

## Conceptualization of Pathology of Diabetes Mellitus in Ayurveda and its Management Through Dietary Modifications

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### Abstract

Diabetes Mellitus (DM) is a serious global health concern. Ayurveda explain this disease under the broad heading of Prameha. It is basically a Kapha dosha disorder with pathological involvement of increased circulating free fatty acids (bahu abaddha meda). Diagnostic approaches to DM in Ayurveda are based on various entities like etiological factors, nature of onset, sequential involvement of different body tissues (dooshya) and even therapeutic varieties. Successful outcome in management of DM depends on chronicity of the illness, association of complications and adherence to specifically advised diet, regimen and exercise. Ayurvedic classics are very particular about dietary management especially of non refined and fiber rich food articles. Medicated gruel (oushadha yavagu) is effectively used for controlling various diseases in Ayurveda. Dashamoola medicated gruel is traditionally practiced in various stages of DM. Dashamoola is a popular combination of 10 herbs specifically indicated in inflammation (swayathu). It has good potential to remove kleda (one of the main pathological element in Prameha) through urine. Nephro, Hepato and Gastrotoxic potential of aqueous extract of Dashamoola has been evaluated and found to be safe by animal experiments. Further some ingredients of Dashamoola have antidiabetic, nephroprotective and cardiogenic effect. As per Ayurvedic Pharmacopoeia of India Dashamoola provide relief from inflammation and its decoction is traditionally practiced by tribal people as anti-inflammatory. There is increasing evidence that low-grade inflammation is closely involved in the pathogenesis of type 2 diabetes and several drugs with anti-inflammatory properties lower both acute-phase reactants and glycemia. As subclinical inflammation is indeed another facet of the IRS, anti-inflammatory treatment may also be beneficial in Diabetes Mellitus. The administration of Dashamoola medicated gruel has shown encouraging results in diabetic patients of freshly diagnosed type 2 DM and even to chronic stages like nephropathy and neuropathy. Case report studies are recorded in routine clinical practice. The full paper review the pathogenesis of Prameha with reference to DM and the role of diet and exercises advised in Ayurveda with special emphasis to case reports of Dashamoola medicated gruel in various stages of DM.

**Keywords:** Prameha; Sthoulya; Type 2 DM; Medodhatu; Oushadha Yavagu

### Abbreviations

DM: Diabetes Mellitus; IRS: Insulin Resistance Syndrome

### Introduction

Diabetes mellitus (DM) is a metabolic disorder resulting from a defect in insulin secretion, insulin action, or both in turn leads to chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism. Globally, 382 million people (8.3% of the adult population) had diabetes in 2013. Of these, 175 million (46%) were undiagnosed. 592 million people (10% of adults) will have diabetes by 2035. Diabetes was responsible for 11% of the total global adult health expenditure (USD \$548 billion) and 5.1 million deaths. 80% of people with diabetes live in low- and middle-income countries [1]. In South-East Asia, the regional preva-

lence in 2013 is 8.2% (72.1 million) and projected to be 10.1% by 2035 amongst half of people with diabetes are undiagnosed. India becomes top in the region with 65.1 millions diabetic people with prevalence of 9.09% [2]. India behind China leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the "diabetes capital of the world". A community based cross-sectional survey done in urban areas of Ernakulam district in Kerala has revealed a very high prevalence of 19.5 percent [3]. This phenomenal rise in diabetes has been ascribed to rapid changes in demographic, nutritional and socioeconomic factors, the so-called epidemiologic, nutritional and economic transition.

Type 2 diabetes is the commonest form of diabetes and is characterized by disorders of insulin secretion and insulin resistance [4]. Pharmacological interventions in Type 2 diabetes are aimed

primarily to save life and alleviate symptoms. Secondary aims are to prevent long-term diabetic complications and, by eliminating various risk factors, to increase longevity. But oral hypoglycemic agents on chronic usage may deplete pancreatic beta cells. Eventually Insulin also becomes important in type 2 DM when blood glucose levels cannot be controlled by diet, weight loss, exercise and oral medications. Well-planned dietary modifications along with closely monitored pharmacological interventions in Type 2 DM may prolong the essentiality of Insulin usage. Ayurveda identifies many dietary formulations in management of diabetes. It is worthy to investigate the role of Ayurvedic dietary formulations in controlling diabetes when supplemented along with conventional medicine. It is also important to know the role of Ayurveda in improving the quality of life in Type 2 DM patients.

