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RESEARCH ARTICLE

Diabetes mellitus in ayurveda wsr to it's aetiopathogenesis

[1*]Seetha Chandran, [2]Prakash Mangalasseri, [3]Patgiri, B. J., [4]Galib, R., [5]Prasanth Dharmarajan, [6]Krishnkumar, V. and [7]Prajapati, P. K.

[1]Department of Rasasastra and Bhaishajya Kalpana, IPGT&RA, G AU, Jamnagar, Gujarat, India
[2]Department of Kayachikitsa, Vaidyaratnam P.S. Varier Ayurveda College, Kottakal, Kerala, India
[3]Department of Rasasastra and Bhaishajya Kalpana, IPGT&RA, G AU, Jamnagar, Gujarat, India
[4]Department of Rasasastra and Bhaishajya Kalpana, All India Institute of Ayurveda, New Delhi, India
[5]Department of Panchakarma, All India Institute of Ayurveda, New Delhi, India
[6]Regional Ayurveda research Institute for eye disease, Lucknow, India
[7]Department of Rasasastra and Bhaishajya Kalpana, All India Institute of Ayurveda, New Delhi, India

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ABSTRACT

In Ayurveda, Diabetes Mellitus can be interpreted under the broad clinical entity described as *Prameha*. *Prameha* is a multi systemic disease caused by the imbalance of *Tridosha (biohumors),* initially mediated through *Kapha* affect urinary system and manifest as polyuria. The primary focus of pathogenesis in *prameha* shows the role of increased abdominal adiposity in the susceptibility of DM. Different types of *Prameha* mentioned in Ayurvedic classics can be compared with various stages of diabetes. Symptoms of beta cell destruction in prodromal stage and vascular complications due to deformities in rasayani (channels of nutrition) are mentioned. Aetiopathology of *Prameha* in described in a unique way, which emphasize that management should be focused on correction of metabolism at multi systemic level, to prevent the complications. The paper gives an insight in to the aetiopathogenesis of *Prameha* in relation to that of Diabetes Mellitus.

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INTRODUCTION

Diabetes mellitus (DM) describes a metabolic disorder of multiple etiologies characterized by insulin resistance, relative insulin deficiency and hyperglycemia with disturbances of carbohydrate, fat and protein metabolism (American Diabetes Association, 2009) According to the International Diabetes Federation (IDF), the total number of diabetic subjects to be around 40.9 million in India (Sicree *et al.,* 2015). In *Ayurveda* Diabetes Mellitus can be interpreted under the broad clinical entity described as *Prameha*. Both the concepts of DM and *Prameha* go hand in hand at the level of aetiopathology and management. *Prameha* is a multi systemic disease caused by the imbalance of *Tridosha (bio humors),* initially mediated through *Kapha* affect urinary system and manifest as polyuria etc. The specificity and variability of different *nidana* (aetiological factors), *dosha* (causative humour) and afflicted tissue (*dushya*) opposed by body resistance decides the manifestations of multiple varieties of *Prameha*. Current review analyse the aetiopathogenesis of *Prameha* in relation to that of DM.

Corresponding author: **Seetha Chandran,**
Department of Rasasastra and Bhaishajya Kalpana, IPGT&RA, G AU, Jamnagar, Gujarat, India.

MATERIALS AND METHODS

Ayurvedic classics, Textbooks of clinical medicine and internet publications were consulted and reviewed for carrying out the present work

