



Review Article

## TYPE 2 DIABETES MELLITUS IN AYURVEDA W.S.R TO MEDOVAHA SROTAS

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### ABSTRACT

Non-communicable diseases (NCDs) kill 41 million people each year, which is equivalent to 74% of the entire deaths globally. According to the statistics from the International Diabetes Federation, in the year 2021 there are 537 million adults (20-79 years) living with diabetes i.e., 1 in every 10 persons is said to be diabetic. It is high time for the approach to diabetes mellitus is remodelled. Prameha is the most commonly correlated disease with diabetes mellitus. Prameha is a Medovaha srotodushti vikara and Prameha purvarupa is seen in Medovaha srotodushti avastha. Avyayama, Divaswapna, Kaphavardhaka ahara vihara etc are the causative factors for Prameha. Ayurveda always follow a holistic approach in treatment aspect. Being lifestyle disorder diabetes also need that type of approach. Our Acharya have explained Prameha chikitsa emphasising the importance of modifying the food and lifestyle of the patient. From that it is clear that diabetes cannot be managed simply with medication. Lifestyle is also important in managing this disease. Our target group is not only diabetic patients but also people who are in their pre-diabetic stage. Ayurvedic management of diabetes mellitus with respect to Prameha is still an unexplored area. Early detection, analysis and holistic approach in this condition may make milestones in reversing this condition in many populations or managing well in the others. Deeper understanding of Prameha is needed.

### INTRODUCTION

Non-communicable Diseases (NCDs) kill 41 million people each year, which is equivalent to 74% of the entire deaths globally. Among them cardiovascular diseases account for most deaths which is 17.9 million annually, followed by cancers (9.3 million), chronic respiratory diseases (4.1 million), and diabetes (2.0 million including kidney disease deaths caused by diabetes)<sup>[1]</sup>. According to the statistics from the International Diabetes Federation, in the year 2021 there are 537 million adults (20-79 years) living with diabetes i.e., 1 in every 10 persons is said to be diabetic and the age-adjusted comparative prevalence of diabetes in India is 9.6% and which is predicted to

increase to 10.4% by the year 2030. A high percentage of individuals with undiagnosed diabetes (which is currently more than 50%) is yet another cause of concern<sup>[2]</sup>. In a prospective study conducted in 2007 the estimated cumulative incidence of T2DM in Kerala was calculated to be 21.9% and the incidence of pre-diabetes was 36.7%. When they were followed, it was observed that nearly 60% of the participants among the pre-diabetes got converted to T2DM by the year 2017, and this shows an epidemic trend for T2DM in Kerala<sup>[3]</sup>. All these data point out that it is high time for the approach to diabetes mellitus is remodelled. With proper awareness, education, and proactive management, individuals can take control of their health and mitigate the risks associated with diabetes. This article is a humble attempt to shed light on the importance of early detection, lifestyle modifications, and possibility of Ayurvedic management for effective diabetes control.

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Comprehensive literature search including classical texts and various review articles and clinical studies published in online databases to identify relevant studies on the Ayurvedic management of diabetes mellitus.

Approximately 90% to 95% of diabetic patients have type 2 diabetes, and many of them are overweight. Although classically considered “adult-onset,” the prevalence of type 2 diabetes in children and adolescents is increasing at an alarming pace due to the increasing rates of obesity in these age groups<sup>[4]</sup>. The two defects that characterize type 2 diabetes mellitus are insulin resistance and relative insulin deficiency. Obesity especially central obesity emerged as the most important modifiable risk factors for developing T2DM in Kerala<sup>[3]</sup>.

People with Asian Indian phenotype are more likely to be overweight especially around the abdomen, which is due to the higher tendency to accumulate visceral fat. Other factors that contribute to overweight in Asian Indians include urbanization, adaptation to less physically active lifestyle, chronic stress and consumption of an unhealthy diet high in energy and poor in nutrients. In such conditions the excess calories from the consumption of foods gets stored in the form of fat in the adipose tissues.

Insulin resistance, identified as an impaired biologic response to insulin by target tissues, primarily involves liver, muscle, and adipose tissue. Insulin resistance impairs glucose disposal, resulting in a compensatory increase in beta-cell insulin production and hyperinsulinemia. Type 2 diabetes (T2D) being the predominant consequence, insulin resistance can also result in hypertension, dyslipidemia, hyperuricemia, elevated inflammatory markers, endothelial dysfunction, and a prothrombotic state.

After intake of a caloric load and conversion to glucose, muscle is the primary site for glucose disposal, accounting for up to 70% of tissue glucose uptake. In chronic caloric excess, muscle tissue accumulates intramyocellular fatty acid that signals energy excess within the cell, decreasing proximal insulin signalling and thus reduced glucose uptake by the muscle tissue. The excess glucose in the blood is shunted to the liver to be metabolized or stored.

