



CRITICAL REVIEW ON DIABETES MELLITUS VIS-A-VIS MADHUMEHA: AN OVERVIEW

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ABSTRACT

Prameha was well known and well-conceived as a disease entity in ancient India. Classical *Prameha* is a syndromic presentation of variety of urinary and extra-urinary disorders, which are preferably based on quality and quantity of urine. Several clinical conditions like obesity, metabolic syndrome, Prediabetes, and Diabetes mellitus of biomedical sciences are presumed to be a sequential event of similar etio-pathological consequences. These disorders and its management can be traced in Ayurveda literature under *Prameha*. A chronological study of the *Ayurvedic* classics and the *Samgraha* texts have shown changing trends of emphasis on its understanding and practice. There is a group of clinical conditions characterized by polyuria which find place in the writings of Indian physicians as *prameha*. *Charaka*, *Sushruta* and *Vagbhata* were the prominent Indian physicians who had described the disease *prameha* as a set of complex urinary disorders in their famous treatise *Charaka Samhita*, *Sushruta Samhita* and *Ashtanga Hridaya* respectively. The patho-physiology, types and principles of management of *Prameha* of Ayurveda is described with highly evolved manner, which is comparable to diabetes mellitus of modern medicine. However nowadays, diabetes mellitus is being correlated with *Madhumeha*, which is actually the terminal stage of *prameha*. Keyword: Ayurveda, *Prameha*, *Madhumeha*, Polyurea, Diabetes mellitus.

KEYWORDS: *Charaka Samhita*, *Sushruta Samhita* and *Ashtanga Hridaya*.

INTRODUCTION

Diabetes mellitus (DM) is a rapidly growing metabolic disorder of multiple etiologies, characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism result from body's inability to produce enough insulin and/or effectively utilize the insulin.^[1] The first WHO Global report on diabetes shows that the number of adults living with diabetes has almost quadrupled since 1980 to 422 million adults.^[2] Despite deep understanding of underlying molecular mechanisms, ensuing cellular events, prodigious advances in medical technologies and new drugs development, the Biomedicine is still not in a position to cure diabetes. The economic burden, morbidity and mortality associated with diabetes are increasing day by day. The ancient Indian system of medicine, Ayurveda, originated in the Vedic period (1500-600 BC),^[3] aims to protect and maintain the health of a healthy person and to cure the diseased one in a holistic way. Ayurvedic medicine is known for its potential to work on multifactorial interlinked complex pathologies. However, neither Biomedicine nor Ayurveda seems capable of completely addressing the problem of diabetes. Both systems of medicine have their own strengths, and an integrated approach seems a better option to tackle the

problem of diabetes. It is important to recognize that *madhumeha* and diabetes mellitus are not synonyms. Correlations between diabetes and *madhumeha* or *prameha* should be made on the basis of comprehensive study of their pathogenesis in both systems.

According to Ayurveda "swastha or the healthy person is an individual who is in a state in which the *doshas*, *agni* and *dhatu*s are all in equilibrium, the excretion of *mala* (the body wastes) is regular and the mind, senses and the soul are all tranquil".^[4] Etiological factors initiate and sustain a chain of events which ultimately manifest as disorder or disease. The initiation and progression of these events depend upon multiple factors such as intensity and duration of exposure to etiological factors, season, body type (*prakriti*), strength of body tissues (*dhatu*sarta) etc. The six stages through which a disease develops are known as *kriyakala*. These are *samchaya* (accumulation), *prakopa* (aggravation), *prasara* (spreading or migration), *sthanasamshraya* (localization), *vyakti* (manifestation) and *bheda* (differentiation/ complication). Each stage of *kriyakala* produces some features of respective *doshas* on the basis of which it can be diagnosed and subjected to drug or non-drug treatment. Intervention in early stages increases

the likelihood of better outcome. At stage of *sthanasamshraya* the prodromal symptoms (*poorvaroopa*) of a disease begin to appear. *Poorvaroopa* may or may not be disease specific. *Vyakti* is the stage of manifestation of disease specific signs and symptoms, and at this stage a specific diagnosis can be made about a disease.^[5]

Epidemiology & Prevalence^[6-8]

The prevalence of diabetes is rising at an alarming rate. 80% of people with diabetes live in low-and middle-income countries and the socially disadvantaged in any country are the most vulnerable to the disease. The number of people with diabetes in Southeast Asia in 2017 is 80 million and this is expected to increase to 151 million by the year 2045. Diabetes currently affects more than 62 million Indians, which is more than 7.1% of the adult population. The average age on onset is 42.5 years. Nearly 1 million Indians die due to diabetes every year. The high incidence is attributed to a combination of genetic susceptibility plus adoption of a high-calorie, low-activity lifestyle by India's growing middle class. Indians had the highest prevalence of diabetes (12.8%), followed by Malays (11.3%) and Chinese (8.4%). Both the thrifty genotype and thrifty phenotype hypotheses appear to have etiological roles in the development of diabetes in the Asian populations. The phenotype of T2D in Asians is characterized by young age of the onset, predisposition to beta-cell failure and visceral adiposity.

