

Diabetes Mellitus and *Madhumeha*: Exploring Ayurvedic Principles, Pathophysiology and Integrative Therapeutic Strategies

Dr.Sunder Sharma¹, Dr. Rosy Chauhan²

¹MD (Kayachikitsa) IPGT&R, GAU, Jamnagar, Gujarat Deputy Director Technical (Retd), Govt. Of Himachal Pradesh.Ex Lecturer Kayachikitsa cum RMO, MGGV Chitrakoot, MP

²Associate Professor, Department of Panchkarma Vimla Family Ayurvedic Medical College Hardoli Kanpur Uttar Pradesh

Abstract—Diabetes Mellitus is one of the most prevalent chronic metabolic disorders worldwide and poses a significant challenge to global healthcare systems due to its rising incidence, complications, and economic burden. Ayurveda describes a comparable condition under the spectrum of *Prameha*, particularly *Madhumeha*, which is characterized by derangement of *Dosha*, impaired *Agni*, vitiation of *Meda Dhatu*, and dysfunction of various *Srotas*. Classical Ayurvedic literature emphasizes the role of improper dietary habits, sedentary lifestyle, psychological stress, and hereditary factors in the pathogenesis of *Madhumeha*. Contemporary biomedical science explains Diabetes Mellitus through mechanisms involving insulin resistance, pancreatic beta-cell dysfunction, chronic inflammation, and metabolic dysregulation. The present review aims to explore the conceptual correlation between Diabetes Mellitus and *Madhumeha* by critically analyzing Ayurvedic principles, pathophysiological mechanisms, clinical manifestations, and therapeutic approaches. The article further evaluates the potential of integrative therapeutic strategies combining Ayurvedic interventions such as *Ahara*, *Vihara*, *Shodhana*, *Shamana*, and *Yoga* with modern pharmacological management. Integrative care may offer a holistic and patient-centered approach by improving glycemic control, preventing complications, enhancing quality of life, and reducing disease progression. Recent evidence-based studies on Ayurvedic formulations and lifestyle interventions have also demonstrated promising outcomes in diabetic management. Therefore, integrating traditional Ayurvedic wisdom with modern medical advancements may provide a comprehensive strategy for the prevention and management of Diabetes Mellitus.

Index Terms—*Madhumeha*, *Prameha*, *Agni*, *Dosha*, *Shodhana*, *Integrative Medicine*

I. INTRODUCTION

Diabetes Mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin resistance, or both. It has emerged as one of the most significant non-communicable diseases worldwide due to its increasing prevalence, long-term complications, and impact on quality of life. According to recent global estimates, the burden of diabetes continues to rise rapidly, particularly in developing countries such as India, where urbanization, sedentary lifestyle, unhealthy dietary habits, and stress contribute significantly to disease progression. The condition is associated with serious complications including neuropathy, nephropathy, retinopathy, cardiovascular disorders, and metabolic disturbances, thereby creating substantial healthcare and economic challenges.[1] Ayurveda describes a clinical condition comparable to Diabetes Mellitus under the broad spectrum of *Prameha*, particularly *Madhumeha*. Classical Ayurvedic texts explain *Madhumeha* as a disorder involving derangement of *Dosha*, vitiation of *Meda Dhatu*, impairment of *Agni*, and dysfunction of various *Srotas*. The disease is primarily associated with excessive intake of unwholesome food, sedentary habits, lack of physical activity, psychological stress, and hereditary predisposition. Ancient Ayurvedic scholars such as *Charaka*, *Sushruta*, and *Vagbhata* have elaborately discussed

the etiopathogenesis, symptomatology, prognosis, and management principles of *Prameha* and *Madhumeha*, indicating the advanced understanding of metabolic disorders in traditional medicine.[2]The pathophysiology of Diabetes Mellitus in contemporary medicine involves complex interactions among genetic susceptibility, insulin resistance, pancreatic beta-cell dysfunction, oxidative stress, and chronic low-grade inflammation. Interestingly, several of these mechanisms show conceptual similarity with Ayurvedic principles involving disturbed *Agni*, accumulation of *Kleda*, and pathological alterations in *Meda Dhatu*. Such parallels have encouraged researchers to explore integrative perspectives that combine modern biomedical understanding with Ayurvedic concepts for comprehensive disease management. The increasing interest in evidence-based traditional medicine has further strengthened the scope of integrative therapeutic approaches in chronic metabolic disorders.[3]