The liver is responsible for processing energy substrates. It packages, recirculates, and creates fatty acids and also process, stores, and creates glucose. When skeletal muscle develops insulin resistance, excess glucose in the blood is shunted to the liver. When the liver tissue senses an excess of energy substrate, particularly in the form of diacylglycerol, a process similar to that in skeletal muscle occurs, resulting in the decrease of proximal insulin signalling

by the liver. Now excess glucose present in the blood enters the hepatocytes through an insulin-independent pathway, stimulating denovolipogenesis (DNL) and thus creating more fatty acids from the glucose surplus. The excess fatty acid is deposited in the liver or as ectopic lipid throughout the viscera. Additionally, immune-mediated inflammatory changes contribute to excess lipolysis from adipose tissue, which is re-esterified by the liver and further adds to circulating fatty acid and ectopic lipid deposition. Finally, normal insulin-mediated suppression of gluconeogenesis is defective, and the liver continues to create more glucose, adding to the circulating glucose surplus. If the liver becomes insulin-resistant, it will result in significant metabolic consequences.

### Adipose Tissue

The mechanism of lipolysis is regulated by insulin. The failure of insulin to suppress lipolysis in insulin-resistant adipose tissue, especially visceral adipose tissue, increases circulating free fatty acids (FFAs). Higher levels of circulating FFAs directly affect both liver and muscle metabolism, further exacerbating insulin resistance in these tissues and contributing to lipotoxicity-induced beta-cell dysfunction.

In majority of the cases the sequence of insulin resistance is observed first in adipose, followed by hepatic and later in muscular tissues. The elevated fasting blood sugar is due to the impaired endogenous glucose production by the liver. When insulin resistance develops in skeletal muscles, there will be decrease in glucose uptake and subsequent glycogen synthesis contributing to elevated level of PPBS and the increased hormone sensitive lipase in the adipose tissue leads to excess circulating free fatty acids. All these three factors combinedly increase the state of insulin resistance.

This will ultimately result in excess glucose in the blood. In the early stages, pancreas tries to compensate this by excess production of insulin. At this stage of hyperinsulinemia the FBS will be in normal range between 100-125mg/dl. This state is called pre-diabetes stage or impaired glucose tolerance. But over the period of time, apparently the islet beta cells are unable to compensate for the insulin resistance and their ability to produce the insulin decreases, ultimately leading to the apoptosis of many of these beta cells. This result in insulin deficiency leading to the manifestation of type 2 diabetes mellitus.

It has been reported that the decline in islet beta-cell function can begin on an average of 12 years before T2DM diagnosis<sup>[6]</sup>. But being a silent epidemic, this chronic metabolic disorder has emerged as a

pressing health concern, affecting millions of individuals worldwide and posing significant challenges for both individuals and healthcare systems alike. It is the time to explore more in Ayurveda *Sastra* not only to cure the diabetes patients but also to prevent the risk category from developing this disease.

### Concepts in Ayurveda

*Prameha* is the most commonly correlated disease with diabetes mellitus. *Prameha* is a *Medovaha srotodushti vikara* and *Prameha purvarupa* is seen in *Medovaha srotodushti avastha*. *Avyayama*, *Divaswapna*, *Kaphavardhaka ahara vihara* etc are the causative factors for *Prameha*<sup>[7]</sup>. For the persons who indulge constantly in these types of food and lifestyle, the *Tridosha* get vitiated, mix with *Medas*, get localised in *Vasti* and begin to flow out resulting in manifestation of *Prameha*<sup>[6]</sup>. *Prameha* can be considered as *Kapha pradhana tridosha vyadhi*.

### Samprapti of Kaphaja, Pittaja and Vatika prameha<sup>[8]</sup>

- *Avyayama*, *Sleshmala aharam*, *Nava dhanyam*, *ghrita*, *Ksheera* and *Ikshu* products in excess leading to vitiation of *Kapha*. This vitiated *Kapha* mix with *Abadha meda* due to its similar *Guna* and due to excess quantity of these vitiated *Kapha* it further mixes with *Mamsa* and also with other *Sareera kledabahula dhatu*. Since *Kleda vahanam* is the function of *Mootra*, all these vitiated *Kleda* mix with *Mootra* and further get localised at *Vasti* and manifested as *Kaphaja prameha*.
- *Ushna*, *Amla*, *Lavana*, *Katu* in excess, food intake during indigestion, exposure to excessively hot sun, heat of fire, physical exertion and anger leads to *Pitta kopa* and this will result in *Pitta prameha* which manifest faster than *Kaphaja prameha*.
- *Kashaya*, *Katu*, *Thiktha*, *Laghu*, *Ruksha ahara*, *Ativyavaya*, *Ativyayama*, *shoka* etc will cause *Vata kopa* and thus *Vataja prameha*.