Observation and analysis

Classification

There are 2 main categories of DM -type I and type II, which can be distinguished by a combination of features. Type 1 DM is a chronic illness characterized by the body's inability to produce insulin due to the autoimmune pancreatic β cell destruction. Onset most often occurs in childhood, but late onset is also seen. Type 2 diabetes involves varying degrees of hepatic insulin resistance (causing an inability to suppress

hepatic glucose production), peripheral insulin resistance (which impairs peripheral glucose uptake) in combination with a β-cell secretory defect. (Medscape, 2016) In Ayurveda *Prameha* is classified on the basis of, etiology; clinicopathology; body constitution and of prognosis. Sahaja (congenital) variety of *Prameha* patients are lean, emaciated and weak and *apathya nimithaja* (acquired) variety of *Prameha* patients are obese (Acharya susruta., 2005.a). Based on the dosha *dushya* factors and abnormality in urine, twenty types of prameha are explained. (Acharya Caraka., 2010.a). Naming of these twenty types of abnormalities are based upon the increase and decrease of specific guna (quality) or combination of gunas in each dosha. For example., derangement of Madura and seeta guna of kapha cause ikshuvaalika meha (type) (Acharya Sree Gayadasa., 1997). On the basis of prognosis, *Prameha* can be classified in to three; curable, incurable and controllable.

Aetiopathology

Currently autoimmunity is considered as the major factor in the patho physiology of type 1 DM. In this, culmination of lymphocytic infiltration and destruction of insulin-secreting beta cells of islets of Langerhans of the pancreas occurs. It involves incompletely understanding interactions between susceptible genes, auto antigens, and environmental factor (Merck and Co., 2017). An explosive onset of symptoms in a young, lean patient always has been considered diagnostic of type 1 DM. Presumably type 2 DM develops when a diabetogenic lifestyle (excessive caloric intake, inadequate caloric expenditure, obesity) is superimposed on a susceptible genotype. (Merck and Co., 2017). In type11 DM, when insulin secretion can no longer compensate for insulin resistance, gives rise to fasting and postprandial hyperglycemia, (Merck and Co., 2016). A role for excess glucagon cannot be underestimated; indeed, type 2 diabetes is an islet paracrinopathy in which the reciprocal relationship between the glucagon-secreting alpha cell and the insulin-secreting beta cell is lost, leading to hyper glucagonemia and hence the consequent hyperglycemia (Unger *et al.,* 2010) Ayurveda identify causative factors which increase *meda, mutra* and *kapha*, generally leading to the pathogenesis of *Prameha* (Acharya Vagbhata, 2005. a). All *Pramehas* are explained to be involving all 3 humors (*doshas)* with predominance of one. Three *doshik* varieties can happen separately with predominance of one. But usually *kapha prameha* turn to *paittika prameha* by time and end up in *vatika prameha.* The etiological factors are identified for separate *doshik* varieties. *Kaphaja Prameha* is caused by fresh cereals, dairy and sugar products, meet and reduced physical activities (Acharya Caraka., 2010. b). Rather the opposite of above etiological factors like spicy food, hot environment, physical exersion, anger, intake of contradictory food articles etc are the causes of *paittika Prameha* (Acharya Caraka., 2010. c) Similarly *vatika prameha* is caused by low calorie diet, skipping of meals, excessive physical activity, suppression of manifested urges, stress etc (Acharya Caraka., 2010. d)

On analyzing the pathogenesis of *Prameha* the components identified are *bahudrava* (excessively liquefied) *kapha as dosha* . *Dhatus* involved are *medas* (fat), *mamsa* (muscle), *vasa* (muscle fat), *majja* (marrow), *kleda* (bodyfluids), s*ukra* (semen), *raktha* (blood), *lasika* (lymph) and *rasa* (plasma) (Acharya Caraka., 2010.b). Vitiated *Kapha* predominant *Tridosha* associated with *Abadha Medodhatu* (free fatty acids) leads to looseness of other body tissues. Since *Kapha* governs the fluid metabolism of the body even at the cellular level, morbid *Kapha* increased in its liquidity cause for elimination of excess *Kleda* (watery waste product in the body) through *mootra marga.* These are drawn into *vasthi (urinary system)*, seated where it produces *Prameha* (Acharya Susruta., 2005. b). This may also cause chronic urinary elimination of various other *Dhatu* (tissues) as essential micr ents. Compared to onutri the *kaphaja Prameha* pathology, onset is rapid in *paithika* and *vatika.*