Management of Diabetes Mellitus requires a multidimensional approach focusing on glycemic control, prevention of complications, and improvement of overall health status. Modern treatment strategies mainly include oral hypoglycemic agents, insulin therapy, dietary regulation, and lifestyle modification. However, long-term pharmacological therapy may sometimes be associated with adverse effects, economic burden, and reduced patient compliance. Ayurveda offers a holistic approach emphasizing *Nidana Parivarjana*, *Ahara*, *Vihara*, *Shodhana*, *Shamana*, and rejuvenative measures for restoring metabolic balance and preventing disease progression. Integrating Ayurvedic interventions with conventional management may provide better patient-centered care, improve quality of life, and reduce complications associated with diabetes.[4]Therefore, the present review aims to critically explore the Ayurvedic understanding of *Madhumeha* in correlation with Diabetes Mellitus, focusing on conceptual principles, pathophysiological mechanisms, clinical features, and integrative therapeutic strategies. The article also highlights the relevance of evidence-based Ayurvedic interventions and the future potential of integrative medicine in the management of chronic metabolic diseases.[5]

Conceptual Understanding of *Madhumeha*

Ayurveda describes *Madhumeha* under the broad spectrum of *Prameha*, which is considered a major metabolic disorder characterized by excessive and abnormal urination. The term *Prameha* is derived from the root “*Mih Sechane*,” indicating increased frequency and quantity of urination. Classical Ayurvedic texts have described twenty types of *Prameha*, categorized on the basis of predominance of *Dosha* into *Kaphaja*, *Pittaja*, and *Vataja Prameha*. Among these, *Madhumeha* is considered one of the most severe forms and is predominantly associated with aggravated *Vata Dosha*. The condition is characterized by passage of urine resembling honey in color, taste, and consistency, along with systemic debility and tissue depletion.[6]According to *Charaka Samhita*, excessive intake of newly harvested grains, curd, fatty food, sweet substances, sedentary habits, day sleep, and lack of physical exercise are major causative factors for *Prameha*. These factors contribute to vitiation of *Kapha Dosha*, increase in *Kleda*, impairment of *Agni*, and abnormal accumulation of *Meda Dhatu*. Over time, chronic metabolic disturbance results in depletion of body tissues and aggravation of *Vata Dosha*, ultimately leading to *Madhumeha*. The disease is therefore considered a disorder involving both over-nourishment and tissue degeneration.[7]

Classification of *Prameha*

Type of Prameha	Dominant Dosha	Number of Types
Kaphaja Prameha	Kapha	10
Pittaja Prameha	Pitta	6
Vataja Prameha	Vata	4

Among the four types of *Vataja Prameha*, *Madhumeha* is regarded as difficult to manage because of profound tissue depletion and chronicity. *Sushruta* explains that the pathological process involves derangement of *Meda*, *Mamsa*, *Kleda*, *Shukra*, and *Ojas*. The loss of *Ojas* through urine is considered a hallmark feature of *Madhumeha*, indicating systemic weakness and impaired vitality. This concept shows remarkable similarity with

chronic metabolic deterioration and catabolic changes observed in uncontrolled Diabetes Mellitus.[8]

The Ayurvedic understanding of *Madhumeha* also emphasizes the importance of hereditary predisposition, referred to as *Beeja Dosha*, which may be correlated with genetic susceptibility recognized in modern medicine. Furthermore, psychological stress, lack of physical activity, excessive sleep, and unhealthy dietary practices have been identified as major contributors to disease manifestation. These observations closely parallel the established risk factors of Type 2 Diabetes Mellitus, including obesity, sedentary lifestyle, stress, and poor dietary habits.[9]