### DISCUSSION

Due to *Nidana* there will be increased *Kapha* in the body which further mix with *Abaddhamedas* and *Mamsa* at a later stage. This *Samprapti* may be considered as the excessive accumulation of fat in the adipose tissue and muscles leading to insulin resistance. *Ama* is not just an undigested food, it can be anything that is excessively accumulated which the body can't utilize or reject<sup>[9]</sup>. Thus, the excessively accumulated fat in the adipose tissue produces inflammatory cytokines which may be considered as *Ama*. These inflammatory cytokines (*Ama*) causes a *Srotorodha* which may be better understood as the blockage of the insulin receptor cells in the tissues. This blockage of insulin receptor cells by the inflammatory cytokines is commonly understood as insulin resistance which results in hyperglycaemia. In

the satiety centre of the brain, it is this insulin resistance induced leptin resistance that act as or creates the *Srotorodha* thus disrupting the normal feeding behaviour of the satiety centre thereby causing the individual to eat more, commonly known as polyphagia.

The early stages of insulin resistance when there is hyperglycaemia, the body tries to manage it by secreting excess insulin and this condition is called hyperinsulinemia also understood as pre-diabetic stage. During this stage the blood glucose level will be normal but closer to upper boarder line which indicates impaired glucose mechanism. The persistence of this condition leads to the dysfunction of the pancreatic beta cells resulting in inadequate insulin secretion and hyperglycaemia manifesting as type 2 diabetes mellitus.

Various clinical studies have been conducted and many among those became successful in managing this disease. Most of the studies conducted and being conducted aims at reducing FBS, PPBS or HbA1C but none of the studies tries to understand *Prameha* in its true form which is why it is important that we should also diagnose a diabetic person in terms of *Prameha*. Because Ayurvedic management of diabetes mellitus targets at correcting impaired fat metabolism including insulin resistance. Then only the reversal of diabetes can be done which is still a dream for most of the patients. Many patients diagnosed with clinical diabetes may not have classical signs and symptoms of *Prameha*. It is the time to rethink whether we are addressing diabetes mellitus or *Prameha*. It is important to identify the predominant *Dosha* also.

### Scope of Ayurveda

Ayurveda always follow a holistic approach in treatment aspect. Being lifestyle disorder, diabetes also need that type of approach. Our *Acarya* have explained *Prameha chikitsa* emphasising the importance of modifying the food and life style of the patient. From that it is clear that diabetes cannot be managed simply with medication. Lifestyle is also important in managing this disease. Our target group is not only diabetic patients but also people who are in their pre-diabetic stage.

### 1. Identifying the risk factors

Risk factors for *Prameha* include person who indulges in *Kapha vardhaka ahara vihara* including sedentary type of job, excess intake of oily and other processed food, day sleep, lack of exercise, family history of diabetes or other metabolic disorders, central obesity, BMI >25kg/m<sup>2</sup>, pre-diabetic stage etc. The prevalence of pre-diabetic stage is also increasing day by day. This stage also called as hyperinsulinemic stage which can be identified by symptoms like excess

hunger, lethargy etc which is similar to *Medoroga*. *Acharya Charaka* in *Sutrastana* has explained various *Dhatu pradoshaja vikara* including the *Medo pradoshaja vikara*. On analysing the *Medo pradoshaja vikaras* one can see that both *Prameha Poorvaroopa* and *Sthoulya* are mentioned in this context<sup>[10]</sup>. Addressing this group in a preventive way will help to bring back major population from this epidemic. *Nidana parivarjana* itself may be enough in this stage.

## 2. Importance of Medodushti

*Acharya Susruta* in *Nidanasthana* has stated that *Prameha* can be diagnosed by not merely the presence of excess urine but should have the presence of *Poorvarupa*<sup>[11]</sup>. It is already mentioned that *Purvarupa* indicates *Medodushti*. *Acarya Vagbhata* states that *Sadhyasadyata/* prognosis of the condition depend up on the strength of *Medodushti* in one's body and further adds that *Prameha* caused by *Kapha* and *Pitta* having all premonitory symptoms are incurable and *Pitta prameha* in which *Medas* not vitiated greatly is *Sadhya*<sup>[12]</sup>. This shows that *Medodushti* has a strong role in the prognosis and treatment of this condition.

The extent of *Medodushti* can be assessed by the strength of *Poorvarupa* which gives us the condition of the disease and how to address the patient. In acute cases we may reverse the diabetes and the patient may able to continue in modified life style and diet in an extent even without medications.

