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URBANISATION, DIETARY SHIFTS, AND THE RISING INCIDENCE OF *MADHUMEHA*: INVESTIGATING THE CAUSES

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ABSTRACT

Diabetes Mellitus Type 2 (T2DM) or *Madhumeha*, as it is known in Ayurveda, is a multifactorial and complex global healthcare issue that is rapidly increasing with urbanization, lack of physical activity, and alterations in eating habits. The growing weight of this pathology indicates the current need for the creation of integrative strategies that go beyond the traditional biomedical explanations and involve integrating traditional knowledge into practice. This paper attempts to address the etiology of *Madhumeha* pathogenic process through the synthesis of Ayurveda principles and modern biomedical paradigms, including insulin resistance, chronic inflammation, and neuroendocrine disorder. The aim is to find out general causative agents such as inappropriate nutrition, lack of exercise, mental strain, and derailment of biological timetables, and assess positive approaches to both prevention and cure. To this end, the paper relies on classical Ayurvedic sources, on good peer-reviewed biomedical literature, and the paper is cultural authentic and scientifically credible. The findings are significant in that urban environmental exposures can be thought of as upstream determinants of metabolic risk, and integrative approaches, including *Dinacharya* (daily regimen), *Pathya-Apathya* (dietary guides), *Medhya Rasayana* (rejuvenative therapies) and *Yoga* integrated with modern tools of public health such as digital health systems, policy change, and city planning and design, can offer upstream examples of prevention. The result of this effort highlights the possibility of incorporating the ancient Ayurvedic knowledge combined with the modern sciences to develop a culturally aware, community-related, and systems-level model of diabetes prevention and management.

Keywords: *Madhumeha*, Type 2 Diabetes Mellitus, Ayurveda, Urbanization, Lifestyle Disorders, *Agnimandya*, Insulin Resistance, Preventive Healthcare, *Rasayana Therapy*, Integrative Medicine

INTRODUCTION:

Increasing incidence of diabetes mellitus, specifically Type 2 Diabetes Mellitus (T2DM) has emerged as a major issue in

urban populations since it has a multipathogenic aetiology and an ever-rising burden. Ayurveda recognizes this condition as *Madhumeha*, a subgroup of the group

Prameha, which is a disease that is caused by sweet urine excess and sequential degradation of body tissues due to the poor lifestyle and dietary habits of an individual [1]. *Madhumeha* is treated by Ayurveda knowledge on the balance of the *Kapha*, *Vata*, and *Meda Dhatu*, mostly triggered by the overindulgence in *Madhura Ahara* (sweet and heavy foods), lack of physical exercise, mental strains, and repression of normal mental urges. They are the contributing factors of *Agnimandya* (deficient digestive fire) and *Srotorodha* (obstruction to the channels within the body) that eventually throw systemic metabolism out of order [2].

Biomedically, T2DM evolves with insulin resistance, dysfunction of the 2-cell and low-grade inflammation, all highly correlated with a sedentary lifestyle and nutrient-dense food [3]. The two viewpoints can be united by the fact that both attribute the key to the aetiology of *Madhumeha* to rapid urbanization in general and the lifestyle associated with it in particular: the alteration of dietary habits, physical inactivity, stress, and disruption of biological rhythms [4].

The process of urbanization hastened the intake of ultra-processed meals and drinks, and high-fat diets [5] that harm glucose homeostasis and lead to obesity and insulin resistance, two clinical indicators of T2DM [6]. When combined with a sedentary lifestyle, long working hours, sleeping disorders, and the lack of physical exercise, they contribute to the aggravation of metabolic imbalances. Ayurveda calls this trend *Apathyanimittaja Madhumeha* or diabetes due to malnutrition and unhealthy lifestyle, thus confirming ancient wisdom in new scientific evidence.