Diabetes caused 5.1 million deaths in 2013; every six seconds a person dies from diabetes. Diabetes caused at least 548 billion dollars in health expenditure in 2013 – 11% of total spending on adults. India, a country experiencing rapid socioeconomic progress and urbanization, carries a considerable share of the global diabetes burden. Recent studies have shown a rapid conversion of impaired glucose tolerance to diabetes in the southern states of India, where the prevalence of diabetes among adults has reached approximately 20% in urban populations and approximately 10% in rural populations. Because of the considerable disparity in the availability and affordability of diabetes care, as well as low awareness of the disease, the glycemic outcome in treated patients is far from the reality. Lower age at onset and a lack of good glycemic control are likely to increase the occurrence of vascular complications. In India the rapid modernization from an energy-scarce to energy-rich environment has led to high rates of metabolic syndrome and diabetes. While we cannot obviously reverse the economic prosperity in India, we can definitely limit the impact of rapid lifestyle changes associated with economic growth and it can be prevented and managed by various culturally appropriate methods including Ayurveda and Yoga to curb the rising burden of diabetes.

Etymology & Definition

Etymology of Prameha

The word *Prameha* consists of two words i.e. *Pra* (*upsarga*-prefix) and '*Meha*'. *Meha* is derived from the root '*Mih Sechane*' meaning watering with reference to disease of human body. Excessive quantity and frequency is indicated by the prefix *Pra*. Therefore, the word *Prameha* means passing of urine profusely both in quantity and frequency.^[9]

Definition

Prameha

Acharya Vagbhatta has described *Prameha* as frequent and copious urine with turbidity i.e. *Prabhutavila Mutrata*.

Classification of Prameha

Ancient Indian physicians have tried to classify the disease in different manner, which are mentioned as below.

1. Doshika Classification

Twenty types of *Prameha* have been described in *Ayurveda*, which are further classified on the basis of dominant sets of *Doshas*.

- | | | |
|----------------------------|---|----|
| i. <i>Kaphaja Prameha</i> | - | 10 |
| ii. <i>Pittaja Prameha</i> | - | 06 |
| iii. <i>Vataja Prameha</i> | - | 04 |

2. Aetiological classification

On the basis of aetiology, *Sushruta* has mentioned clearly two types of *Prameha*. One is *Sahaja* (hereditary) another is *Apathyanimittaja* (acquired).^[10] *Acharya Bhela* has named them as – *Prakritaja* and *Svakritaja Prameha*.

- a. **Sahaja:** Hereditary diabetes ie Type 1 DM (*sushruta*). *Sahaja Prameha* occurs as a result of *Bija dosha* i.e. genetic origin. While describing prognosis, *Acharya Charaka* has narrated that *Jatapramehi* is incurable.^[11]
- b. **Kulaja:** Familial diabetes ie Type 2 DM (C.S.Chi. 6/57).
- c. **Apathyanimittaja:** Acquired diabetes ie Type 2 DM (*Sushruta*). It occurs due to unwholesome *Ahara & Vihara*. (faulty diet & lifestyle errors)
- d. **Dhatukshayajanya madhumeha-** Diabetes mellitus due to nutritional deficiency. (M.Ni. 33/24-25).
- e. **Vataprakopajanya madhumeha-** Diabetes mellitus associated due to chronic debilitation disease (C.S.Su.17/80).
- f. **Avarittavatajanya madhumeha-** Insulin resistance diabetes mellitus. (A.H.Ni.10/18)

3. Constitutional Classification

Charaka has advanced the view that the patients of *Prameha* may be categorized into two categories depending upon their body constitution viz. *Sthula* and *Krishna Pramehi*^[12,13] (Ch.Ci.6/15). According to *Sushruta* body constitution of *Sahaja Pramehi* is generally *Krishna* (lean & thin) and that of

Apathyanimittaja Pramehi is *Sthula* (obese) (*Su.Ci.* 11/3).

4. Prognostic classification^[14]

Sadhya (Curable): *Kaphaja, Sthula, Apathyanimittaja*, New cases without complications, *Pittaja* in which *Medodhatu* not highly vitiated.

Yapya (Palliative): *Pittaja Prameha*

Asadhya (Incurable): *Vataja, Sahaja pramehi & Jataprmehi*.