## Materials and Methods

1. **Review Study:** Classical Ayurvedic texts with commentaries, Modern textbooks, Internet publications were referred to compile and analyse the relevant information.
2. **Case Reports:** Nine cases of Type 2 DM at various clinical stages undergone Dashamoola medicated gruel therapy are observed and the outcome were tabulated.

## Observation and analysis

### Review study

#### Etiopathology of DM in ayurveda

Ayurveda consider DM under the broad heading of Prameha which is a disease of pathological association of vasti (urinary system) [5]. It is caused by bahudrava Shleshma (Kapha with increased liquidity), bahu abaddha meda (increased free fatty acids) and kleda (excretory portion of body fluids) [6]. Basically Prameha is of two types – Sahaja (congenital) and Apathyanimittaja (acquired). Sahaja variety of prameha patients are krisha (lean) rookshashi (eat food articles of minimal calorie), alpashi (eat less amount of food), pipasu (have extreme thirst) and bhrisham parisarna sheela (hyperactive and wandering nature). The second variety Apathyanimithaja patients are sthoola (obese), snigdha bhwaashi (voracious eater of calorie rich diet) and shayyasana swapna sheela (prefer sedentary life style) [7]. These two may be compared with juvenile onset Type 1 and maturity onset Type 2 diabetes mellitus. Therapeutically also patients of prameha are of two categories. The first groups of patients are sthoola and balavan (obese and physically fit). The second group is krisha and durbala (Lean, emaciated and weak) [8].

Ayurveda identify various causative factors for development of Sthoola Prameha (Type 2 DM). They are high calorie diet, sedentary habits and absence of exercise. Along with these genetic predisposition and inheritance also play important role. Etiological factors identified in Ayurvedic texts include excess and frequent use of navanna (fresh cereals), ksheeravikara (dairy products), ikshuvikara (sugar products), maamsa (meat) and swapnashayanaanasanaprasanga (reduced physical activity) etc which increase meda (adipose tissue), mutra (urine) and kapha [9]. The mani-

festation of Prameha due to these causes is of comparatively slow onset.

As Prameha is a disease with specific vitiation in Meda (adipose tissue) it is advised in Charakasamhita to refer the chapter pertained on “Ashtaninditeeya” for its treatment in elaboration. Morbid obesity (Atisthoulya) is one among eight contemptible and miserable diseases. There are eight important causes mentioned in Ayurveda for such morbid obesity [10]. They are

1. Over nourishment (Atisampooranat)
2. Excessive usage of sweet, oily and cold articles which are heavy to digest (Guru madhura sheetasnigdhopayogat)
3. Sedentary life style (Avyayamat)
4. Sexual abstinence (Avyvayat)
5. Day sleep (Divaswapnat)
6. Persistent over jovial attitude (Harshanityatwat)
7. Lack of worries and concern (Achintanat)
8. Genetic predisposition (Beejaswabhatvat)

The above factors separately or in combination result in obesity. Over nourishment, lack of exercise and genetic predisposition are well established as explicit causes for obesity. These factors are reflected as life style related issues in the current era. So obesity in long run manifest as Prameha. The morbid obesity adds eight defects in leading healthy life. They are as follows [11].

1. Reduced life expectancy (Ayusho hrasa)
2. Sluggish movements (Javaparodha)
3. Difficulty in sexual indulgence (Kricchrayavayata)
4. Fatigue (Dourbalyam)
5. Foul body odour (Dourgandhyam)
6. Excessive Sweating (Swedaabaadha)
7. Excessive Hunger (Kshudatimaatram)
8. Excessive Thirst (Pipasaatimatram).

These health issues are applicable to Sthoola Pramehi (obese diabetes) also.