Currently almost 101 million diabetics are estimated to be living in India by the International Diabetes Federation (IDF) [7]. The disease burden is excessively unequal in cities in contrast to countryside areas [8]. This epidemiological pattern is congruent with Esoteric Doctrines of Ayurveda as *Madhumeha* is also a metabolic disorder that can be referred to as *Adhyatmika Vyadhi*, the disease of the inertia lifestyle and lack of harmony between food, daily routine, and environment [9]. The problem of diabetes has especially escalated in India. According to the ICMR-INDIAB study released in 2023, there are more than 101 million already diabetic people in India, with another 136 million people being prediabetic [10]. In India, the urban adult population is estimated at 12-18 per cent in comparison with that of 5-7 per cent of urban populations [11].

With such a situation, it is quite pertinent to review *Madhumeha* in the classical and contemporary perspectives. This paper attempts to unify Ayurvedic *Nidana* (etiological theory) with modern epidemiological discoveries and lifestyle studies in order to get a comprehensive insight into the ever-increasing incidence of diabetes in the urban population. Focus is placed on a unifying viewpoint that has provided a mode to harmonize Ayurvedic ideas of pathogenesis with those of biomedicine in insulin resistance, chronic inflammation, and neuroendocrine imbalance. Through this, urbanization and lifestyle change have been formalized as an upstream ecological determinant, and the possibility of a combination of traditional wisdom Ayurveda and modern solutions, such as digital health technologies, policy

change, and urban planning, have been highlighted.

Purpose and Scope of the Study

This paper is an attempt to integrate ancient Ayurvedic knowledge and modern-day medical facts in looking at the role of urbanisation and dietary modification in the aetiology of *Madhumeha* (Type 2 Diabetes Mellitus).

Purpose:

To explore the most important life and food style transitions caused by urbanisation that culminate in the rising *Madhumeha* burden in India and the world. The research tries to investigate the intersecting causal paths of Ayurvedic *Nidanas* and the current risk elements.

Scope:

- To read classical Ayurvedic texts and to find *Nidana* (causes) and *Samprapti* (pathogenesis) of *Madhumeha*.
- To evaluate the modern epidemiological evidence associating urban life with Type 2 Diabetes.
- This study presents an integrative framework for understanding how *Madhumeha* disease will increase due to modern urban stressors, and provides recommendations for prevention through Ayurveda, as well as strategies for public health.
- The research is a work of literature and qualitative, as it deals with secondary data and textual comparison, and it has a possible impact on the urban health policy, Ayurvedic wellness promotion, and preventive care models.

Diabetes burden of the world and India - Statistical overview

Urbanisation is a Major Change in Human Living Conditions

Urbanisation is another significant socio-economic transformation of living styles, working, eating, and environmental relationships. Today, the world has more than 56 per cent of its population residing in urban areas, and this number is projected to rise to 68 per cent in the year 2050 [12]. However, in India, the urban population has risen to almost 36% in 2021, compared to 27.8% in 2001. This has been associated with massive changes in occupation, movement, access to food, and life behaviour [13].

Type 2 Diabetes (T2DM) and diabetes mellitus have become a global problem and a public health emergency, primarily associated with non-communicable diseases. The International Diabetes Federation (IDF) estimates that world leaders now carry 537 million adults with diabetes, and this number will reach 643 million by 2030 and 783 million by 2045 [14]. The more disturbing is the fact that more than 75 per cent of diabetes patients currently live in low- and middle-income countries, marking the acute increase of the condition in transition economies.

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This transition, in Ayurvedic terms, represents the disintegration of the *Dincharya* (daily habits) and *Ritucharya* (seasonal behaviour), which are required to sustain a *Tridoshic* equilibrium. The cities have a propensity to introduce erratic eating schedules, greater consumption of highly refined and antagonistic foodstuffs, cerebral strain, poor sleeping patterns, and deficiency of physical activities, all of which are *Nidanas* (causative factors) of *Madhumeha* [17].

Contemporary studies also confirm that one is more likely to experience obesogenic environments in urban areas, having sedentary jobs, being dependent on the digital world, decreased access to green space, and convenience foods with lots of calories. They are closely linked to insulin resistance and increasing levels of metabolic syndrome and precondition the dynamics of developing diabetes mellitus.