Nidana (Aetiology) of Prameha

The etiological factors of *Prameha* can be broadly classified into *Sahaja* and *Apathyanimittaja*.

Sahaja Nidana^[15-17]

In addition to other factors, the classics have also accepted the concept of hereditary factor as a cause of *Prameha*. *Sahaja Vikara* may be either *Janmabalapravritta* (congenital) or *Adibalapravritta* (hereditary). *Charaka* while describing the prognosis of *Prameha* clearly said that this is *Kulaja Vikara* resulting due to *Bija dosha*. He mentioned that *Dushyas* may be in *Bija, Bijabhaga* and *Bijabhagavayava*. So we can say that this disease may be inherited from generation to generation.

Charaka has also mentioned that over indulgence of *Madhura rasa* by mother during pregnancy is likely to induce *Prameha*.

The above mentioned etiological factors of *Prameha* are very similar to the contemporary concept of Diabetes mellitus. Recent studies have shown that there is a genetic component in the etiology of type 1 DM. The study have shown that the cumulative concordance among twins from birth to age 25 is 70%, which indicates that genetic factors cannot account for 100% of incidence, but environmental, immunity and other factors are also contributory.^[18] It has suggested autoimmunity as an important contributory factor in type 1 DM.^[19]

Apathyanimittaja^[20-22]

A. Samanya Nidana: When we go through the etiological factors given in classics we can subdivide them in following heads viz. *Aharajanya, Viharajanya, Manasika*.

i. Aharajanya Nidana

It includes excessive and frequent use of following.

- Hayanaka, Yavaka, Chinaka, Uddalaka* etc. in newly cultivated form.
- Consumption of new pulses like *Harenuka* and *Masha* with *Ghrita*.
- Guda* and *Ikshuvikara* preparation, milk, fresh milk, *Mandakadadhi*.
- Meat and soup of different *Anupa, Audaka* and *Gramya* animals.
- All other materials which increase *Kapha dosha*.

The incompatible food when ingested produces toxic metabolites (*Gara-visha* and *ama*) and gradually hampers the process of metabolic disorders including diabetes mellitus.

ii. Viharajanya Nidana

- Stress producing factors like- over anxiety, anger, worry, grief etc.
- Ingestion of food with inadequate intervals.
- Faulty dietary habits.
- Indulging sex / sleep with fully belly after meals etc.
- Excessive consumption of alcoholic beverages. (*Basavaraja*- 14 century AD)

All these factors also directly disturb metabolism of ingested food and thereby in due course, it produces *Apathyanimittaja Madhumeha*. In conventional medicine, upto now no specific genes have been identified and account its role in type 2 DM. However there are possibilities of greater involvement of genetic factors than Type 2 DM. In type 2 DM, two major problems are identified, one is reduced secretion of insulin in peripheral tissues. Obesity is another major etiological factor; accounts for 80% of cases of type 2 DM.

iii. Manasika Nidana

In *Charaka Samhita* psychological factors such as anxiety, anger, worry, grief etc. have been described to play an important role in the genesis of *Vataja & Pittaja Pramehas*.

B. Vishesha Nidana

Charaka (C.S.Ni.4/5,24,36) has described the aetiological factors in three main groups based on predominance of *Dosha*.

i. Kaphaja Prameha^[23]

The general aetiological factors of *Prameha* resemble with the specific aetiological factors of *Kaphaja Prameha*.

ii. Pittaja Prameha^[24]

The habitual use of spicy foods, *Lavana, Katu, Amla Rasa* and *Ushna virya Dravyas*, frequent and irregular meals, exposure to bright sun, or any kind of heat, excessive exercise, anger etc. and *Paittika* constitution of body are prone to suffer from *Pittaja Prameha*.

iii. Vataja Prameha^[25]

The excessive use of *Ruksha, Katu, Kashaya, Tikta, Laghu* and *Shita viryadravyas*, excessive sexual indulgence, exercise and *Shodhana* therapy, suppression of natural urges, starvation, trauma, mental stress, exposure to sun, increased blood loss and wrong posture of the body are causative factors to produce *Vataja Prameha*.