Important Components Involved in *Madhumeha*

Ayurvedic Component	Role in <i>Madhumeha</i>
<i>Dosha</i>	Predominantly <i>Kapha</i> and <i>Vata</i>
<i>Dushya</i>	<i>Meda, Mamsa, Rasa, Shukra, Ojas</i>
<i>Agni</i>	Impairment of metabolic activity
<i>Srotas</i>	Dysfunction of <i>Medovaha</i> and <i>Mutravaha Srotas</i>
<i>Kleda</i>	Excess pathological fluid accumulation

Modern medical science explains Diabetes Mellitus primarily through insulin resistance, beta-cell dysfunction, and altered glucose metabolism. Ayurveda, however, interprets the disease through a holistic framework involving deranged *Dosha*, impaired *Agni*, tissue dysfunction, and obstruction of body channels. Despite differences in terminology and conceptual framework, both systems recognize the multifactorial nature of the disease and the central role of lifestyle and metabolism in its pathogenesis. This conceptual similarity provides a strong foundation for integrative therapeutic approaches combining Ayurveda and modern medicine.[10]

Ayurvedic Pathophysiology (*Samprapti*) of *Madhumeha*

The Ayurvedic pathogenesis of *Madhumeha* is complex and multifactorial, involving disturbances in *Dosha, Dushya, Agni,* and *Srotas*. Excessive intake of *Madhura, Snigdha,* and *Guru Ahara,* along with sedentary habits, excessive sleep, psychological stress, and lack of exercise, leads to aggravation of

Kapha Dosha. The aggravated *Kapha* causes impairment of *Jatharagni* and *Dhatvagni*, resulting in improper metabolism and excessive accumulation of *Kleda* and *Meda Dhatu*. Over time, these pathological changes produce obstruction in various body channels, particularly *Medovaha* and *Mutravaha Srotas*, thereby initiating the disease process of *Prameha*.[11]

According to classical Ayurvedic texts, chronic metabolic derangement eventually causes depletion of deeper body tissues and aggravation of *Vata Dosha*. In advanced stages, the vitiated *Vata* carries *Ojas* toward the urinary system, resulting in excessive excretion of turbid and sweet urine, a condition referred to as *Madhumeha*. Loss of *Ojas* is considered a significant pathological event indicating deterioration of vitality, immunity, and tissue nourishment. This process may be correlated with progressive metabolic imbalance, catabolism, and chronic complications observed in uncontrolled Diabetes Mellitus.[12]

Samprapti Ghataka of *Madhumeha*

Component	Description
Dosha	Predominantly <i>Kapha</i> and <i>Vata</i>
Dushya	<i>Meda, Mamsa, Rasa, Lasika, Ojas</i>
Agni	<i>Jatharagni</i> and <i>Dhatvagni Mandya</i>
Srotas	<i>Medovaha</i> and <i>Mutravaha Srotas</i>
Srotodushti	<i>Sanga</i> and <i>Atipravritti</i>
Udbhava Sthana	<i>Amashaya</i>
Adhithana	<i>Basti</i>
Roga Marga	<i>Madhyama Roga Marga</i>

The pathological process of *Madhumeha* demonstrates significant involvement of *Meda Dhatu*, which is considered the principal *Dushya* in *Prameha*. Excessive accumulation and vitiation of *Meda* lead to metabolic dysfunction and increased body unctuousness, producing conditions favorable for disease manifestation. This concept closely resembles the role of obesity, dyslipidemia, and adipose tissue dysfunction in modern diabetic pathogenesis. Similarly, impairment of *Agni* may be correlated with altered metabolic activity and defective glucose utilization observed in Diabetes Mellitus.[13]

