclude that herbs mentioned as *Pramehaghna* has proven antidiabetic activity. The plants which did not have antidiabetic activity in Ayurvedic literature have its variants mentioned in classics and other authoritative books showing antidiabetic activity. This work will facilitate coming research scholars, stake holders and students to initiate further research on the drugs mentioned in Ayurvedic literature for its antidiabetic activity. It also help to formulate new

formulations from above mentioned drugs and also validate the neo formulations with the in-vivo studies mentioned in the studies adopted above. This fact is concluded by exhaustive survey on various herbs in literature that these herbs should be taken for preparation of effective herbal therapeutic agent. Research community need to explore possibility to invent new drugs for management DM Type II like currently AYUSH 82(Developed by CCRAS & it has marketed in various trade name like right sugar, Diavit 82, DB6, IME 9) and BGR 34(Developed by CSIR/NBRI) proven as very effective drug in the treatment of DM type II; hence research community of *AYUSH* system of medicines may explore the new era for NPD (new drug Development).

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