Purvarupas (Prodromal Symptoms) of Prameha

Purvarupas are valuable signs and symptoms to predict the disease in its early stage & to check its progression towards *Madhumeha* and its complications by applying appropriate therapeutic measures.^[26]

Critical analysis of Purvarupa

- *Karapada daha* is due to *Ashayapkarsha gati* of *Pitta*. It may be also due to loss of *Ambu*, which has *Shitaguna* required for *prirana*, failing to which results in *Daha*.
- *Karapada suptata* is due to *Ashayapkarsha gati* of *Kapha*.
- *Asya madhurya* is due to *Kapha prakopa* by various *nidana*.
- *Kesheshu Jatilibhava* and *Keshnakha Ativriddhi*s because of *atimala sanchaya*, which in turn due to defect in metabolism (*Bhutagni* and *Dhatvagni Paka*).
- *Sarvakala tandra & Nidra* is due to loss of *Rasa&Oja*.
- *Snigdha, Pichchhila & Gurugatrata* is due to vitiation of *Kapha* by corresponding qualities of *Snigdha, Pichchhila & Guru*.
- *Mukha talu kantha shosha* and *Pipasa* are due to *Ruksa guna* of *Vata* and also due to loss of *shita & snigdha* caused by *Udakakshya*. Increased *Jatharagni* is also responsible for these symptoms.
- *Shatpada Pipilika Mutrabhisaranam* is due to presence of *Madhurata* in *mutra*. *Kaye Malam&Dantadi Maladhytvamis* because of their excessive productions in defective metabolism (*Bhutagni* and *Dhatvagni Paka*).
- *Dehe Chikkanata* is due to *Medovaha Srotodushti*.

Regarding the excessive excretion of *Malas* in the buccal cavity, one significant modern observation may be quoted i.e. thickening of vascular wall of buccal mucosa, especially of gums has been reported in prediabetic condition. [Lozanocastaneda,1964].

So, *Purvarupa* of *Prameha* may be correlated with the clinical condition of.

- Metabolic syndrome
- Prediabetic stage
- Early Stage of Type-2 DM
- Subclinical Stage of Type-2 DM

Rupa (Clinical features) of Prameha

The *Rupa* includes both signs and symptoms of diabetes mellitus observed at various stages. It can be categorized as below.

1. General features of Prameha

a. Urine Characteristics

Prabhutamutrata: This cardinal feature has described by all *Acharyas*, *Vagbhatta* has mentioned *Prameha* as the disease of *Mutratripravritija* (*A.H.Ni 9/40*) i.e. patient voids more urine both in quantity and frequency. *Gayadasa* on (*Su. Ni. 6/6*) opinions that this excess urine

quantity is because of liquification of the *Dushyas* and their *Amalgamation*.^[27]

Avilamutrata: Patient voids turbid urine. According to *Gayadasa* and *Dalhana*, this turbidity of urine is due to the nexus between *Mutra, Dushya* and *Dosha*. (*Su.Ni. 6/6*)

Kashyapa has mentioned following symptoms of *Prameha* to be observed in pediatric patients (*Ka. Su.25/22*).

- *Akasmata Mutranirgamana:* Child excretes urine suddenly with no intention.
- *Makshika Akranta* : Flies get attracted towards the urine.
- *Shveta* and *Ghana Mutrata* : Child excretes urine having *Shveta* colour and solid consistency i.e. turbidity.

b. Associated signs and symptoms

Before propounding the treatment of *Prameha*, *Acharya Sushruta* in *Chikitsasthana* described two type of *Prameha* as follows.

Sahaja Pramehi

- *Krishha* (asthenic)
- *Raukshya* (dry body)
- *Alpashi* (consumes less food)
- *Bhrisha Pipasa* (voracious thirst)
- *Parisaranashila* (restless always desires to wander)

Apathyanimittaja

- *Sthula* (Obese)
- *Bahuashi* (voracious eater)
- *Snigdha* (unctuous body texture)
- *Shayyasanasvapnashila* (like to sit down & sleep always)

2. Premonitory features of Prameha

According to *Sushruta* the person should be diagnosed as *Pramehi* when complete or partial premonitory symptoms of *Prameha* accompanied by polyuria (**PravrittamutrAmatyartham**) get manifested (*Su.Ni.6/22-23*). In this context, *Gayadasa* opined that in this disease all prodromal symptoms get converted into *Rupa* due to specific nature of disease i.e. *Vyadhi Prabhava*.

3. Specific Symptomatology of Prameha

This includes the physico-chemical characteristics of urine of twenty types of *Prameha*, which is based on specific interactions of *Dushya* and *Dosha*. Further, it is categorized into three major heads of *Vataja, Pittaja*, and *Kaphaja Prameha*.