Sequential Pathogenesis of Madhumeha

Stage	Ayurvedic Event
1	Excessive intake of <i>Kapha</i> -aggravating diet and lifestyle
2	Vitiation of <i>Kapha Dosha</i>
3	Impairment of <i>Agni</i>
4	Accumulation of <i>Kleda</i> and vitiation of <i>Meda Dhatu</i>
5	Obstruction of <i>Srotas</i>
6	Aggravation of <i>Vata Dosha</i>
7	Depletion and excretion of <i>Ojas</i> through urine
8	Manifestation of <i>Madhumeha</i>

Modern biomedical science explains Diabetes Mellitus through mechanisms involving insulin resistance, pancreatic beta-cell dysfunction, oxidative stress, chronic inflammation, and altered carbohydrate metabolism. Ayurveda interprets similar pathological changes through the concepts of *Agnimandya*, *Meda Dushti*, and *Srotorodha*. Both systems acknowledge the multifactorial nature of the disease and emphasize the importance of metabolic imbalance and lifestyle disturbances in disease progression. Therefore, understanding the Ayurvedic *Samprapti* of *Madhumeha* may provide valuable insights for developing integrative therapeutic approaches aimed at metabolic correction and prevention of complications.[14]

Modern Pathophysiology of Diabetes Mellitus

Diabetes Mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Type 2 Diabetes Mellitus is the most common form and is strongly associated with obesity, sedentary lifestyle, unhealthy dietary habits, and genetic predisposition. The disease develops gradually through complex interactions between environmental and hereditary factors, ultimately leading to impaired glucose metabolism and metabolic dysfunction.[15]The central mechanism involved in Type 2 Diabetes Mellitus is insulin resistance, in which peripheral tissues such as muscle, liver, and adipose tissue fail to respond effectively to insulin. Initially, pancreatic beta cells compensate by increasing insulin secretion; however, prolonged metabolic stress eventually leads to beta-

cell dysfunction and inadequate insulin production. As a result, glucose uptake decreases and blood glucose levels rise progressively, leading to chronic hyperglycemia.[16]

Obesity and metabolic syndrome play a crucial role in disease progression. Excess adipose tissue promotes release of inflammatory cytokines, free fatty acids, and oxidative mediators that interfere with insulin signaling pathways. Chronic low-grade inflammation and oxidative stress further aggravate insulin resistance and contribute to vascular and neurological complications associated with diabetes. Persistent hyperglycemia also causes glycation of proteins and endothelial dysfunction, leading to complications such as nephropathy, retinopathy, neuropathy, and cardiovascular diseases.[17]

Major Mechanisms in Diabetes Mellitus

Mechanism	Pathological Effect
Insulin resistance	Reduced glucose uptake
Beta-cell dysfunction	Inadequate insulin secretion
Obesity	Increased inflammatory mediators
Oxidative stress	Cellular and vascular damage
Chronic hyperglycemia	Microvascular and macrovascular complications

From an Ayurvedic perspective, these pathological events may be conceptually correlated with *Agnimandya*, *Meda Dushti*, *Kleda Vriddhi*, and *Srotorodha*. Impaired metabolic activity resembles defective *Agni*, while abnormal fat accumulation and metabolic imbalance parallel vitiation of *Meda Dhatu*. Thus, both Ayurveda and modern medicine recognize metabolism, lifestyle, and tissue dysfunction as key components in the pathogenesis of diabetes, supporting the relevance of integrative therapeutic strategies.[18]

Correlation between Diabetes Mellitus and Madhumeha

Diabetes Mellitus and *Madhumeha* share several similarities in terms of causative factors, clinical manifestations, disease progression, and chronic complications. Both conditions are strongly associated with sedentary lifestyle, excessive intake

of calorie-rich food, obesity, stress, and hereditary predisposition. Ayurveda explains these factors through aggravation of *Kapha Dosha*, impairment of *Agni*, and vitiation of *Meda Dhatu*, whereas modern medicine describes them as contributors to insulin resistance and metabolic dysfunction. Despite differences in terminology, both systems recognize metabolic imbalance as the central factor in disease development.[19]The pathological basis of Diabetes Mellitus involving impaired glucose metabolism and insulin resistance may be conceptually correlated with *Agnimandya* and *Meda Dushti* described in Ayurveda. In *Madhumeha*, excessive accumulation of *Kleda* and obstruction of *Srotas* disturb normal metabolic activities and tissue nourishment. Similarly, modern biomedical science explains that obesity, inflammation, and adipose tissue dysfunction interfere with insulin signaling pathways, ultimately resulting in hyperglycemia. Thus, both systems emphasize derangement in metabolism and body tissue function as major pathogenic events.[20]