## 3. Deciding the treatment protocol to be adopted

Even though all *Acarya* explained 20 types of *Prameha*, while coming to the treatment principle the ultimate preference is whether the patient is *Sthula* or *Krisha*. So, once we diagnosed *Prameha* in a patient, the next step is to assess is whether the person is *Stula* or *Krisha*. In *Sahaja Prameha*, the person will be lean, dry, eats very little food, is thirsty and wanders around always. But in *Ahita aharaja - Apathya nimittaja prameha* the patient will be obese, eats more food, is unctuous, desires of sedentary habits<sup>[13]</sup>.

In both *Prameha brimhana* is the line of management. In *Krishapramehi* it is the primary modality. In *Sthulapramehi* it is secondary after proper *Shodhana*<sup>[14]</sup>. For a *Sthulapramehi* we can select *Shodhanachikitsa* if he is suitable. *Snehapana, Vamana, Virechana, Vasti, Udwartanam, and Takradhara* can be selected according to the condition and the medicines for the treatment also can be selected based on the *Dosha* involved.

*Vamana* induces *Apatarapana* as it minimizes peripheral insulin resistance and increases the utilization of glucose by muscles. It also alleviates *Bahudrava Kapha* and *Meda*. *Vamana* by doing *Urdhva kaya shodhana* it also helps in relieving neuro-

inflammations there by regulating the hunger and satiety centre. *Virechana* drugs are cholagogues in nature which reduces various enzymes responsible for hepatic glucose production and ultimately, reduction in hepatic glucose production occurs. *Virechana* effectively reduces the symptoms of metabolic syndrome as it evacuates several waste products from the body and significantly decreases the levels of fasting blood glucose and serum triglycerides. In *Vatavyadhi chikitsa, Acarya Vagbhata* says that when excess *Kapha* or *Pitta* getting liquefied and exhibit their symptoms in the *Pakwashaya*, they should be cleared by *Vasti*. So, in *Prameha* also *Vasti* cleanses the *Koshtha* by eliminating vitiated toxins (*Malarupi abadhameda*) and corrects the intestine's functioning, which in turn regulates the proper absorption of glucose. It also corrects the *Jatharagnimandya* and *Dhatavagnimandya* (glucose metabolism) and enhances glucose absorption in the body<sup>[16]</sup>.

The *Shamana* medicine should not increase *Medas, Mutra* or *Kapha* and should improve strength<sup>[15]</sup>. All those medicines can be chosen for *Pramehi* and can give in different *Kalpana* based on *Dosha* like *Kashaya* and *Churna* for *Kapha* and *Pitta, Ghrita* for *Vatika pramehi*.

For a person having fatty liver along with diabetes, giving medicines for *Pandu* or other liver enhancing medicines from *Grahani, Kamala, Udara* etc along with *Prameha aushadha* seems to give better results.

## 4. Modification of Lifestyle

Being a lifestyle disorder, modification of lifestyle is more important than medications. Excess calorie intake must be restricted. Proper diet will help in both preventive as well as curative way. Exercise helps to reduce excessively accumulated fat and also improves insulin sensitivity. Cardio along with HIIT exercises together will give better results than single type of exercises. Maintaining normal body weight and managing central obesity will helps to a great extent. Stress management by meditation also helps in chronic stress conditions.

## CONCLUSION

Ayurvedic management of diabetes mellitus with respect to *Prameha* is still an unexplored area. Early detection, analysis and wholistic approach in this condition may make milestones in reversing this condition in many populations or managing well in the others. Deeper understanding of *Prameha* is needed for this. *Kaphaja pramehi* may give a long year h/o sedentary life pattern as well as a pre-diabetic stage. A *Pittaja pramehi* may be associated with hepatic pathology or continuous exposure to hot climate and

sudden manifestation of diabetes mellitus. A *Vatika pramehi* may be associated with parental h/o diabetes mellitus or c/o diabetic complications within a very less year of onset. Assessing the diabetes subjects and risk groups in depth and giving proper treatments including *Shodhana chikitsa* after identifying the *Dosha* and *Dhatudushti* is the key for this epidemic. Diabetes is no longer a disease to be managed at OP level. *Udwartana*, *abhyanga* and *Vamana* like *Shodhana* is essential to address the established insulin resistance in the subjects. We know the islet beta-cell function can begin on an average of 12 years before T2DM diagnosis. But being a silent epidemic, this chronic metabolic disorder has emerged as a pressing health concern, affecting millions of individuals worldwide and posing significant challenges for both individuals and healthcare systems alike. Identifying the risk group and early detection will help to retain the proper beta cell functioning which may be more difficult after the manifestation of diabetes mellitus. Researches should be done to assess the role of Ayurvedic management by analysing the pre and post insulin resistance, pancreatic function etc. It is the time to explore more in Ayurveda *Sastra* not only to cure the diabetes patients but also to prevent the risk category from developing this disease.

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