4. Specific Symptomatology of Madhumeha

According to *Sushruta* all the varieties of *Prameha* if not treated properly may be converted into *Madhumeha* in due course of time.

a. Urine Characteristics

Patient of *Madhumeha* passes urine having *Kashaya* and *Madhura* taste, *Pandu* in colour and *Ruksha* quality (Ca. Ni. 4/44). Commenting upon this assertion of *Charaka*, *Gangadhara* opines that natural *Madhura Rasa* of *Oja* is replaced by *Kashaya Rasa* in *Vasti*. According to *Chakrapani*, *Vata* because of its *Prabhava* converts *Madhura rasa* of *Oja* into *Kashaya Rasa*.

b. Associated Symptomatology

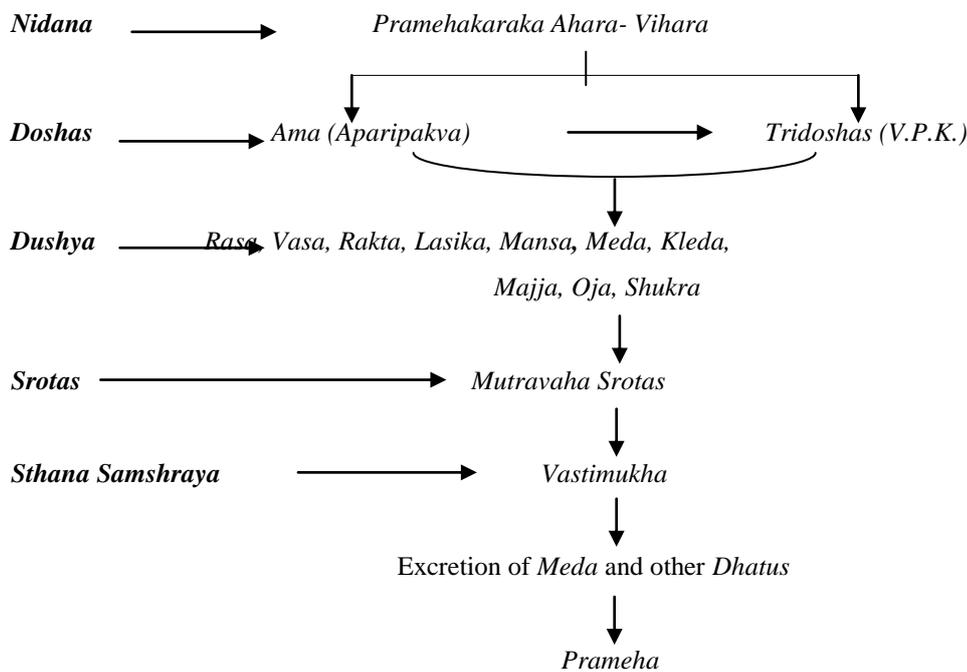
ShariraMadhurya: This special feature mentioned only by *Vagbhata*. According to him, the body of *Madhumehi* patient also becomes *Madhura* (A.H.Ni 10/21).

Psycho-physiologocal features: According to *Sushruta*, *Madhumehi* prefers to stand still stand than walking, lying down than sitting and sleeping than lying down. This feature has been explained as '*Panchavidhakriyashryalinga*' by *Dalhana*.

Samanya Samprapti (general pathogenesis) of Prameha

General pathogenesis of *Prameha* is described elaborately by *Charaka* in *Nidanasthana* (C. Ni. 4/8). Although *Prameha* is a *Tridoshika* disease but initially it starts with derangement of *Kapha Dosh*.^[28] According to *Charaka*, *Kaphaja* and *Paittika Prameha* follow the same course except with only one difference that *Pitta* is predominant in place of *Kapha*.

Sushruta opines that if a person takes *Pramehajanaka Ahara Vihara*, *Ama* is formed and *Vata*, *Kapha*, *Pitta* become aggravated which vitiate mainly *Medodhatu* along with other *Dhatu*s. These aggravated *Doshas* and vitiated *Dhatu*s reach *Vasti*. They remain there for some time and this retention for considerable duration may lead to develop *Prameha* of various types by excreting vitiated *Dhatu*s with urine (Su. Ni.6/4).



Dalhana interprets the term *Aparipakva* as '*Ama*'. Again he emphasize that *Ama* does not only mean *Ama doshas* but *Ama Dushya (Medashca Aparipakvam)* too. *Gayadasa* comments that formation of *Medas* is not interrupted but impaired with qualities of '*Ama*' (*Medashca aparipakvamiti asamyak parinatam*).