Comparative Correlation between Diabetes Mellitus and *Madhumeha*

Modern Concept	Ayurvedic Correlation
Insulin resistance	Agnimandya
Obesity and dyslipidemia	Meda Dushti
Metabolic dysfunction	Dhatvagni Vaishamya
Vascular complications	Srotodushti
Polyuria	Prabhuta Mutrata
Hyperglycemia	Madhura Mutrata
Chronic tissue damage	Ojakshaya

Clinically, both conditions exhibit features such as excessive urination, excessive thirst, fatigue, weakness, delayed wound healing, and progressive tissue depletion. Ayurvedic texts describe symptoms like *Prabhuta Mutrata*, *Avila Mutrata*, excessive sweating, lethargy, and body heaviness, which resemble the manifestations observed in Diabetes Mellitus. Furthermore, chronic complications affecting eyes, kidneys, nerves, and cardiovascular system may be interpreted in Ayurveda as consequences of prolonged *Dosha Dushti*, *Dhatu Kshaya*, and *Ojas* depletion.[21]

Diagnostic approaches in both systems also demonstrate complementary perspectives. Modern diagnosis primarily depends on fasting blood glucose,

postprandial blood glucose, HbA1c, and glucose tolerance tests. Ayurveda, however, emphasizes clinical examination, assessment of *Dosha*, *Dushya*, *Agni*, *Srotas*, and characteristic urinary features. Integrating both diagnostic approaches may provide a more comprehensive understanding of disease severity, metabolic status, and individualized patient management. Therefore, the conceptual correlation between Diabetes Mellitus and *Madhumeha* forms a strong basis for integrative therapeutic strategies combining Ayurvedic and modern medical approaches.[22]

Integrative Therapeutic Strategies

Management of Diabetes Mellitus and *Madhumeha* requires a comprehensive and multidimensional approach aimed at correcting metabolic imbalance, preventing complications, and improving overall quality of life. Ayurveda primarily emphasizes *Nidana Parivarjana*, which involves avoidance of causative dietary and lifestyle factors responsible for aggravation of *Dosha* and impairment of *Agni*. Regulation of food habits, physical activity, sleep, and stress management are considered fundamental principles in both Ayurveda and modern diabetic care. Such preventive measures play a vital role in controlling disease progression and maintaining metabolic homeostasis.[23]

Ayurvedic management of *Madhumeha* includes *Ahara Chikitsa*, *Vihara Chikitsa*, *Shodhana*, and *Shamana* therapies. Dietary interventions focus on consumption of low-calorie, high-fiber, and easily digestible food substances that help regulate *Kapha* and *Meda*. Physical exercise, *Yoga*, and lifestyle modification improve metabolic activity and reduce obesity-related complications. *Shodhana Chikitsa* procedures such as *Vamana*, *Virechana*, and *Basti* are described for elimination of vitiated *Dosha*, whereas *Shamana Chikitsa* involves use of herbal formulations possessing anti-diabetic and rejuvenative properties.[24]

Commonly used Ayurvedic drugs in *Madhumeha* include *Gudmar* (*Gymnema sylvestre*), *Haridra* (*Curcuma longa*), *Amalaki* (*Emblica officinalis*), *Meshashringi*, and *Nisha Amalaki*. These drugs have shown potential anti-hyperglycemic, antioxidant, and metabolic regulatory activities in various experimental and clinical studies. Ayurveda also advocates individualized treatment based on *Dosha*,

body constitution, disease stage, and associated complications, thereby supporting a personalized therapeutic approach.[25]

