DIABETES MELLITUS- MANAGEMENT THROUGH AYURVEDA HERBS

*1Pratibha 2Jaggi Sagarika 3 Rana Abhishek

1Assistant professor, Department of Dravyaguna, Sri Ganganagar college of Ayurvedic Science and Hospital, Tantia University, Sriganganagar, Rajasthan
2Assistant professor, Department of Ayurveda Samhita & Sidhanta, Sri Ganganagar college of Ayurvedic Science and Hospital, Tantia University, Sriganganagar, Rajasthan
3Associate Professor, Department of Roga Nidana, Sri Ganganagar college of Ayurvedic Science and Hospital, Tantia University, Sriganganagar, Rajasthan

*Corresponding Author: Dr. Pratibha, Department of Dravyaguna, Sri Ganganagar college of Ayurvedic Science and Hospital, Tantia University, Sriganganagar, Rajasthan

ABSTRACT
Diabetes mellitus has now become most common among all the diseases in present era. In India, this disease is increasing very fast and it seems that India is going to be capital of diabetes in next coming years. It can be correlated with Madhumeha in Ayurveda. In Charaka samhita, Madhumeha has been described as a type of Vataja prameha which is characterized by passing of honey like urine in excess amount. Diabetes mellitus is a chronic medical condition associated with abnormally high level of sugar and can last a life time. Over time, diabetes mellitus can lead to blindness, kidney failure, nerve damage and atherosclerosis, leading to strokes, coronary heart diseases, and other blood vessel diseases in the body. Modern system of medicine is successful in preventing diseases of infective origin but it is difficult to prevent lifestyle diseases alone with it. As Ayurveda is recognized as foremost life science and describes ways to prevent and manage lifestyle disorders. Diabetes mellitus can be prevented and better managed by principles of Ayurveda. Some herbal medications showing antidiabetic effects bring into being varying effects on the blood sugar levels with minimal side effects. Some important herbal drugs which have antidiabetic activity like as (Meshshringi) Gymnema sylvestre, (Karvellaka) Momordica charantia, (Methika) Trigonella foenum graecum, (Beejaka) Pterocarpus marsupium etc.
Keywords: Lifestyle diseases, Madhumeha, Diabetes mellitus, antidiabetic activity

Introduction:
In India now a day’s life style of people has underwent drastic changes due to modernization, which leads to sedentary life style and unhealthy dietary habits such as fast food consumption etc. Result of which is that most of the people suffer from high blood pressure and diabetes mellitus commonly known as lifestyle disorders. The number of diabetics is projected to rise from 15 million in 1995 to 57 million by the year 2025 making it the country with the highest number of diabetics in the world.\textsuperscript{1} Diabetes is a metabolic disorder may result in deficiency or dysfunction of the insulin production. If dietary and lifestyle changes are adopted properly as described in Ayurvedic classic texts, we can prevent the disease. The main causative factor is said to be sedentary lifestyle and food habits. In Ayurveda it is described in vataja prameha, and can be correlated with Madhumeha which can be manage conservatively with exercise, diet and internal medication.\textsuperscript{2} Side effects of modern therapy for DM include- increased frequency of hypoglycemia, weight gain, increased economic cost. In Diabetes control and complications trial individuals with the greatest weight gain exhibited increases LDL cholesterol and Triglycerides as well as increase in B.P. this could increase the risk of CVD.\textsuperscript{3} Ayurveda provides better solutions in the management of Diabetes Mellitus.

Diabetes:
Diabetes is a metabolic disorder. Most of the food we eat is broken down by the digestive juices into a simple sugar called glucose. Glucose is the main source of fuel for the body. After digestion, the glucose passes into bloodstream where it is available for body cells to use for growth and energy. For the glucose to get into the cells, insulin must be present. When we eat, the pancreas is supposed to automatically produce the right amount of insulin to move the glucose from our blood into our cells. If body doesn't make enough insulin or the insulin doesn't work right, the sugar cannot get into the cells. It stays in the blood. This makes high levels of glucose (or sugar) in the blood (hyperglycemia). As a result, glucose builds up in the blood, overflows into the urine, and passes out of the body (glucosuria). Thus Diabetes is a chronic condition that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin.\textsuperscript{4}

Classification of diabetes:
Type 1 (IDDM) insulin dependent diabetes mellitus - Beta cell destruction, usually leading to absolute insulin deficiency.
- Immune mediated
- Idiopathic

Type 2 (NIDDM) Non-insulin dependent diabetes mellitus - Characterized by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production.

