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AN AYURVEDIC APPROACH TO PREVENT AND CONTROL DIABETES MELLITUS

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ABSTRACT

Diabetes is a major metabolic disorder in present era. According to International Diabetes Federation there were over 72,946,400 cases of diabetes in India in 2017. Prevalence rate is 8.7% in total of adult population and it is increasing day by day. Number of people are not diagnosed or prediabetic or at the risk of diabetes. It is important and need of time make these people aware about diabetes and inform them how they can minimize the risk and prevent the diabetes. Changes in lifestyle and adaptation of healthy daily habit may be beneficial for them. Traditional medicine system like Ayurveda may be very much helpful for both prediabetic and diabetic people in prevention and control of diabetes. Life style i.e. recommended diets, physical activities, exercise and suggested restriction in the same categories described in Ayurveda classics may be adopted, and it may be beneficial for them. In the present paper review has been done on causes, risk factors, diagnostic parameters & tools, recommended and restricted diets & physical activities and general medicines mentioned in text. It can be said that by understanding all these points' prevention and control of diabetes may be possible.

Keywords: Madhumeha, Prameha, Ayurvedic lifestyle, Diabetic diets.

INTRODUCTION

Diabetes mellitus is a progressive metabolic disorder, characterized by hallmark signs such as hyperglycemia i.e. high blood sugar level for a prolonged period. It occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces[1]. As per the report of International Diabetic Federation, There were over 72,946,400 cases of diabetes in India in 2017[2]. According to WHO Diabetes is a growing challenge in India with estimated 8.7% diabetic population in the age group of 20 and 70 years[3]. Recent surveys indicate that diabetes now affects a staggering 10-16% of urban population and 5-8% of rural population in India[4]. The rising prevalence of diabetes and other non-communicable diseases is driven by a combination of factors -rapid urbanization, sedentary lifestyles, unhealthy diets, tobacco use, and increasing life expectancy[5]. Diabetes is likely to continue to be a leading cause of morbidity

and mortality in the near future. It has been proved from several epidemiological studies that the current worldwide status is broadly due to modified dietary habits and life style changes. Current dietary habits along with sedentary life style are main culprits for diabetes outburst. Obesity and overweight are the most important risk factors responsible for diabetes. Much of the diabetes burden can be prevented or delayed by behavioral changes favoring a healthy diet and regular physical activity[6]. Along with glucose control, for patients of Diabetes, there is a strong need of maintaining a healthy and balanced life in order to avoid any complications. There are essentially keys i.e. self-preservation behaviors in patients with diabetes that predict healthy outcomes eating well, being physically active, monitoring blood sugar regularly, compliance and adherence to the medications prescribed, good problem-solving skills, healthy coping skills and risk-reduction behaviors. All of these behaviors have proven to show a positive correlation with good glycemic control, reduction of complications and improvement in quality of life[7]. In Ayurvedic terminology, Diabetes can be correlated with *Prameha*[8]. Various causative factors, sign, symptoms, medicines, diets and activities for management are describe in the classical ayurvedic texts[9,10,11,12]. These remedies and lifestyle can be adopted by diabetic and prediabetic person to prevent and control the disease. Objective of the present paper is to describe the general information available in text to manage the Diabetes.

MATERIALS & METHODS:

Various Ayurvedic text, authentic online and offline resources i.e. Websites of World Health Organization (WHO), International Diabetes Federation (IDF), research journals, Database, references books were reviewed, related information was compiled and summarized.

CAUSATIVE FACTOR[13,14,15,16,17]:

Table 1: Showing the causative factors of Prameha (Diabetes) according to Ayurveda

Physical & Mental causes	1. *Asyasukham* – Comfortable seating (luxury, sedentary lifestyle, lack of physical activities and exercise) 2. *Swapnasukham* – comforts of sleeping, excess sleeping 3. *Kapha krut cha sarvam* – All foods and lifestyle activities which increase *Kapha* 4. *Chinta* (stress) 5. *Shoka* (grief) 6. *Bhaya* (fear) 7. *Alasya* (sedentary life)
Dietary causes	1. *Dadhi* – Excessive consumption of Curd and its preparations. 2. *Gramya-oudaka-anupa mamsa* – flesh or meat soup of animals living in water and marshy regions 3. *Payamsi* – Excessive consumption of milk, its derivatives and preparations 4. *Navaanna panam* – Food, drinks and dishes prepared from new grains etc 5. *Guda* (Jaggery) 6. *Guda vaikruti* – Jaggery, its derivatives and dishes made out of it 7. *Ikshurasa* (sugarcane juice) 8. *Madhura Ahara* (sweet substances) 9. *Pishta Ahara* (carbohydrate rich food) 10. *Adyashana* (repeated food intake) 11. *Adhikashana* (excess food intake) 12. *Ahitashana* (unwholesome diet) 13. *Guru ahara* (heavy food) 14. *Samashana* (improper diet)
Other	1. *Deergharoga* (longstanding illness) 2. *Sahaja* (inherited factor)