Integrative Approaches in Diabetes Management

Ayurvedic Approach	Modern Correlation
<i>Nidana Parivarjana</i>	Risk factor modification
<i>Ahara Chikitsa</i>	Dietary management
<i>Vihara and Yoga</i>	Lifestyle intervention and exercise
<i>Shodhana Chikitsa</i>	Detoxification and metabolic correction
<i>Shamana Aushadhi</i>	Pharmacological management

Modern medical management mainly includes oral hypoglycemic agents, insulin therapy, dietary regulation, and regular monitoring of blood glucose levels. Although these therapies effectively control hyperglycemia, long-term management often requires sustained lifestyle modification and prevention of secondary complications. Integrative therapeutic strategies combining Ayurveda and conventional medicine may provide synergistic benefits by improving glycemic control, reducing oxidative stress, enhancing quality of life, and minimizing complications. Therefore, a holistic and evidence-based integrative approach appears promising in the long-term management of Diabetes Mellitus and *Madhumeha*. [26]

II. DISCUSSION

Diabetes Mellitus is a multifactorial metabolic disorder with increasing global prevalence and significant long-term complications. Ayurveda explains a comparable condition in the form of *Madhumeha*, which involves derangement of *Dosha*, impairment of *Agni*, vitiation of *Meda Dhatu*, and dysfunction of *Srotas*. Although the conceptual frameworks of Ayurveda and modern medicine differ, both systems recognize the importance of metabolic imbalance, lifestyle factors, and chronic disease progression in the pathogenesis of diabetes. The Ayurvedic concepts of *Agnimandya*, *Meda Dushti*, and *Ojakshaya* demonstrate considerable similarity with insulin resistance,

obesity, metabolic dysfunction, and chronic tissue damage observed in Diabetes Mellitus. This conceptual correlation provides a scientific basis for integrating Ayurvedic principles with contemporary diabetic management. Ayurveda emphasizes holistic care through dietary regulation, lifestyle modification, *Shodhana*, and *Shamana* therapies, while modern medicine primarily focuses on glycemic control and prevention of complications. Integrative therapeutic strategies may offer additional benefits by addressing both metabolic correction and overall wellbeing. Practices such as *Yoga*, physical activity, stress reduction, and individualized dietary management can improve patient compliance and quality of life. Furthermore, several Ayurvedic medicinal plants have demonstrated promising anti-diabetic and antioxidant properties in recent studies. Therefore, combining evidence-based Ayurvedic interventions with conventional treatment approaches may contribute to more comprehensive and patient-centered diabetes management.

III. CONCLUSION

Diabetes Mellitus and *Madhumeha* exhibit significant similarities in terms of causative factors, metabolic disturbances, clinical manifestations, and chronic complications. Ayurveda provides a comprehensive understanding of *Madhumeha* through the concepts of *Dosha*, *Agni*, *Meda Dhatu*, and *Srotas*, while modern medicine explains the disease through insulin resistance, beta-cell dysfunction, and metabolic imbalance. The correlation between these two perspectives highlights the relevance of integrative approaches in diabetic management.

Ayurvedic principles such as *Nidana Parivarjana*, *Ahara*, *Vihara*, *Shodhana*, and *Shamana* therapies emphasize holistic care and lifestyle correction, which are equally important in modern diabetic management. Integrating Ayurvedic interventions with conventional treatment strategies may help improve glycemic control, reduce complications, enhance quality of life, and promote long-term metabolic stability.

Therefore, a scientifically validated integrative approach combining Ayurveda and modern medicine may provide a more comprehensive, patient-centered,

and sustainable strategy for the prevention and management of Diabetes Mellitus and *Madhumeha*.