Other types of Diabetes
- Genetic defects of insulin action
- Genetic defects of β cells
- Exocrine diseases of pancreas
- Endocrinopathies
- Drug induced
- Gestational

Diagnosis of Diabetes mellitus:
- Patients complains of symptoms suggesting of diabetes
- Test urine and ketones
- Measure random blood sugar /fasting blood sugar

indications for oral glucose tolerance test
FBS: 6.1-7.0 mmol/L (110-126 mg/dL)
Random BS: 7.8-11.0 mmol/L (140-199 mg/dL)\(^5\)

Causes for diabetes in Ayurveda –

आस्थ्यसुखं स्वप्नसुखं दधीनं ग्राम्योदकानूपरसााः पयांस।
नवान्नपानं गुडवैकृतं च प्रमेहहेतुः कफकृच्च सववम्॥ (च.चि.6/4)

Sedentary lifestyle, lack of physical activities and exercise, excess sleeping, excessive consumption of Curds, flesh or meat soup of animals living in water and marshy regions, excessive consumption of milk, its derivatives, food, drinks and dishes prepared from new grains, jaggery, its derivatives and all foods and lifestyle activities which increase Kapha are the main causes of Prameha.

Pathophysiology:

Type-1 Diabetes (IDDM) - Autoimmune destruction- Pathologically, the pancreatic islets are infiltrated with lymphocytes (in a process termed insulitis). After all β-cells are destroyed, the inflammatory process abates, the islets become atrophic. The autoimmune destruction of pancreatic β-cells is leads to a deficiency of insulin secretion. This loss of insulin secretion that leads to the metabolic derangements associated with IDDM.
Type-2 Diabetes (NIDDM) - Type 2 diabetes is due to insufficient insulin production from beta cells in the setting of insulin resistance. Insulin resistance, which is the inability of cells to respond adequately to normal levels of insulin, occurs primarily within the muscles, liver, and fat tissue. In the liver, insulin normally suppresses glucose release. However, in the setting of insulin resistance, the liver inappropriately releases glucose into the blood. The proportion of insulin resistance versus beta cell dysfunction differs among individuals, with some having primarily insulin resistance and only a minor defect in insulin secretion and others with slight insulin resistance and primarily a lack of insulin secretion. Other potentially important mechanisms associated with type 2 diabetes and insulin resistance include: increased breakdown of lipids within fat cells, resistance to and lack of incretin, high glucagon levels in the blood, increased retention of salt and water by the kidneys, and inappropriate regulation of metabolism by the central nervous system. However, not all people with insulin resistance develop diabetes, since an impairment of insulin secretion by pancreatic beta cells is also required.  

Samprapti in Ayurveda:

The etiological factors aggravate Kapha, pitta, Meda and mansa and obstruct the normal pathway of vata. Agitated Vata carries the ojus to basti (urinary bladder) and manifest Madhumeha which is difficult for management. On the other hand, mental stress and strain, food, drinks and activities that increases the vata and dhatu kshaya causes aggravation of vata and leads to Madhumeha. These types of patients are generally emaciated. Madhumeha is incurable and caused by aggravation of vata. Naturally, ojas is of sweet taste. Due to the roughness of vata converts it into that of astringent taste and takes it into the urinary bladder; this causes Madhumeha (Diabetes mellitus) Patients pass urine, sweet and astringent taste, pale in color and unctuous. Madhumeha rog is arising by two ways:  
1. Aggravation of vata, due to dhatukshya  
2. Obstruction to the srotas (channels)

Symptoms:

- **Premonitory symptoms**  
In Ayurveda we can find the described of early symptoms of the disease. They are accumulation of dirt on the teeth (mouth, eyes, nose, and ears), a feeling of burning sensation in the palms and soles, stickiness of the skin all over the body, thirst and a sweet taste in the mouth etc., and mootra madhuryam (sweetness of urine).

- **Clinical symptoms**  
Prabhoota mutrata (Polyuria), Avila mutrata (Turbid Urine) and Medo dushti lakshanas are the main symptoms of prameha.

- **Main symptoms (Modern science):** Polyuria (Excessive urine), Polyphagia (Excessive hunger), Polydipsia (Excessive thirst), Exhaustion/Tiredness, Giddiness, Polyneuritis (Numbness/Tingling), Visual disturbance.

Complication of Diabetes mellitus:
Diabetes is a serious metabolic disorder with micro and macrovascular complications that result in significant morbidity and mortality. Diabetes increases the risk of long-term complications.