According to *Sushruta* in addition to the predominance of *Doshas* the roles of *Dushyas* have been also emphasized in the pathogenesis of *Prameha* (Su. Ni 6/9).

| S.No. | Prameha | Doshic Predominance | Dushyas |
|-------|-----------------|----------------------------------|----------------------|
| 1. | Kaphaja Prameha | ↑ed kapha and ↓ed pitta and vata | Meda |
| 2. | Pittja Prameha | ↑ed pitta and ↓ed kapha, vata | Rakta & meda |
| 3. | Vatika Prameha | ↑ed vata ↓ed pitta and kapha | Vasa, majja and meda |

1. According to *Sushruta*, *Madhura Ahara* taken in excess along with day sleep and sedentary lifestyle, may convert into fat due to metabolic block (*Ama Rasa*). It contributes to the adiposity of the body leading to overweight. So the present day concept of metabolic syndrome in the obese patients where

most of the carbohydrate being converted into fatty acids is well conceived by *Sushruta*. Overweight in prediabetic patents has been observed to be associated with hyperinsulinemia and increased FFAs level. Due to the increased FFAs level in serum, the glucose entry to the cells is hampered, resulting in insulin resistance and finally diabetes. The FFAs are the soluble form of fat, which are fit for utilization in energy metabolism, coming from adipose tissue. So one can conclude that triglyceride content of Adipose tissue is an example of *Baddha Medas* and FFA may be compared with *Abaddha Medas*. Hence, sometimes the *Kaphaja* type of *Prameha* is correlated with Type 2 DM with or without Insulin Resistance.

2. Ayurveda described that *Ama/Amavisa* (intermediary toxic products of digestion and metabolism) and emotional factors (mental stress), are also responsible for manifestation of *Pittaja Prameha*. The relationship between *Prameha* and *Ama/Amavisa* is well documented in ayurveda. The relationship of *Ama* with psychological factors as stated in Charak Samhita is the evidence of relationship of *Prameha* with mental stress. The emotional factors enhance the level of counter regulatory hormones (cortisol, epinephrine, nor-epinephrine) that may alter the carbohydrate, protein, and fat metabolism. The mode of action of these hormones in the genesis of diabetes is through mobilization of FFAs from TG of adipose tissue. Adrenal hyperactive secretion causes lipolysis and protein breakdown resulting in muscle wasting. Stress also increase sympathetic activity which cause increased insulin secretion but the other glands are predominant that check the insulin response at tissue level.
3. *Vataja Prameha* is *Asadhya* or incurable, because patients lose vital essence of all tissue i.e. *Ojas* and other important *Dhatu*s through urine very rapidly

and such patients are of Asthenic build. This advanced condition is comparable to NIDDM progressing into IDDM. It is stage of diabetes in which there are complications, including nephropathy, which result in excretion of vital substances through the urine.

Based on pathogenesis, as described above certain scholars suggests that the three types of *Prameha* i.e. *Vataja*, *Pittaja* and *Kaphaja* are different types of diabetes mellitus as known in modern medicine. *Kaphaja Prameha* can be compared to type 2 DM where there is insulin resistance leading to hyperinsulinemia and finally leading to insulin secretory defect. *Paatika Prameha* is suggested to be due to over secretion of counter regulatory hormones as it happens in the state of stress and *Vatika Prameha* may be correlated to type 1 DM, where there is auto immune or idiopathic destruction of β – cells of islets of langerhans of pancreas. However such correlations are not acceptable to all scholars are many of them are skeptical about the context of 20 type of *Prameha* and consider only *madhumeha* as Diabetes Mellitus.

Samprapti Ghataka (Pathogenetic component)

Dosha: *Tridosha* (specially *Kapha Pradhana*).

Dushya: *Rasa, Rakta, Mamsa, Meda, Majja, Vasa, Lasika, Oja, Shukra, Ambu* (C.Ch.6/8)^[29], *Sveda* (A.H.Ni, 10/4)^[30] (specially *Medas* and *Ojas*)

Srotas : All types of *Srotasa* except *Asthi* (specially *Rasa* and *Medavaha*)

Srotodushiti : *Atipravritti, Sanga, Vimarga gamana*.

Adhithana : *Vasti*

Pratyatma lakshana : *Prabhuta Mutrata & Avila mutrata*

Sancharsthana : *Sarvanga Sharira via Rasayani*

Roga Marga : *Abhyantara*

Sadhya/Asdhyata : *Kaphaja- Sadhya*

Pittaja – Yasya

Vataja – Asadhya

Vyadhi Svabhava : *Chirakari*

Diagnostic criteria for Diabetes Mellitus^[31]

| |
|--|
| FPG \geq 126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.* |
| OR |
| 2-h PG \geq 200 mg/dL (11.1 mmol/L) during OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.* |
| OR |
| A1C \geq 6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.* |
| OR |
| In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose \geq 200 mg/dL (11.1 mmol/L). |

Prameha Upadrava (Complications)

1. General Complications^[32]

Trishna, Atisara, Daha, Daurbalya, Arochaka, Avipaka, Putimamsa pidaka, Alaji, Vidradhi etc. (C.Ni.4/48)

2. Specific Complications

a. Kaphaja Prameha^[33]