#### Management of Type 2 DM in ayurveda

As nidana parivarjana (avoidance of causative factors) is a principal component in Ayurvedic management all the patients should be exclusively advised regarding this [12]. A proper planning of Ayurvedic diet and drug along with routine exercises in these patients may help to improve the glycemic control. The two therapeutic varieties of Prameha as sthoola/balavan (obese and physically fit) and krisha/durbala (lean and weak) is essentially diagnosed for fixing Shodhana (purificatory) or shamana (palliative) treatments [13]. Shodhana therapy includes selective oleation, mild fomentation, therapeutic emesis and purgation as well as decoction enema. Before internal or external oleation, rookshana (desiccating therapy) is mandatory in Prameha especially if the patient possess increased medodhatu symptoms [14]. The best rookshana method is udwarthana (dry power massage) in Prameha patients. Lamgha-

na (depletion of medus and kapha) can be achieved by upavasam (controlled fasting) or rookshahara (fat free diet). Treatment explained in Ayurveda for morbid obesity in general can also be adopted in Type 2 DM. The dietary articles should be guru (heavy to digest) but apatarpanam (of minimal nutritional value) like fibre/cellulose rich diet [15]. Even though laghu (easy to digest) dietary articles ensure lamghana, the hunger of the patient will not be pacified. The rookshana can also be achieved by seka (decoctions or liquids like medicated buttermilk applied all over the body as streams), lepana (external applications like medicated pastes, vatatapa seva (exposure to sun and wind), vyayamam (exercises) etc [16].

### Role of diet and exercise

Ayurveda advocates various dietary articles to control Prameha. These include Apupa (cake of rice and black gram baked in steam), Sakthu (corn flour) etc. Yava (barley) is an excellent food supplement mentioned in Ayurveda [17] for controlling Prameha as it is less absorbed in GI tract, so ensure low glycemic index. Venuyava (seeds of bamboo tree), trinadanya (variety of grain produced by certain grasses) and mudga (green gram) also practiced as diet for Prameha patients. Purana shali (Seasoned rice) is preferred over normal rice. Beverage known as srikukkuta (the sour buttermilk processed with the residue of sesame and mustard) is advised for drinking. Jambu (*Syzygium cumini*) fruits as it is and raga (moderately sweet drink prepared from them) are very useful. Bitter vegetables like Karavelaka (bitter gourd), Patola (snake gourd) etc are advised for regular use. Ayurveda advocates strenuous exercises for such patients who are unable to afford costly treatments. There are advises like as the patient of diabetes should go on walk (by foot) of 100 yojana (approximately 800 miles), without making use of an umbrella and foot-wear, adhering to the way of life of an ascetic (disciplined and hard life), or dig a reservoir of water by himself or wander along with a herd of cows sub sting on the dung, urine etc [18]. Further in Sushruta Samhita the practice of regular exercises, wrestling, riding on hoarse, pedestrian journey etc are explained for routine practice for controlling prameha [19].

### Oushadha yavagu (Medicated Gruel)

As explained earlier Dietary modifications are also very important in management of Diabetes mellitus through Ayurveda. Patients are advised to restrict calorie intake, consume food with low total fat content and high (predominately unrefined) carbohydrate content [20]. Oushadha Yavagu or medicated gruel is effectively used for controlling various diseases in Ayurveda [21]. A gruel prepared with Dashamoola is indicated for cough, hiccough, dyspnoea and diseases due to kapha [22]. Type 2 DM is a typical example of disease due to kapha [23]. Dashamoola gruel is traditionally practiced in various stages of DM. Dashamoola is a popular combination of 10 herbs. The combination is explained in Ayurvedic classics as Swayathuhara (anti-inflammatory) and relives oedema of various causes [24]. It pacifies all the three bodily humors and cures certain respiratory ailments [25]. It has good potential to remove kleda (one of the main pathological element in Prameha) through urine. Nephro, Hepato and Gastrotoxic potential of Aque-

ous Extract of Dashamoola has been evaluated and found to be safe by animal experiments [26].