Acute Complications
- Diabetic Ketoacidosis (DKA)
- Hyperglycemic Hyperosmolar State (HHS)

Chronic Complications
- Microvascular- Eye disease Neuropathy
- Retinopathy
- Nephropathy
- Pulmonary oedema
- Macrovacular- Coronary Artery Diseases
- Peripheral vascular diseases
- Cerebral Vascular diseases

Conventional treatment of Diabetes Mellitus:
Management in Ayurveda:
Ayurveda clearly defines this disease and its line of treatment. This major disease can be managed by giving comprehensive attention to four aspects which are *Nidan Parivarjana, Ahara* (Diet), *Vihara* (exercise) and *Aushdha* (medicine). The role of *Ahara* and *Vihara* are equally or even more important to control blood sugar level as well as to prevent complications of this disease. According to Ayurveda, the line of treatment of *Madhumeha* is strictly based on individual’s constitution.

In general, *Vataja prameha* patients are advised to have *Bhrimhana* (i.e. medication and diet which increase *dhatus* in the body) along with *Shamana chikitsa*. In Obese Diabetic patient with optimal body strength having intense increase of *doshas*, bio-purification (*Shodhan chikitsa*) of the body is advised after *Snehana Karma* completion. This depends on *dosha* predominance. {*Kaphaja* are advised to have emetics, *Pittaja* are advised to have purgation.}

Diet:
The following are the articles of food which can be given to the diabetes. In all classics, *ahara dravyas* are described in detail and they cover all the food groups are:
1. **Cereals**: *Yava* (*Hordeum vulgare* - Barley) are the best, different preparations of food, prepared from Barley can be given. *Wheat* (*Godooma*) can also be given. *Rice*: - Ayurveda prescribed old rice (*purana shali*), as one of the cereals, which can be prescribed to the diabetic patients.
2. **Pulses**: *Mudga* (*Vigna radiata*), *Chanaka* (*Cicer arrietum Linn.*), *Kulattha* (*Dolichos biflorus*), *Adhaki* (*Cajanus cajan* - Pigeon pea) etc, can be taken.
3. **Vegetables**: All types of bitter vegetables (*Tikta shaka*) e.g. *Karela* (*Momordica charantia* - Bitter gourd), *Methi* (*Trigonella foenum-graecum*), *Patola* (*Vietnamese luffa*), *Rasona* (*Allium sativum* Linn. – Garlic), *Udumbara* (*Ficus racemosa*) etc. should be given.
4. **Fruits**: Jambu (Syzygium cumini), Amalaki (Phyllanthus emblica), Kapitha (Limonia acidissima - Wood Apple), Tala phala (Borassus flabellifer, Kharjura (Phoenix sylvestris)

5. **Seeds**: Kamala, Utpala seeds can be allowed to take.

**Life style recommendations:**

Some of the home and herbal remedies prescribed by Ayurveda are described below.

1. Include turmeric and cinnamon diets.
2. Avoid oily, fried and starchy foodstuffs.
3. Avoid coffee, sugar, refined flour and alcohol
4. Eat smaller meals (low fat diet) five to six times a day instead of having three large meals.
5. Increase intake of vegetables like spinach, cucumber, tomatoes, onion, sprouts, beans, garlic etc.
6. Refrain from taking stress.
7. Regular exercise. Walk for at least 40 minutes a day.
8. Avoid red meat and excessive salt in your meals.
9. Avoid white bread, rice, potatoes, sweet and sugary foods.

**Yoga and Exercise:**

Yoga improves all sorts of metabolism in the body. So diabetics should perform different types of yoga. Yoga will definitely help in Diabetes mellitus. Regular practice of matsyendrasana, Vajrasana, Yogmudra, Paccimottanasana, Sarvangasana, Halasana like asanas, Nadi Shuddhi Pranayama, Bhastrrika and Bhramari pranayaama and Kapaal bhati can prevent and improve the condition of Pramehi. Hard exercises are prescribed for diabetics and obese persons. In short for diabetics exercise serves the purposes of (1) Utilizing the fat (2) Metabolizing sugar fat, carbohydrates, and also proteins and consumes the glucose in the body.

**Some important single herbs:**

Ayurveda has a wide range of medicinal plants which have anti-diabetic activity like as Gymnema sylvestre, Momordica charantia, Trigonella foenum graecum, Pterocarpus marsupium etc.