Ayurveda Madhumeha

Definition and Types:

"*Madhumeha* is classified under *Prameha* (a group of 20 urinary disorders) and is considered the most debilitating among them. It is traditionally identified as *Vataja Prameha*, where *Vata dosha* predominates, especially in its chronic or severe manifestations [18].

Even though *Vata* is more in the chronic phase, the pathology starts with the involvement of *Kapha* and *Pitta*, mainly because of the accretion of *Meda dhatu* (fat), and *Kleda* (fluid) and then the degradation of *Agni* (digestive/metabolic fire).

Nidana (Causative Factors):

According to the earlier classical Ayurvedic literature, Charaka Samhita and Sushruta Samhita, there are the following *Nidanas* (causes) of *Madhumeha*:

- **Ahara (Diet):** Over consumption of *Madhura*, *Snigdha* and *Guru Ahara* - heavy, sweet and oily food Type.

- **Vihara of Lifestyle:** Habit of sitting all the time (Sedentary life, Proper names In Sanskrit, nomen, *Avyayama*), leaping in the day (Sleeping in Daytime, *Divaswapna*), pleasure of luxuries, and stress (*Chinta*, *Shoka*).

- **Sharirika Prakriti:** Individuals with a *Kapha* or *Meda* dominant body type are more vulnerable.[19]

They are causative factors that result in vitiation of *Kapha* and *Meda*, and this facilitates the occurrence of metabolic imbalance and the development of the disease.

Samprapti (Pathogenesis):

Development of the disease occurs in the following steps

- **Agnimandya-** Repression of digestive/metabolic fire.

- **Ama formation-** build-up of undigested metabolic waste.

- **Srotorodha-** Obstruction of *srotas* (microchannels), making nourishment of tissue and removal of wastes impossible, i.e. two *srota Medovaha* and *Mutravaha* are central to the pathogenesis of *Madhumeha* and are frequently cited in both classical Ayurvedic texts and contemporary Ayurvedic research

- **Dhatukshaya and Ojakshaya** - Slow exhaustion of the body tissues and vital immunity.

- **Vata Prakopa** - Obstruction of channels causes an increase in *Vata*, which gives rise to the popular characteristics of *Madhumeha*, which include polyuria, weakness, and weight loss.

This step-by-step pathogenesis is quite holistic and is perfectly consistent with the

current ideas of chronic metabolic syndrome.

Diabetes Mellitus in Contemporary Science

Aetiology:

Type 2 Diabetes Mellitus (T2DM) is a biomedical condition that occurs as a result of a complex interaction of genetic, environmental, and behavioural processes. The likes of commonly occurring etiological contributions are:

- Genetic predisposition
- One relevant dietary factor is a high-calorie diet and excessive consumption of sugar.
- Endocrine disruptor environmental toxins exposure [20]

T2DM is much more preventable and lifestyle-based, unlike Type 1 Diabetes, which has autoimmune causes.

Risk Factors:

Modern clinical research boasts a list of risk factors, which are not much different to those of Ayurvedic *Nidanas*.

- Chronic Stress and Sleep Disarrangement – Increases the amount of cortisol and distorts insulin sensitivity.
- Sedentary Lifestyle- Has been proven to be a risk factor in its own right, even among persons with normal body weight.

These lifestyle-related factors correspond to Ayurvedic explanations of *Apathyanimittaja Madhumeha*, as the very wrong behaviour and diet contribute to the derangement of the system.

Nutrition and Transition of Diets

The transition of dietary patterns, which shifts traditional whole-food diets to convenience foods characterised by simplicity and high calories but low nutrients, is one of the most interesting consequences of urbanisation. The loss of millet, legumes, fermented food, and seasonal vegetables is compensated for by an increase in refined sugars, saturated fat, processed meat, and ultra-processed snacks.