Further some ingredients of Dashamoola have antidiabetic [27], nephroprotective [28] and cardiotoxic [29] effect. Eminent Ayurvedic physicians and hospitals also claim the benefit of Dashamoola gruel in management of Diabetes Mellitus. The administration of this medicated gruel has shown encouraging results in diabetic patients of freshly diagnosed type 2 DM and even to chronic stages like nephropathy and neuropathy. Case series studies are recorded in routine clinical practice.

### Case report study

Nine patients diagnosed of type 2 DM attended in the OPD of VPSV Ayurveda College, Kottakkal administered with Dashamoola gruel as evening diet were selected for observational reporting. The patients were in various stages of Type 2 DM from freshly detected cases to advanced stages like diabetic nephropathy or neuropathy. The medicated gruel was prepared as per classical method. Case reports are tabulated incorporating essential information. The observations seen on patients were interesting. A freshly diagnosed case initially undergone allopathic drugs and later stopped self. The BSL level were increased on stopping modern drugs and later failed to control the same through strict diet and exercises. Later the case was started with Dashamoola gruel without any conventional or Ayurvedic medication which has shown a successive reduction of HbA1c. Three cases in the selected group had features of diabetic nephropathy and the administration of Dashamoola gruel has shown improvement in renal function parameters and certain associated symptoms. Another three cases had features suggestive of neuropathy and the outcome after gruel administration was favorable. One patient had uncontrolled BSL, fatigue, itching all over the body and recurrent abscess even with insulin therapy, underwent Dashamoola gruel and got marked improvement in symptoms and lab values. All the patients consumed the Dashamoola gruel had shown reduction in blood sugar levels. No patient had reported any untoward complications non compliance with the dietary modification. Only one patient among nine had some palatability issues.

### Discussion

Increased Kapha dosha and Medodhatu (adipose tissue) are the key pathological elements in the Sthoola Pramehi (Obese diabetes/Type 2DM). The etiological factors explained in Ayurveda for Sthoulya (obesity) are unique and still relevant nowadays. According to Ayurveda avoiding sex during fertile period is also identified as a definite cause for obesity. A study has reported the relation of Serum Testosterone Levels to H D L Cholesterol and Triglyceride in Men. The study findings were suggesting the positive association between levels of testosterone and HDL cholesterol and the negative association between levels of Testosterone and Triglyceride. (Loreta Bica, Mimoza Lezha, *et al*). Low S. Testosterone level was associated with linear increase in Serum TG level and was independently associated with an unfavorable lipid profile. So these finding may indicate that a low total testosterone level is associated with impaired TG metabolism [30]. Persistent over jovial attitudes and lack of routine worries impart anabolic effects on the body and

hence explained as a measure to improve weight in Ayurveda [31]. But recent researches reveal that stress is explained as a leading causative factor for obesity through various phenomenons. Many review articles provides basic support for the relationship between chronic stress, alterations in HPA activity and obesity [32]. But according to Ayurveda absence of any types of concerns will reduce the usage of Rasadhātu (nutritive tissue) in the body and get further accumulated and slowly leads to chronic adiposity.

The effects of obesity also important as it may affect quality of living and daily activities of the diabetic person. According to Ayurveda obesity reduces life expectancy. In morbid obesity, only Medodhatu is getting nourished. Other tissue elements are deprived of nourishment. This ultimately leads to accelerate aging process. The effect of obesity on mortality and life expectancy at different levels of BMI is reported as follows. In both sexes, mortality was lowest in the upper end of the 'healthy' range (BMI 22.5–25 kg/m<sup>2</sup>). The average life expectancy was reduced by two to four years in the BMI range 30 – 35 kg/m<sup>2</sup> (international BMI classification 'obese (class I)'). The average life expectancy was reduced by eight to ten years in the BMI range 40–50 kg/m<sup>2</sup> (international BMI classification 'obese (class III)' or morbid obesity) [33,34].