Rational drug approach:

The drug individually or collectively should possess following properties-

1. **Kleda- shoshaka**
2. **Mutra-sangrahaniya**
3. **Mansa and Meda dhatu- karshak**
4. Stimulate **Sapta-dhatvagni**
5. Health restorative (**Balya** property)
6. Pacify **Kapha** and **Pitta**

- **Kleda- Shoshak, Mansa and Meda-Karshaka** property of drug can be viewed to act by reducing Insulin resistance either by reducing hepatic gluco-neogenesis or enhancing the action of insulin in target tissues. Stimulation of Sapta-dhatvagni can be viewed to act by stimulating Insulin secretion. Balya property helps to check patient bala and pacify Vata along with emaciation. By virtue of **Mutrasangrahaniya** property drug reduces excretion of Oja via urine. **Kapha-pitta** pacifying property further checks vitiation of **Vata** due to obstruction.
Based on the above rational drug approach following drug/group of drugs should be incorporated in the current management of Diabetes mellitus.¹³

1. **Meshasringi**: (Fig.1)
   - Latin name - *Gymnema sylvestre* R.Br.
   - Properties:
     - Rasa - Kashaya, Tikta
     - Guna- Laghu, Ruksha
     - Virya- Ushna
     - Vipaka- Katu
     - Doshaghnata- Kapha-Vataghna
   - Used Part- Leaves
   - Chemical constituents: Gymnemic acid, Gymnemine, Gymnemagenin, Gymnemasides, Anthraquinone compounds etc.

   **Action on Diabetes:**
   The ethanolic and aqueous extract of Gymnema sylvestre contain triterpene, gymnemic acids, gymnema saponins, gymnemasides. The extract of Gymnema sylvestre, is useful in controlling blood sugar to treat type-2 diabetes. It increases the insulin producing beta cells of pancreas and significantly reduces the metabolic effects of sugar by preventing the intestine from absorbing the sugar molecules during the process of digestion. Gymnema sylvestre regulates the blood sugar levels by increasing the enzyme activities affording the utilization of glucose by insulin dependent pathways. Thus Gymnema sylvestre corrects the metabolic derangements in the liver, kidney and muscles.¹⁴

2. **Karvellaka**: (fig.2)
   - Latin name – *Momordica charantia* Linn.
   - Properties:
     - Rasa- Tikta, Katu
     - Guna- Laghu, Ruksha
     - Virya- Sheeta
     - Vipaka- Katu
     - Doshaghnata- Kapha-Pittaghna
   - Part used- Fruit, Seeds
   - Chemical constituents- momordicin I & momordicin II, cucurbitacin B, Glycosides (momordin, charantin, charantosides, goyaglycosides), Terpenoid compounds- momordicinin, momordicilin, momordol.

   **Action on Diabetes:**
   *M. charantia* contains lectin that has insulin like activity due to its nonprotein specific linking toghther to insulin receptors. This lectin lowers blood glucose level by acting on peripheral tissues. Lectin is a major contributor to hypoglycemic effect. The possible modes of the hypoglycemic actions of *M. charantia* and its various extracts and compounds are its hypoglycemic effect, stimulation of peripheral and skeletal muscle glucose utilisation, inhibition of intestinal glucose uptake, inhibition of adipocyte differentiation, suppression of key gluconeogenic enzymes, stimulation of key enzyme of HMP pathway, and preservation of pancreatic islet cells and their functions.¹⁵
3. **Beejaka:** (fig.3)
Latin name – *Pterocarpus marsupeum*, Family- *Fabaceae*
Properties- Rasa- Kashaya, Tikta
  - Guna- Laghu, Ruksha
  - Virya- Sheeta
  - Vipaka- Katu
Doshaghnata- Kapha-Pittaghna
Part used- Heart wood
Chemical constituents: kinotannic acid, kino- red, k- pyrocatechin (catechol), resin & gallic acid. Marsupinol (−) Epicatechin, its active principle.

**Action on Diabetes:**
*Pterocarpus marsupium* is reported to have not only hypoglycemic property but also β-cell protective and regenerative properties, effects which have been attributed to the flavonoid content in the plant. Complete restoration of normal insulin secretion and regeneration of beta cells have been reported in various experimental models of diabetes. Epicatechin has been shown to have insulinogenic property by enhancing insulin release and conversion of proinsulin to insulin.\(^\text{16}\)

4. **Tvaka (Cinnamon):** (fig.4)
Latin name- *Cinnamomum zeylanicum* Blume, Family- Lauraceae
Properties- Rasa- Katu, Tikta, Madhura
  - Guna- Laghu, Ruksha, Tikshna
  - Virya- Ushna
  - Vipaka- Katu
Doshaghnata- Vata-Pittaghna
Part used- Stem bark, Oil
Chemical constituents: Cinnamaldehyde, eugenol, benzaldehyde, (−) epicatechin, cinnzeylanin, cinnamyl alcohol.