This shift in nutrition is referred to by:

- More refined carbs and sugar-sweetened drinks
- Overconsumption of trans fats, sodium, and preservatives
- Reduction in the dietary fibre, phytonutrients and vital micronutrients

These types of diets have been associated with having a dysbiosis of the gut, systemic inflammation, and loss of insulin sensitivity- the primary cause of metabolic syndrome and diabetes [21].

The Ayurvedic term for such foods is *Ahita Ahara*, meaning they are incompatible and unsuitable. Incessant luxuriance results in *Ama* (undigested food) formation, *Medo Dhatu* vitiation, and eventual vitiation of the digestive fire (*Agnimandya*) and tissue metabolism (*Dhatwagni dysfunction*) [22]. Furthermore, overindulgence in cold, heavy, sweet foodstuffs (*Sheetala, Guru, Madhura Rasa*) consumption without balancing activities witnesses the occurrence of *Kapha* and *Meda vridhhi* that are known as the main etiological culprits of *Prameha* and *Madhumeha* [23].

Thematic Table 1: Comparative Causative Factors of Madhumeha / Diabetes Mellitus

Theme	Ayurvedic Perspective	Modern Biomedical Perspective
Dietary Factors	<i>Ahita Ahara</i> – excessive intake of <i>Madhura</i> (sweet), <i>Snigdha</i> (unctuous), <i>Guru</i> (heavy) food	High-calorie diet, ultra-processed foods, sugar-sweetened beverages, saturated fats

Lifestyle Patterns	<i>Avyayama</i> (sedentary life), <i>Divaswapna</i> (daytime sleep), overindulgence, lack of discipline	Physical inactivity, screen time, prolonged sitting, and poor sleep hygiene
Circadian Disruption	Disregard of <i>Dinacharya</i> (daily routine) and <i>Ritucharya</i> (seasonal regimen), leading to <i>doshic</i> imbalance	Night-shift work, irregular sleep–wake cycles → circadian rhythm disruption → hormonal/metabolic imbalance
Psychological Factors	<i>Chinta</i> (worry), <i>Bhaya</i> (fear), <i>Shoka</i> (grief) disturb <i>Vata</i> and <i>Agni</i>	Chronic stress, depression, and cortisol elevation impair insulin function
Constitutional Susceptibility	<i>Kapha-Meda Pradhana Prakriti</i> (body type prone to fat accumulation and sluggish metabolism)	Genetic predisposition, family history, and central obesity
Metabolic Derangement	<i>Agnimandya</i> , <i>Ama</i> formation, <i>Srotorodha</i> (blocked microchannels), <i>Dhatukshaya</i> (tissue loss)	Insulin resistance, beta-cell dysfunction, oxidative stress, and chronic inflammation
Environmental Exposure	Not directly described, but pollution is interpreted as <i>Vikriti Karana</i> (aggravating factors)	Persistent organic pollutants, endocrine-disrupting chemicals, and air pollution
Gut Health & Digestion	Weak <i>Jatharagni</i> , improper <i>Ahara</i> , leads to <i>Ama</i> and impaired <i>Dhatwagni</i> (tissue-level digestion)	Gut dysbiosis, reduced microbiome diversity, affects insulin regulation and inflammation.

Ayurvedic explanation of modern lifestyle causes

These interpretations are based upon the occurrence of dosha imbalances, *Agni* (digestive fires), and blockage of *Srotas* (body channels) that together cause impairment of tissue metabolism and the development of disease.

The *Vishamashana* (Irregular Eating Habits)

Disturbs the biological clock and causes irregular secretion of digestive enzymes and hormones, thus damaging *Jatharagni* (central digestion).

This Ayurvedic perception mirrors the current observation that chrono nutrition studies indicate that circadian disruption, insulin resistance, and evidence of Type 2 diabetes are associated with poor timing of meal intake [24].

***Agnimandya*:** Possibility to suppress the fire of the digestive tract and cellular metabolism and failure of correct digestion and absorption of nutrients, provoking *Pose* (*Ama*) and *Dhatushodhana* (tissue degeneration).