Obese individuals are sluggish in movements, face difficulty in sexual indulgence and general fatigue. These are due to inappropriate nourishment to various Dhātu (tissue elements), reduced body compactness and heaviness. Recent studies also prove that obesity is associated with lack of enjoyment of sexual activity, lack of sexual desire, difficulties with sexual performance, and avoidance of sexual encounters. Sexual quality of life is most impaired for women, individuals with Class III obesity [35]. The ergonomic effects of obesity-related functional performance impairment were investigated and the findings indicated that on average, approximately 40 percent shorter endurance times were found in the obese group, with the largest differences in the hand grip and simulated assembly tasks. During those tasks, individuals in the obese group also exhibited greater declines in task performance [36]. Increased sweating, polydipsia and polyphagia are suggestive of eventual transformation of obesity to type 2 diabetes mellitus.

The diet exercise and therapeutics explained in Ayurveda can be successfully incorporated for the treatment of Type 2 DM especially in the initial stages. Ayurvedic herbs namely *Gymnema sylvestre*, *Momordica charantia*, *Trigonella foenum-graecum*, *Coccinia indica*, *Pterocarpus marsupium* and *Ficus bengalensis* are extensively researched for their hypoglycemic effect as a single drug by animal experiments and clinical studies by various scholars [37]. Certain polyherbal/herbomineral combinations like Ayush-82, MA-471, Abraga Chendooram, D-400, Sandan Podia, and M-93 are also proved for hypoglycemic effect [37]. But in obese diabetes patients before starting therapeutic interventions, Ayurveda advocates non therapeutic measures like dietary modifications and exercises. The role of regular exercise in controlling Type 2 DM is explicit. The diet advised in Ayurveda is found to be highly beneficial for controlling hyperglycemia. But in routine clinical practices dietary advises in the form of changing the menu is not normally

and regularly observed by patients due to various reasons. Advising a specific menu to the patients for whole life starting from breakfast to supper is a big challenge to physicians. But patient often gets convinced by changing the food habit of one meal time to a therapeutically processed diet. Oushadha Yavagu (Medicated gruel) is such a modification of diet and further serves the purpose of delivering therapeutic effect of the drug through diet. Medicated gruel has many other benefits like improving digestion, easy absorption, facilitating excretion and improving vitality [38].

As mentioned earlier Dashamoola is identified as combination of 10 herbs having 'Swayathu' alleviating property [15]. The symptomatology of 'Swayathu' is strikingly similar to cardinal features of inflammation [39]. According to the Ayurvedic Pharmacopoeia of India (1990) Dashamoola is one of the folk medicine, a polyherbal formulation believed to have the potential for providing relief from inflammation [40] and the water decoction is traditionally practiced by tribal people as anti-inflammatory [41]. There is increasing evidence that low-grade inflammation is closely involved in the pathogenesis of type 2 diabetes and elevated circulating inflammatory markers such as C-reactive protein and interleukin-6 predict the development of type 2 diabetes. Several drugs with anti-inflammatory properties lower both acute-phase reactants and glycemia, possibly decrease the risk of developing type 2 diabetes. Therefore, if subclinical inflammation is indeed another facet of the IRS, anti-inflammatory treatment may also be beneficial in Diabetes Mellitus [42]. So the indication of Dashamoola gruel in Type 2 Diabetes Mellitus can be justified owing to the anti-inflammatory property of the combination as highlighted in Ayurvedic treatises. Further recent experimental [43,44] and clinical trials conducted on individual and whole ingredients of the combination also support this view [45,46].

The administration of this medicated gruel in the case series study group has shown encouraging results in diabetic patients of freshly diagnosed type 2 DM and even to chronic stages like nephropathy and neuropathy. The change in diet pattern and introduction of medicated gruel as evening diet was accepted by the patients with good compliance. All the patients were shown reduction in blood sugar levels.

## Conclusion

Ayurveda identify the role of Kapha dosha and Medodhatu (adipose tissue) in the development of Type 2 DM. The etiopathological aspects and therapeutic guidelines of Sthoulya (obesity) can be effectively incorporated in understanding and managing Type 2 DM. Dietary modifications like Dashamoola medicated gruel in case series studies has shown encouraging results. Anti inflammatory property of Dashamoola may be responsible for this as low grade inflammation is found to be important in development of Type 2 DM. Further studies are recommended for confirming the efficacy of this therapeutic diet in Type 2 DM.

## Conflict of Interest

No financial interest or any conflict of interest exists.

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