REFERENCES

- [1] International Diabetes Federation. (2021). *IDF diabetes atlas* (10th ed.). International Diabetes Federation.
- [2] Sharma, P. V. (2014). *Charaka Samhita of Agnivesa* (Vol. 1). Chaukhambha Orientalia.
- [3] Tripathi, B. (2019). *Ashtanga Hridayam of Vagbhata*. Chaukhambha Sanskrit Pratishthan.
- [4] American Diabetes Association. (2024). Standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S1–S350.
- [5] Sushruta. (2018). *Sushruta Samhita* (Edited by Ambikadutta Shastri). Chaukhambha Sanskrit Sansthan.
- [6] Sharma, P. V. (2014). *Charaka Samhita of Agnivesa* (Vol. 2). Chaukhambha Orientalia.
- [7] Tripathi, B. (2019). *Charaka Samhita: Chikitsa Sthana*. Chaukhambha Surbharati Prakashan.
- [8] Shastri, A. (2018). *Sushruta Samhita* (Vol. 1). Chaukhambha Sanskrit Sansthan.
- [9] Gupta, A., & Sharma, R. (2020). Ayurvedic concept of *Madhumeha* and its correlation with Diabetes Mellitus: A review. *Journal of Ayurveda and Integrative Medicine*, 11(3), 245–252.
- [10] American Diabetes Association. (2024). Classification and diagnosis of diabetes: Standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S20–S42.
- [11] Sharma, P. V. (2014). *Charaka Samhita of Agnivesa* (Vol. 2). Chaukhambha Orientalia.
- [12] Tripathi, B. (2019). *Ashtanga Hridayam of Vagbhata*. Chaukhambha Sanskrit Pratishthan.
- [13] Sharma, H., & Chandola, H. M. (2011). Prameha in Ayurveda: Correlation with obesity, metabolic syndrome, and diabetes mellitus. *Ancient Science of Life*, 30(3), 85–91.
- [14] American Diabetes Association. (2024). Pathophysiology and complications of diabetes. *Diabetes Care*, 47(Supplement_1), S52–S76.
- [15] American Diabetes Association. (2024). Classification and diagnosis of diabetes: Standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S20–S42.
- [16] Kumar, V., Abbas, A. K., & Aster, J. C. (2021). *Robbins and Cotran pathologic basis of disease* (10th ed.). Elsevier.
- [17] DeFronzo, R. A., Ferrannini, E., Zimmet, P., & Alberti, G. (2015). *International textbook of diabetes mellitus* (4th ed.). Wiley-Blackwell.
- [18] Sharma, H., & Chandola, H. M. (2011). Ayurvedic concepts in the pathogenesis of Diabetes Mellitus. *Ancient Science of Life*, 30(3), 85–91.
- [19] Sharma, H., & Chandola, H. M. (2011). Ayurvedic concepts in the pathogenesis of Diabetes Mellitus. *Ancient Science of Life*, 30(3), 85–91.
- [20] American Diabetes Association. (2024). Standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S1–S350.
- [21] Tripathi, B. (2019). *Charaka Samhita: Nidana and Chikitsa Sthana*. Chaukhambha Surbharati Prakashan.
- [22] Gupta, A., & Sharma, R. (2020). Integrative understanding of *Madhumeha* and Diabetes Mellitus: A comparative review. *Journal of Ayurveda and Integrative Medicine*, 11(3), 245–252.
- [23] American Diabetes Association. (2024). Lifestyle management and standards of care in diabetes—2024. *Diabetes Care*, 47(Supplement_1), S120–S138.
- [24] Tripathi, B. (2019). *Charaka Samhita: Chikitsa Sthana*. Chaukhambha Surbharati Prakashan.
- [25] Gupta, R., & Bajpai, K. G. (2018). Role of Ayurvedic herbs in management of Diabetes Mellitus: A review. *Journal of Ayurveda and Integrative Medicine*, 9(4), 256–263.
- [26] Sharma, H., & Chandola, H. M. (2011). Ayurvedic management of diabetes and integrative therapeutic approaches. *Ancient Science of Life*, 30(3), 85–91.