This Ayurvedic pathology correlates to the current models of mitochondrial dysfunction, chronic inflammation, and insulin resistance in cells, which are the underlying concepts behind Type 2 diabetes development [25].

***Apathyahara* Incompatible Food Combinations**

Apathyahara in Ayurveda refers to food that is inauspicious to health, including its taste, treatment, and combination. Another example is curd should not be consumed along with meat, and milk should not be taken with citrus fruits because such

combination is known as *Viruddha Ahara* (incompatible food) and may cause *Ama* (toxins), *Kapha-Meda vriddhi* (fat accumulation) and deranged metabolism [26].

A similar issue is echoed in the modern Science of nutrition, in which inflammatory response, gut dysbiosis and post-prandial oxidative stress have been detected after the wrong combination or processing of food [27].

Avyayama and Divaswapna (Absence of Exercise and Sleep in the Daytime)

Apathyavihara or inappropriate lifestyle, such as *Avyayama* (lack of physical activity) and *Divaswapna* (daytime sleepiness), increases Kapha and encourages Meda dhatu vitiation, which are significant factors in the pathogenesis of *Madhumeha*.

Contemporary research supports the notion that a sedentary lifestyle, combined with poor sleep hygiene, contributes to abdominal obesity, decreases insulin sensitivity, and accelerates the progression of metabolic syndrome [28].

- ***Srotorodha And Agnimandya*** (Blocked Channels and Weak Digestion) The dietary and lifestyle mistakes come to their logical conclusion to create:

- ***Srotorodha***: Stopping of microcirculatory channels that deliver nutrients and get rid of waste. This slows the process of *Dhatu poshana* (tissue nourishment) that results in metabolic lethargy.

7. Integrated Analysis

The Ayurveda medical system is in harmony with modern biomedical Science, where a comprehensive system of aetiology and development of *Madhumeha* (Type 2 Diabetes Mellitus) is possible. Although

they employ different terminologies and paradigms, both traditions identify close lifestyle and environmental risk factors, upsetting the internal balance in the human body.

Communal triggers: Food, physical movement and stress

Both of the systems recognise a poor diet, lack of physical activity, and psychological stress as a centre of disease development:

- Ayurveda starts describing these in terms such as *Apathyahara* (incompatible diet), *Avyayama* (lack of exercise), and *Manasika bhava* (mental disturbances) that cause *Agnimandya*, *Ama* formation, and *Srotorodha*.

- It can be heard again in modern medicine, where a high-glycaemic diet, sedentary lifestyle and chronic stress are associated with insulin resistance and oxidative stress and beta-cell dysfunction. This convergence implies that the two systems recognise behaviour-induced metabolic derangement as the causal factor of diabetes.

A Common Pathophysiology of Hormonal and Doshic Imbalance

Both make mention of problems of internal dysregulation at the core physiology:

- Contemporary Science singles out neuroendocrine changes, e.g., cortisol dysregulation under long-term stress, which turns off glucose uptake, distorts fat distribution and coerces insulin resistance [29].

- A similar mechanism is explained by *Vata* and *Pitta* aggravation according to Ayurveda due to *Chinta* (anxiety), *Shoka* (grief) and *Atichintana* (overthinking), which disrupts *Agni* and leads to *Dhatukshaya* (tissue depletion) [30].

The metabolic stress and its downstream sequence can be considered in a powerful integrative viewpoint of cortisol overproduction being functionally analogous to *Vata-Pitta* derangement.

Preventive and Remedial Measures

As the load of *Madhumeha* (Type 2 Diabetes Mellitus) has been on the rise, a dual strategy incorporating Ayurvedic and contemporary biomedical courses of action will offer a hopeful future in both prevention and long-term management. All the systems offer complementary and contextual tools to reduce risk factors and to increase resilience to disease progression.

Ayurvedic View

In Ayurveda, daily routine (*Dinacharya*), dietary moderation, and the mind-body balance are highlighted as the saving grace to restore the *doshic* balance and hinder the evolution of *Prameha* into *Madhumeha*.