Makshikopasarpanam, Alasya, Mamsopachaya, Pratishyaya, Saithilya, Arochaka, Avipaka, Kapha praseka, Chhardi, Nidra, Kasa and *Shvasa* (Su.Ni.6/15).

b. Pittaja Prameha^[34]

Vrisanayoravadaranam, Vasti-bheda, Medhra-toda, Hridaya Shula, Amlika, Jvara, Atisara, Arochaka, Vamathu, Paridhumayana, Daha, Murchha, Pipasa, Nidranahsa, Pandu, Pitta-vinmutranetratva. (Su.Ni.6/15)

c. Vataja Prameha^[35]

Hridgraha, Lauhya, Anidra, Stambha, Kampa, Shula, Baddha Purisatva (Su.Ni.6/15).

Prameha Pidaka^[36]

Ayurvedic texts have described *Prameha pidaka* as a major complication of *Prameha*, *Prameha pidaka* develops dependently in patients of *Prameha* and independently in the patients having primary features of *medodushti*. These *Prameha pidaka* require surgical intervention.

In relation to origin of *Prameha pidaka*, *Sushruta* says that due to weakness of *Rasayani* is in patients of *Prameha*, *Doshas* get mobilize to the lower part from upward and as such *pidaka* mostly appear in lower parts of the body in case of *Prameha/Madhumeha*. *Sushruta* opines that *Madhumeha* along with *pidaka* are considered as *Asadhya*. He narrated that these *pidakas* occurs due to *Tridosha* and vitiated *Meda & Mamsa*. These *pidaka* are mainly found in muscular regions, joints and vital points (*Marma*) of the body.

People with diabetes have an increased risk of developing a number of serious health problems. Consistently high blood glucose levels can lead to serious diseases affecting the heart and blood vessels, eyes, kidneys, nerves and teeth. In addition, people with diabetes also have a higher risk of developing infections. In almost all high-income countries, diabetes is a leading cause of cardiovascular disease, blindness, kidney failure, and lower limb amputation.

DM affects the heart and blood vessels and may cause fatal complications such as coronary artery disease (leading to heart attack) and stroke. Cardiovascular disease is the most common cause of death in people with diabetes. Diabetic nephropathy caused by damage to small blood vessels in the kidneys leading to the kidneys becoming less efficient or to fail altogether. Diabetic neuropathy diabetes can cause damage to the nerves throughout the body when blood glucose and blood pressure are too high. This can lead to problems with digestion, erectile dysfunction, and many other functions. Among the most commonly affected areas are the extremities, in particular the feet. Nerve damage in these areas is called peripheral neuropathy, and can lead to pain, tingling, and loss of feeling. Diabetic retinopathy most people with diabetes will develop some form of eye disease (retinopathy) causing reduced vision or blindness.

Women with any type of diabetes during pregnancy risk a number of complications if they do not carefully monitor and manage their condition. People with diabetes have an increased risk of inflammation of the gums (periodontitis) if blood glucose is not properly managed.

Prognosis

1. The ten *Kaphaja Prameha* are curable because of the compatibility in the principles of treatment due to similar nature of *Dosha* and *Dushya* i.e. *Samkriyatvat*
2. The *Pittaja Prameha* are palliable because of the incompatibilities in the line of treatment i.e. *Vishamakriyatvat*.
3. The *Vataja Prameha* are incurable because of great severity of disease or involvement of *Dosha* and *Dushyas* (specially *Ojas*) contradictory treatment i.e. *Mahatyayvat*.

Principles of management of Prameha^[37-38]

In all types of *Pramehas*, *Kapha* gets vitiated, but in *Madhumeha* comparatively *Vata* is often aggravated as well. Therefore, therapies will be directed at both *Kapha* and *Vata* simultaneously. *Charaka* has said that the patients who are obese and strong body built, one should adopt *Samshodhana* treatment and who are asthenic body built and weak, one should undergo for *Brihman* therapy. According to *Sushruta*, *krisha Pramehi* should be treated with *Santarpana* measures processed diet and drink, while obese should be treated with *Apatarpana* measures (*Vyayama and Shodhana*). It consists of tri triangular approach, which is described as below.

I. Ahara Chikitsa (Diet Therapy)

Avoidance of etiological factors i.e. *Nidana Parivarjana*, is firmly advocated in all classics for the management of disease. Such types of *Aharas*, which does not increase obesity and opposite to etiological factors of *Prameha* are found suitable for its management. It is well known that diabetes is a disease of modified lifestyle and faulty *Agni*, so more emphasis should be given on diet, promotion bio-fire and time to time use of bio-purificatory measures.