Obesity and weight gain are important determinants of insulin resistance in type 2 DM. (Medscape, 2016) Insulin resistance, which has been attributed to elevated levels of free fatty acids and proinflammatory cytokines in plasma, leads to decreased glucose transport into muscle cells, elevated hepatic glucose production, and increased breakdown of fat. Adipose tissue also appears to function as an endocrine organ, releasing multiple factor. The primary focus of pathogenesis in *prameha* is *vrikka* (urinary system) and *vapa vahanam* (adipose tissue) and the major vitiated one is *Medovahasrotas* (channels of lipid metabolism) (Acharya Caraka., 2010. e) This explains the role of increased abdominal adiposity in the susceptibility of metabolic syndrome and DM. Vyana and Apana vayu prakopa plays significant role in basic pathology of prameha, as there is vitiation of rasadi dushyas all over the body. (Acharya Susruta., 2005. c)

Symptoms

The most common symptoms of DM are polyuria, polydipsia, and polyphagia, along with lassitude, nausea, weight loss, fungal infection and blurred vision, all of which result from the hyperglycemia itself. More significant hyperglycemia causes glycosuria and thus an osmotic diuresis, leading to urinary frequency, polyuria, and polydipsia that may progress to orthostatic hypotension and dehydration (Merck and Co., 2017). Severe nocturnal enuresis secondary to polyuria can be an indication of onset of diabetes in young children (Medscape, 2016). Severe dehydration causes weakness, fatigue, and mental status changes (Merck and Co., 2017). Thirst is a response to the hyperosmolar state and dehydration. Fatigue and weakness may be caused by muscle wasting from the catabolic state of insulin deficiency, hypovolemia, and hypokalemia. Muscle cramps are caused by electrolyte imbalance. Blurred vision results from the effect of the hyperosmolar state on the lens and vitreous humor. Glucose and its metabolites cause osmotic swelling of the lens, altering its normal focal length (Medscape, 2016). Symptoms may come and go as plasma glucose levels fluctuate. Polyphagia may accompany symptoms of hyperglycemia but is not typically a primary patient concern (Merck and Co., 2017). Patients with new-onset type 1 DM will lose weight, despite normal or increased appetite, because of depletion of water and a catabolic state with reduced glycogen, proteins, and triglycerides. Gastrointestinal (GI) symptoms like Nausea, abdominal discomfort or pain, and change in bowel movements may accompany acute Diabetic ketoacidosis (DKA) (Medscape, 2016). Frequent and profuse micturition with turbidity (*Prabootha avila mootratha*) is mentioned as the general symptom of Prameha (Acharya Susruta., 2005.d). Manifestation of symptoms like weight gain, polyuria, polydypsia etc shows the involvement of kapha dosha. Inflammatory conditions like Diabetic carbuncle, Pruritis vulvae or balanitis depicts the paittika involvement and

degenerative changes like Diabetic neuropathy, Diabetic retinopathy, Diabetic nephropathy shows the vatika involvement in prameha etc. Weakness of rasyanis (nutrition channels) of rasa, pitta, kapha and rakta, augments the rapid manifestation of such complications. (Acharya Susruta., 2005.e)