Risk factors:[18,19]

Above 45 years, Obese/ overweight, Family history of (T2DM), Pre-diabetes, Do not exercise, Have low HDL or high triglycerides, Have high BP, Have had Gestational Diabetes, High fat and carbohydrate diet, High alcohol intake, Older people, Women having PCOS

How to check the risk of diabetes: The Indian Diabetes Risk Score (IDRS):

Mohan et al's group from their Chennai Urban Rural Epidemiology Study (CURES) cohort have attempted to develop a simple user friendly Indian Diabetes Risk Score[20]. The CURES is a classic cohort which has generated a risk score called IDRS with two modifiable risk factors (waist circumference and physical inactivity) and two non-modifiable risk factors (age and family history of diabetes), which may be amenable to intervention. The IDRS has a sensitivity of 72.5% and specificity of 60.1% and is derived based on the largest population based study on diabetes in India CURES.

Table 2: IDRS Table

PARTICULARS	SCORE
Age	
<35 years	0
35-49 years	20
>49 years	30
Waist Circumference	
Waist < 80 cm (female), < 90 cm (male)	0
Waist ≥80-89cm(female), ≥90-99cm (male)	10
Waist ≥90 cm (female), ≥100 cm (male)	20
Physical Activity	
Regular vigorous exercise	0
Regular moderate exercise	10
Regular mild exercise	20
No exercise	30
Family history of diabetes	
No diabetes in parents	0
One parent is diabetic	10
Both parent is diabetic	20

- Subjects with an IDRS of <30 was categorized as low risk, 30-50 as medium risk and those with ≥ 60 as high risk for diabetes.
- The mean IDRS increased significantly from normal (48) to pre diabetes (57) to diabetics (61). Limiting the blood sugar testing to those with an IDRS score of 50 and above could identify more than 90% of Indians with diabetes and pre diabetes[21].
- The Indian Diabetes Risk Score (IDRS) showed the strongest (5-fold risk) association with incident diabetes─ higher than obesity or hypertension. Obesity and abdominal obesity conferred a 2-fold risk of diabetes, whereas hypertension conferred a 3-fold risk of diabetes.
- Higher IDRS is also associated with higher risk of metabolic syndrome and CVD risk even among people without pre diabetes or diabetes.

Laboratory technologies for diagnosis[22,23]:

Table 3: Showing the ranges of Blood sugar level in normal, prediabetic & Diabetes

Diagnosis	**FBS** (mg/dl)	**PPBS**(mg/dl)	**HbA1C** (%)
Normal	<100	<140	< 5.6
Prediabetes	100-125	140-199	5.7- 6.4
Diabetes	>125	>199	> 6.4

Other basic laboratory technologies available:

1. Oral glucose tolerance test
2. Dilated fundus examination
3. Foot vibration perception by tuning fork
4. Foot vascular status by Doppler
5. Urine strips for glucose and ketone measurement

REMEDIES FOR PREVENTION & CONTROL:

In Ayurveda this section can be categorized under three sub-sections[24]:

1. *Ahara* (Diet)
2. *Vihara* (Physical activity)
3. *Aushadha* (Medicines)

1. ***Ahara***[25,26,27]

Wholesome diet for diabetes recommended in Ayurveda:

The treatment should be mainly based on the line of increasing stamina and vitality by way of tonics (*brumhana*) diet, drugs etc. and the patient should never be given excessive *Langhana* or *Apatarpana*[28,29] i.e. he should not be starved, he should always be given some food. A diabetic and an obese person generally suffer from excessive appetite and thirst and so some type of nutrition should always be given to them. In classics of Ayurveda, *ahara dravyas* are described in detail and they cover all the food groups are:

1. **Cereals**: Yava (*Hordeum vulgare* - Barley) is the best, different preparations of food, prepared from Barley can be given e.g. *Mantha, Odana, Appopa*, bread, etc. Wheat (*Godhuma*), Rice - Ayurveda prescribed old rice (*purana shali*), as one of the cereals, which can be prescribed to the diabetic patients.
2. **Pulses**: Mudga (*Vignaradiata Greengram*), Chanaka (*Cicer arietinum Linn.* – Bengal gram), 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* - Fenugreek), Patola (*Vietnamese luffa*, Vietnamese gourd, or Chinese okra), Rasona (*Allium sativum* Linn. – Garlic), Udumbara (*Ficus racemosa* - Cluster Fig Tree, Indian Fig Tree), etc. should be given.
4. **Fruits**: *Jambu* (Syzygium cumini - Black berry), *Amalaki* (*Phyllanthus emblica* - Indian gooseberry), Kapitha (*Limonia acidissima* - Wood Apple, Elephant Apple, Monkey Fruit), Tala phala (*Borassus flabellifer* - the Asian Palmyra palm, Toddy palm, Sugar palm), Kharjura (*Phoenix sylvestris* –Date Sugar Palm), Kamal (*Nelumbo nucifera* Indian lotus, sacred lotus, bean of India, or simply lotus,) *Utpala* (*Nymphoea Stellata*) etc., can be allowed to take.
5. **Seeds**: *Kamal, Utpala* seeds can be allowed to take.
6. **Liquor**: Old sura (old wine) may be given.
7. **Oils**: Mustard oil (Sarshapa taila) is best. Ingudi (*Balanitis aegypotiaca*) *Ghrita* may be used in *pitthaja prameha*.

Unwholesome diets: *Ikshu* (sugar cane juice), *Taila* (oil), *Ghrita* (ghee), *Guda* (jaggery), *Madya* (alcohol), *Pishtanna* (carbohydrate rich food), *Dadhi* (curd), *Navanna* (new grains), *Kshara* (Alkali),*Guda* (Jaggery), Sura(Alcohlic beverage), *Amla* (sour food), *Ikshurasa* (Sugarcane juice), *Anupa mamsa* (Flesh / meat of animals living in marshy areas etc)[30].

2. *Vihara*[31,32,33] (Physical activity)

Exercise Plan:[34,35]

Following aerobic activities should be done 3 to 5 days per week to strengthen heart and lungs and improve circulation:

Walk briskly: 1.75 miles in 35 minutes (20 minutes per mile), 2 miles in 30 minutes (15 minutes per mile), Join a mall-walking program. **Cycle** 5 miles in 30 minutes or 4 miles in 15 minutes., Swim laps for 20 minutes., Jump rope for 15 minutes., Run 1 1/2 miles in 15 minute (10 minutes per mile)., Play basketball., Shoot baskets for 30 minutes or Play a game for 15-20 minutes., Dance fast (social dancing) for 30 minutes., Skate for 30-40 minutes., Try an at-home exercise video

Yoga[36,37]: ***Asana***: *Surya namaskar***,** *Pacchimotasana, Dhanurasana* (Bow pose in prone position), *Ardha-matsyendrasana* (Half spinal twist), *Vajrasana, Sarvangasana, Halasana, Matsyasana*, *Mayurasana* has been found useful in diabetes. ***Pranayama:*** *Bhramari, Bhastrika, Kapalbhati.* **Meditation**

3. *Aushadha* (Medication)

Anti-diabetic Herbal Drugs:-

Control of T2DM is carried out with appropriate palliative herbal therapies. These herbs are selected based on their properties such as *Rasa, Guna, veerya, vipaka* and *prabhava* that are necessary to bring balance in *doshas*.