Charaka has recommended *Yava, Shashtika* etc. as a principle diet for *Pramehi*. In this concern he suggested that *Yava* first given to animals and then remaining parts collected from the dung of that animals to be consumed by *Pramehi*. The diet indicated by *Sushruta* in *Prameha* contains old types of *Shali, Shashtika* (variety of rice), *Yava*, pulses like *Chanaka, Adhaki, Mudga* and *Kulattha* and bitter and astringent vegetables.

According to *Sushruta* the food which is enriched with any type of fermented material, alcoholic substances, excessive water intake, milk, oil, ghee and the syrups and meat of aquatic and near aquatic animals should be avoided to the patients of *Prameha*.

2. Vihara (Exercise)

Sushruta has described that in advance stage of *Prameha*, *Pramehi* should practice of regular physical exercise, wrestling, actual sports, riding on a horse, or an elephant, long walks, pedestrial journeys, practicing archery, casting of javelins etc. He has also recommended in detail to the management of *Prameha* for poor and rich patients with exercise and diet.

Poor patients should move from one to the other village and earn his living by begging. In this context *Sushruta* wants to convey the role of exercise and less intake of rich food for the management of *Prameha*. For rich patients he has described that persons who eats *Shyamaka*, fruits of *Amalaki*, *Tinduka*, *Ashmantaka* and live with animals and who work by breaking the stones, becomes relieved from *Prameha* within one year. *Yogic* practices are also useful in the management of *Madhumeha*; some *Yogasanas* viz *Bhujangasana*, *Mayurasana*, *Gomukhasana* etc and meditation are believed to improve pancreatic and liver functions too.

Vagbhatta has advised *Ruksha Udvartana*, heavy exercise and awakening in night for the patient of *Prameha*.

3. Aushadhi (Medicines)

As it is evident that *Kapha Dosha* is predominant in *Prameha* and the *Dushya Meda* is of same nature. In *Ayurveda* drugs having *Tikta* (bitter), *Katu* (pungent) and *Kashaya* (astringent) *Rasa* have been recommended for the management of *Prameha*. In *Ayurvedic* classics a number of herbal, mineral and herbo-mineral formulations are advocated for the management of *Prameha*. Some of the important formulations are given as below.

- **Kwatha/ Swaras:** *Darvyadi Kwatha* (C.), *Phalatrikadi Kwatha* (C.), *Vidangadi Kwatha* (Y.P.), *Triphaladi Kwatha* (B.R.), *Manjishthadi Kwatha* (B.R.), *Palash Pushpa Kwatha* (Y.R.)
- **Churna:** *Triphala Churna* (Y.R.) *Sphatika churna* (B.R.), *Eladi Churna* (B.R.), *Karadi Vijadi Churna* (Y.R.), *Guduchhyadi Yoga* (Vrinda)
- **Vati:** *Gokshuradi Vati* (Y.R.), *Chandrapraha Vati* (Y.R.), *Arogyavardhini Vati*
- **Rasa:** *Basanta Kusumakar* (B.R.), *Prameha Chintamani* (B.R.), *Prameha kulantaka* (B.R.), *Vangeshwar* (B.R.), *Vasanatatilaka Rasa* (B.R.)
- **Bhasma:** *Trivanga Bhasma*, *Loha Bhasa*, *Roupya Bhasma*
- **Asava/ Arista:** *Madhvasava* (C), *Lodhrasava*, *Deodarvyarishta* (B.R)

CONCLUSION

In *Prameha/Madhumeha* those drugs are useful which have *Rasayana*, *Balya* and *Jivaniya* properties, as well as *Pramehahara Dravyaprabhava* and *Guna Prabhava* found effective in its management. *Sushruta* clearly indicated the decoction of *Salasaradi Gana* drugs with *Shilajatu* for the treatment of "*Prameha/Madhumeha*".

Thus on the basis of critical overview of diabetes mellitus vis-à-vis *Madhumeha*, we can be concluded that diabetes mellitus is well defined but its etiopathogenesis and management is still evolving in biomedical sciences. The researchers are inclined to evolve its neopathogenesis and remedial measures from traditional system of medicine including *Ayurveda*. In *Ayurveda*, complete orchestra of diathesis of disease and management of diabetes is moving around concept of *Prameha/Madhumeha*. It is interesting to note that in *Ayurvedic* classics deranged functions of *Agni* (bio-fire), *Ojas* (immune component) and *Medas* (lipids) play an important role in the genesis of diabetes mellitus and the same are kept in mind by *Ayurvedic* physician at the time of diagnosis and management. The conventional management of diabetes mellitus is still not very satisfactory and its current strategy of prevention and management is rapidly changing. However, the leads available from this context not only impart significant input for its better understanding of disease diathesis but also help to plan appropriate therapeutic intervention for its management.

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