- ***Dinacharya* (Daily Routine)** programs comprise the following: rising early in the *Brahma Muhurta*, evacuating the bowel and the bladder, tongue scraping (*Jihva Nirlekhan*) and cleaning the teeth (*Danta Dhavana*). This is preceded by oil pulling or mouth gargling (*Gandusha/Kavala*), use of nasal drops (*Nasya*) and as an elective measure the use of collyrium on eyes (*Anjana*). The regimen is followed by oil massage (*Abhyanga*), exercise and bath (*Vyayama*) and *Snana*. Following purification and de-toxification of the body, it is advisable to eat pure food (*Ahara*) followed by normal routine of life (*Dina Vihara*). Those practices should help detoxify the body, speed up metabolism, enhance the basic health, and balance the doshas.[31].

***Pathya-Apathya* (Tempering of the Diet and the Habit)** Ayurveda includes diets

that are based on the dosha with emphasis on *laghu* (light), *snigdha* (moderately unctuous), and easily processed dishes with spices, such as turmeric, fenugreek and cumin. The most important of them are seasonal eating (*Ritucharya*) and food incompatibility [32].

Cognitive and Metabolic Rejuvenators (*Medhya Rasayana*) Herbs that are discussed under the *Rasayana* category such as *Guduchi* (*Tinospora cordifolia*) and *Brahmi* (*Bacopa monnieri*), *Shilajit* and *Ashwagandha*, boost the optimised response towards stress, mental clarity, and glucose metabolism, which is provided with antioxidant, adaptogenic and Ranti properties [33].

Pranayama and yoga, specifically in the form of *Surya Namaskar*, *Kapalabhati*, *Anulom-Vilom*, and meditation, enhance insulin sensitivity, lower cortisol levels, and improve pancreatic functioning, thereby uniting physical, emotional, and energy balances [34].

Contemporary Solution

The current population measures are directed toward the system levels of interventions, technological outreach, and evidence-based lifestyle medicine.

Screening and Awareness among ordinary people

Community-based initiatives to profile diabetes and HbA1c measures and diabetes risk identification tools are vital to the high-burden areas. IDF and WHO recommendations focus more on preventive check-ups in prediabetic groups [35].

Interventions in urban design

Physical activity can be promoted through urban planning that involves walkable urban neighbouring areas, bicycle routes, and open green spaces, which are associated with a reduction of sedentary

risk behaviours, a determinant identified in both the traditional and new models.

Nutritional regulatory policy

Governments are advised to implement front-of-pack Labelling, limit sugar-sweetened beverages, and impose taxation on ultra-processed food commodities. Such steps help minimise excessive intake of calories[36].

Digital Health Technology

Several technological advances, including telemedicine, mobile health applications, wearable sensors, and remote glucose monitoring devices, enable the reach of underserved populations and/or behavioural change programs [35].

CONCLUSION

The *Madhumeha* (Type 2 Diabetes Mellitus) outbreak experience in India is not only a health epidemic, but it is a larger social and ecological transformation related to the modification of lifestyles, modernisation of diets, psychological stress, and environmental exposures. In Ayurveda, this can be achieved by an imbalance of the doshas, weak *Agni* and *Srotorodha*, and modern science would explain this by insulin resistance, imbalance of hormones, and chronic inflammation.

The two systems have some common causes notwithstanding the different names, and these include poor dietary intake, lack of physical activity, stress, and sleep disturbance. Common upstream drivers in these two paradigms are urbanisation, which derails *Dinacharya* and *Ritucharya*. A solution where modern solutions (such as digital health, urban planning and health screening of the population) are integrated together with Ayurvedic practices (*Dinacharya*, *Pathya-Apathya*, *Rasayana*, and *Yoga*) form a holistic way forward. The

integration of Ayurveda into the policy and community health programs would transform the management of chronic diseases in culturally appropriate and scientifically evidence-based ways.

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