***Gurmara* (*Gymnema sylvesere*)**: *Gurmara* is an herb used in treating diabetes, constipation and minor digestive complaints. It is also used to facilitate weight loss. Its active constituents is gymnemic acids, which possess beneficial effects in controlling blood glucose level by strengthening β-cell. Regeneration of β-cell is possible with the treatment of *Meshshringi*, mainly from acinar cells. The acinar cells are proposed as precursors of ductal cells in focal regions, which can differentiate into β-cells. (Digest j. Nanomaterials & bio structures) extract of *Gymnema* and *andrographis* can be considered as a promising natural remedy for antidiabetic[38]. **Kernel of Mango (*Mangifera indica)*:** Powder of dry seed is used in practice. It decreases the sugar in urine. Aqueous extract of seed shows marked and prolonged decrease in blood sugar in experimental models and in patients also via oral route[39]. *Syzgium cumini* seeds contain 40% of aqueous soluble gummy fibers and 15% of aqueous insoluble fibers. The result of experiment showed that defatted seeds and aqueous soluble gummy fibers from seed significantly lowered the blood glucose level and improved glucose tolerance. Aqueous insoluble fibres do not have significant hypoglycemic activity[40]. ***Jam*una (*Eugenia jambolana*)**: *Jambu* is regarded as a specific medicine in traditional Ayurvedic medicine because of its specific action on the pancreas. The fruit, the seeds, and the whole fruit juice are all useful in the treatment of diabetes. The seeds contain jamboline, which controls the excessive conversion of starch to sugar[41]. For internal usage, dry seeds powder in dose of 3 to 6 grams twice daily with water or butter milk. ***Vijaysara* (*Pterocarpus marsupium*):** It is also known as Indian Kino tree or Malabar kino. Antidiabetic activity of heartwood of Pterocarpus marsupium roxb. has been reported with analysis of its phytoconstituents be Mishra et al[42]. **Bitter Gourd (*Momordica charantia*)**: It is widely used in Ayurveda as antidiabetic, abortificient, antirheumatic and carminative agent. The fruit and seeds of this plant contain active compounds which are charantin, vicine and polypeptide – P having antidiabetic properties. For better therapeutic benefits, extracted juice should be taken early morning daily[43]. ***Bael* (*Aegle marmelos*):** Though this plant is famous for its fruit, here the leaves are the interested area. The aqueous extract of A. *marmelos* leaves significant reduced blood glucose level and showed anti-oxidative activity on alloxan induced diabetic rats[44]. It should be used with powder of black pepper or fenugreek. **Fenugreek (*Trigonella foenum graecum*):** The medicinal qualities or fenugreek seeds are described in Ayurvedic literature. In recent studies, it has been reported that the decoction of fenugreek seeds suppressed the urinary excretion of sugar and relieved symptoms of diabetes[45]. *Methika* having an amino acid named 4-hydroxyisoleucine, which stimulates pancreas to release insulin. Inhibits activity of α-amylase and α-glucosidase[46]. **Turmeric (*Curcuma longa*):** Ayurveda recommends turmeric as an exclusive remedy

for diabetes. The active component of turmeric, curcumin, has caught attention as a potential treatment for diabetes It is more effective if taken with an equal amount of amalki powder. ***Neem* (*Azadirachta indica*):** Acharya Shushruta has mentioned *Nimba* as *Vata Kapha Shamaka*. Some research reveals that Azadirachta leaves extract showed hypoglycemic effect on streptozotocin induced models in similar pattern of insulin but comparatively lesser. In IDDM Models the extract showed reduction in blood sugar level. This effect may be due to restoration of delayed insulin response or due to inhabitation of intestinal absorption of glucose[47]. ***Shunthi (Zingiber officinalis)*** is used in the formulation with the main purpose of *Amapachana*, it is also *Vata- Kapha Shamaka*, which are mainly responsible for the condition of *Madhumeha*. In study it was found that daily administration of aqueous extract of ginger orally at dose of 500 mg/Kg during 30 days reduces the plasma glucose level. That solution have hypoglycemic effect may be by increasing the activity of glycolytic enzymes (glucokinase, phosphofructokinase, pyruvate kinase)[48]. *Mishreya* (*Foeniculum vulgare*) Bhavaprakash has mentioned *Mishreya* is having *Madhura*, *Katu Rasa, Ushna, Vata- Kapha Shamaka, Vrina, Shoola, Akshi Rogahara*. *Mishreya* plays its role on the formulation by *Deepana Karma*. It also inhibits the complications of Diabetes. Some study reveals that Essential oil of *Foeniculum vulgare* corrected the hyperglycemia and pathological abnormalities in diabetic induced rats, which could be in part through its antioxidative effect and restoring of redox homeostasis. It also improves the pathological changes noticed in their kidney and pancreas[49]. All the other drugs having *Kashaya, Tikta, Katu Rasa, Katu Vipaka, Ushna Veerya, Ruksha, Laghu, Kapha shamaka, Kapahavata-shamaka, Pachana* properties may be beneficial in diabetic and prediabetic condition[50].

Anti-diabetic Herbomineral formulation:-

Chandra prabha vati[51]*, Yashad bhasma*[52]*, Vasant kusumarkar rasa*[53]*, Trivang bhasma*[54]*, Swarnavang*[55]*, swarnamakshik bhasma*[56] *etc*. are proved to be the best medicines in treatment of *prameha*. These all can be used in Diabetic and prediabetic conditions under the prescription and supervision of physician.

CONCLUSION

Management through dietary intervention along with life style modification is the most effective way to prevent and reduce the risk of developing diabetes and its complications. It is essential that information about maintaining and controlling weight, dietary modification, regular exercise and yoga is provided through different health education programs. Diabetes risk score will help us to device effective screening strategies to unmask hidden burden of the disease. Diabetes Mellitus is a palliative disease; it cannot be completely cured but, can be controlled by proper *aushadha*, *aahara* and *vihara*. It is also important to undertake more research on the preventative measures in the local context which promote healthy life styles therefore leading to improved quality of life for individuals and societies.

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