Prodromal symptoms

Beta-cell destruction may have started months, or even years, before the onset of clinical symptoms. When 80-90% of the beta cells are destroyed, hyperglycemia develops and diabetes may be diagnosed (Medscape, 2016). Similarly hyperglycemia itself may impair insulin secretion by causing βcell dysfunction (Merck and Co., 2017). Wang *et al* reported that the risk of future diabetes was at least 4-fold higher in normoglycemic individuals with high fasting plasma concentrations of 3 amino acids (isoleucine, phenylalanine, and tyrosine). Concentrations of these amino acids were elevated up to 12 years prior to the onset of diabetes (Wang *et al*., 2007). But no prodromal symptoms were mentioned in modern science. In Ayurveda Symptoms like increased perspiration, burning sensation and bad smell of the body, looseness and flaccidity of body parts, desire for comforts like sitting, sleeping etc, coating of heart ,eyes ,tongue and ears; stoutness of body, increased growth rate of hair and nails, desire for cold, dryness of throat and palate, sweetness of mouth, swarming of ants towards urine etc are mentioned as poorvaroopa (premonitory symptoms) of Prameha. (Acharya Vagbhata., 2005. b). Above features shows that, a prediabetic stage is kapha pradana. Features like burning sensation are explained as roga prabava and kesha nakha vridhi, due to excessive mala (waste) formation in the body. (Acharya Sree Gayadasa., 1997). As per Susrutacharya, in whomsoever the prodromal features of urinary abnormalities are seen and even if there is slight increase in urine, he should be considered to be a prameha rogi (Acharya Susruta., 2005. f)

Complications

Although the pathophysiology of the disease differs between the types of diabetes, most of the complications, including microvascular, macrovascular, and neuropathic, are similar regardless of the type of diabetes. But type 1 DM is associated with a high morbidity and premature mortality. Microvascular complications of diabetes include retinal, renal, and possibly neuropathic disease. Macrovascular complications include coronary artery and peripheral vascular disease (medscape.com). *Upadravas* (Complications) of *kapha* type includes upper GIT features like vomiting, URT features like dyspnoea, corrhyza etc. *Upadravas* of *pitta Prameha* are *pain* in *basthi* and *mehana* (probably due to recurrent UTI), *mushkavadaranam* (testicular changes), insomnia, yellowish discolouration of stool, *daha* (burning sensation), thirst and GIT features like sour eructations, diarrhoea etc. *Hrdgraha* (Constricting sensation in the precordium), *udavartha* (obstinate constipation), *Kampa, shoola* (peripheral neuropathy), *Shosha* (wasting), *swasa* and *kasa* (dry cough and dyspnoea) are some of the complications of *vatika Prameha* (Acharya Vagbhata., 2005.c). All types of *Prameha* on chronicity can be affected with *pitakas* (boils), acquire the technical term *"Madumeha"* because of the similarity of the aroma and taste of honey in sweat and urine. (Acharya Susruta., 2005.g).Vitiation of *Kapha* in *raktha,augments the manifestation of pitaka*. *Vyana vayu dushti* is evident in case of diabetic complications like retinopathy, diabetic carbuncle etc, where hyperperfusion of blood supply is an underlying pathology (Acharya Susruta (2005.h).

Prognosis

Considering the prognostic aspect, in general *kaphaja* variety is curable, *paittika* is controllable and *vatika* is incurable (Acharya Caraka., 2010.f) Pathologically Madumeha is of 2 types viz, absolute insulin deficiency due to β cell damage (*due to dhathu kshaya)* and relative insulin deficiency of various causes *(doshavrtha pathathwa)*. The former is incurable and latter is difficult to cure. This may be compared to Type1 and Type 2 DM.

Treatment

Diabetes mellitus is a chronic disease that requires long-term medical attention to limit the development of its devastating complications and to manage them when they do occur. Treatment involves multiple goals (ie, glycemia, lipids, blood pressure). Individual risk stratification is highly recommended (Medscape, 2016). In case of excessive beta cell destruction, patient need exogenous insulin to reverse this catabolic condition, prevent ketosis, decrease hyper glucagonemia, and normalize lipid and protein metabolism (Medscape, 2016). On analyzing the pathology, it is apparent that in Prameha, deformity of ashta dhamani happens. So the disease consequently causes dysfunction, and failure of several organs, due to vitiation of macro and microvasculature. This is one among the Ashtamahagadas, where cure can't be attained without the help of Rasayanas (Acharya Susruta., 2005.i) This points the essentiality of prevention and correction of rasayanees impaired in Prameha. Though *shamana* therapy (pacifying bio humours), *shodhana* therapy (eliminating bio humours) and regulated diet and exercise are explained as the line of treatment in *Prameha*, in due course on chronicity; patient requires *Tarpana (*enriching body tissues*)* by means of support through micronutrients, which can be compensated with mineral drug supplement. Description of Shilajatu and Swarnamakshika rasayana in Madumeha context, neglecting the role of herbs confirms the craving stage of prameha rogi for micronutrients (Chandran. seetha *et al.,* 2016.a). Also based on the types of Prameha, the modalities of management differs in Ayurveda. And this distinguishing feature makes it unique compared to treatment modalities in other science