**Action on Diabetes:**
Cinnamon is used in the treatment of type II diabetes mellitus & insulin resistance. The antidiabetic effects of cinnamon bark have been shown in streptozotocin-induced diabetic rats. Several studies have also revealed that cinnamon extracts lower not only blood glucose but also cholesterol levels.\(^\text{17}\)

5. **Bimbi:** (fig.5)
Latin name –*Coccinia indica* Linn., Family- *Cucurbitaceae*
Properties- Rasa- Tikta
  - Guna- Laghu, Ruksha, Tikshna
  - Virya-Ushna
  - Vipaka- Katu
Doshaghnata- Kapha-Pittaghna
Part used- Fruit, Root, Leaf
**Action on diabetes:** The pectin isolated from the fruits of C.indica showed a significant reduction in blood glucose levels by decreasing the absorption level of glucose from the intestine, increasing the rate of liver glycogen and decreasing the glycogen phosphorylase.\(^{18}\)

6. **Methika:** (fig.6)
Latin name – *Trigonella foenumgraecum* Linn., Family- *Fabaceae*
Properties- Rasa-Katu
   - Guna- Laghu, Snigdha
   - Virya-Ushna
   - Vipaka- Katu
   - Doshaghnata- Kapha-vataghna
Part used- Seeds, Leaves
Chemical constituents: Steroidal saponins- diosgenin and gitogenin from seeds, tigogenin, trigonelloside, yomogenin, trigofoenosides. The nicotinic acid, alkaloid trogonelline, and coumarin contained by defatted section of the seed of fenugreek prove to be the responsible active ingredient for its anti-diabetic properties.

**Action on Diabetes:** Anti-hyperglycemic effect of the extracts, powder and gum of *Trigonella foenum-graecum* seeds and leaves have been linked to delayed gastric emptying caused by the high fiber content, inhibition of carbohydrate digestive enzymes and stimulation of insulin secretion. A specific amino acid, hydroxyisoleucine, which represents 80% of the free amino acids in *Trigonella foenum-graecum* seeds, may possess insulin-stimulating properties.\(^{19}\)

7. **Jambu:** (fig.7)
Latin name – *Syzygium cumini* Linn., Family- *Myrtaceae*
Properties- Rasa- Kashaya, Madhura, Amla
   - Guna- Laghu, Ruksha
   - Virya-Sheeta
   - Vipaka- Katu
   - Doshaghnata- Kapha-Pittaghna
Part used- Fruit, Phalasthi, Bark, Leaves
Chemical constituents: Jamboline glycoside, cyanidin diglycosides, \(\beta\)-sitosterols, myrsetine.

**Action on Diabetes:** The possible mechanism by which seed brings about a decrease in blood sugar level may be by potentiation of the insulin effect of plasma by increasing either the pancreatic secretion of insulin from cells of the islets of Langerhans or its release from the bound form.\(^{20}\)

8. **Haridra:** (fig.8)
Latin name – *Curcuma longa* Linn., Family- *Zingiberaceae*
Properties- Rasa- Tikta, Katu
   - Guna- Laghu, Ruksha
Virya-Ushna
Vipaka- Katu
Doshagnata- Kapha-vataghna
Part used- Rhizome
Chemical constituents: Curcumin, Curcuminone, eugenol, β-sitosterols.

**Action on Diabetes:** Curcumin active component of turmeric exhibits cholesterol lowering action and phospholipids that were elevated under diabetic condition in streptozotocin induced diabetic rats. It also showed significant countering of renal as well as liver cholesterol that can be corroborated with the *Ayurvedic* concept of *Meda-mansa karshaka* and *Kleda-Shoshaka* property of this herb.²¹

9. *Lashuna:* (fig.9)
Latin name – *Allium sativum* Linn., Family- *Liliaceae*
Properties- Rasa- *Sarva rasa* (*Amla varjita*)
         Guna- *Snigdha, Tikshna, Picchila, Guru*
         Virya- *Ushna*
         Vipaka- *Katu*
         Doshagnata- *Kapha-vataghna*
Part used- Rhizome, Oil
Chemical constituents: Allyl propyl sulphide, Diallyl disulphide, Allicin.