DISCUSSION

Sahaja and *apathyanimithaja Prameha* can be compared with juvenile and adult onset diabetis mellitus. Diabetes can be roughly classified in to 3 stages, prediabetic, diabetic, and complications of diabetes. The state of prediabetes is characterized by an increase in insulin resistance and a decrease in pancreatic beta cell function. It can be identified by an impaired glucose tolerance and/or by an impaired fasting blood sugar (Kaline *et al.,* 2007). When different doshik types of *Prameha* are manifested in sequence, they can be roughly correlated to prediabetic-*Poorvarupa (~ kaphaja),* diabetic *(paittika)* and complications of diabetes *(vatika)*. Though *mootravanadi bheda* is explained for the identification of different types of *prameha*, Symptoms of *purva rupa* and *upadrava* can be considered while determining the type of *prameha*. If the patient suffers from *suptapada (Numbness of*

lower extremities), pindikodweshtanam (muscle cramp*), Nidranasha* (sleeplessness)*, kampa* (tremor), *loulya (greed for food)* etc it can be considered vata predominant. *Similarly other doshik varieties can be ruled out*.

As per Ayurveda classics, all *Prameha* if accompanied with *poorvaroopa and* kaphanupurva vatika prameha (kaphaja prameha which on chronicity became vatika prameha) *even if not accompanied,* becomes incurable. (Acharya Caraka., 2010. g) This may be related with intensity of β cell destruction. As the *poorvaroopa* is clearly mentioned, it will be helpful in taking precautions, to prevent the occurrence or reducing the severity of *Prameha* in future. It is also well known that diabetes is a major cause of end stage renal dysfunction. Improperly formed medas can be equated with faulty formed preliminary tissue. *Vasa* (muscle fat) signifies the stage of diabetic ketosis. Microalbuminuria in chronic diabetic patients can be explained in terms of involvement of *lasika* (lymph). (Mangalasseri. Prakash., 2014) All varieties of *Prameha* finally end up in the manifestation of madumeha which literally means, Diabetes Mellitus. If a patient reports sweet and viscid urine the diagnostic approach may be two folded. It may be either due to over nourishment and aggravated *kapha (sampooranath sledhma samudbhava)* or tissue depletion with vata vitiation *(ksheena dhatu anilatmaka),* which can be compared with NIDDM and IDDM of earlier modern classifications.

According to ACCORD study group aggressive glucose lowering may not be the best strategy in all patients. Because focus on glucose alone does not provide adequate treatment for patients with diabetes mellitus. Treatment modalities in Ayurveda are focused on correction of metabolism at multi systemic level, than merely focusing on hyperglycemia, thereby preventing emerging complications (Chandran.seetha *et al.,* 2016.b).

Conclusion

Established aetiopathogenesis of *Prameha* mentioned in Ayurveda are now new emerging theories in modern medicine. Ayurveda has given vast explanations of symptoms alike a broader concept, which still has to be incorporated by modern medicine. Prognosis of *Prameha* is merely related to the aetiopathogenesis. So understanding and preventing the progress of aetiopathogenesis plays a vital role in its management. And a better understanding is possible by comparing the theories in different system of medicine. This will help to develop better management strategies too.

Conflict of interest: Nil

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