**Action on Diabetes:** Allicin, a sulfur-containing compound showed to have significant hypoglycemic activity due to increased hepatic metabolism, increased insulin release from pancreatic beta cells. S-allyl cystein sulfoxide (SACS), the precursor of allicin and garlic oil, stimulated *in vitro* insulin secretion from beta cells isolated from normal rats. The beneficial effects of SACS could be due to its antioxidant and secretagogues activity.²²

**Discussion:**
It has been found that the percentage of diabetic patients is rising sharply. Today’s man is looking towards *Ayurveda* in a search of perfect and safe treatment. Hence to get the perfect management of Diabetes mellitus without any side effects is a need of present time. As the Diabetes is novel for *Ayurveda*, different theoretical views are postulated to explore new theories of pathophysiology and managements on the logical basis in *Ayurvediya* parlance. *Prabhootta mutrata* (Polyuria), *Avila mutrata* (Turbid Urine) and *Medo dushti lakshanas* are the main symptoms of *Madhumeha* in *Ayurveda*. The classic symptoms of untreated diabetes are loss of weight, polyuria, polydipsia and polyphagia. According to *Ayurveda* the line of treatment of *madhumeha* is strictly on individual’s constitution. It is based on an entire change in the lifestyle of the person, along with medication and diet, the patient is also advised to lead a
healthy lifestyle and live an active life. Even mental aspects of the disease are stressed. There are number of herbs which are used as home remedies for common ailments. Such herbs are easily available, eco-friendly, cost effective and toxicity free due to holistic approach. Different research works had been carried out to evaluate efficacy of these herbs. The majority of the drugs performing antidiabetic action are predominant in Tikta Rasa (bitter taste); Katu Rasa (pungent taste); kashaya Rasa (Astringent taste); Katu Vipaka (pungent metabolism); Laghu- Ruksha Guna (light and rough property) and Ushna Veerya. Such kinds of properties of the drugs are responsible for Sroto-shodhana (purification of channel) & Sroto-vivarana (dilatation of channel) action which in turn reduce diabetes. Kaphaharathwa and associated Dosha samakatwa, medonashaka (fat metabolism) properties are having a vital role in controlling the Diabetes.

**Conclusion:**

It can be concluded that Ayurveda provides better solutions in the form of proper dietary management, lifestyle advises panchakarma like detoxification and bio-purification procedures, yoga, rejuvenation therapies and there are many single herbs and herbal formulations suggested for better management in Madhumeha. They are safe because these drugs will not be lead to hypoglycemic episodes. Commonly used herbs like Meshashringi, Karvellaka, Beejaka, Tvaka, Bimbi, Methika, Jambu, Haridra, Lashuna etc. have proved significant role for combating this dreadful disease. Additional benefit of Ayurvedic management is absence of hazardous effects which is very important in view of the global acceptance of Ayurveda.

**References**

2. Tamboli Wasim Karim, Khabia Pratibha, Therpeutic and preventive aspect of diabetes mellitus through Ayurveda, diet and yoga – A brief review, IAMJ: Volume 3; Issue 8; August- 2015
4. Tamboli Wasim Karim, Khabia Pratibha, Therpeutic and preventive aspect of diabetes mellitus through Ayurveda, diet and yoga – A brief review, IAMJ: Volume 3; Issue 8; August- 2015
6 Http/en. Wikipedia.Org
7 Prabhat Kumar Srivastava et al., Role Of Ayurveda in management of Diabetes mellitus, International research Journal of Pharmacy 2015, 6(1)
8 Das Banani et al., Management of Madhumeha (Diabetes mellitus) with current evidence and intervention with Ayurvedic Rasausadhies, Indian Journal of Traditional Knowledge Vol. 10 (4), October 2011, pp. 624-628.
13 Agrawal et al., An integrated approach to current management of Diabetes Mellitus Type 2: A Conceptual study, UJAVAHM 2013, 01(01): Page 43-47


21 Agrawal et al., An integrated approach to current management of Diabetes Mellitus Type 2: A Conceptual study, UJAHM 2013, 01(01): Page 43-47


Figures-

![fig.1. Gymnema sylvestre](image1)

![fig.2. Momordica charantia](image2)

![fig.3. Pterocarpus marsupium](image3)

![fig.4. Cinnamomum zeylanicum](image4)
Fig. 4. *Coccinia indica*

Fig. 5. *Trigonella foenum-graecum*

Fig. 7. Fruits and seeds *Syzygium cumini*

Fig. 8. *Carcuma longa*

Fig. 9. *Allium sativum*