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The Clinicoetiopathological study of Madhumeha (Type-2 Diabetes Mellitus) with special reference to Deha Prakriti

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Introduction

Prameha is a syndrome manifest by involving complex interaction between *doshas and dushyas* in *srotas* (multiple systems) especially *mutravaha srotas* leading to development of several distinct types and are caused by a complex interaction of genetics (*sahaja, kulaja, jataja, adibala pravritta, anushangi),* life style factors *(Apathyanimittaja)* and environmental factors[1,2, & 3].

Madhumeha is a type of *Vatika Prameha*, is elaborately described since ancient age and its incidence is increasing day by day because of erratic lifestyle and diet leading to obesity followed by *Madhumeha* along with their complications. *Charaka* defined *Madhumeha* as the disease in which the patient passes astringent, sweet, pallor and rough urine.[1] *Sushruta* mentioned that all types of *Prameha*, if not treated converted into *Madhumeha* and become incurable.[2] *Vaghbata* added that the sweetness is present in the whole body[3].

Madhumeha has been classified under the *vatika* type of *prameha*. The *vata* may be provoked either directly by its etiological factors, *avarana* by *kapha* and *pitta* to its path or by continuous depletion of *dhatus*. Also *kapha, vata* and *pitta doshas* interact with *Meda, Rakta, Shukra, Ambu, Vasa, Lasika, Majja, Rasa, Oja and Mamsa* by involving many *srotases*

(multiple systems) and it is caused by a complex interaction of genetics and environmental factors and it is characterized by frequent and copious micturition similar to *madhu* (Honey) having *kashaya* and *madhura-rasa*, *ruksha* and honey like colour and over time leads to serious damage to many of the body's system (*srotases*), especially the *prameha pidaka* and other complications.[3,4]

In modern pathology, Diabetes Mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia. Several distinct types of DM exist and are caused by a complex interaction of genetics and environmental factors. Behavioural and life style related risk factors–Obesity, mental stresses, Physical inactivity, Diet, and Westernization, Urbanization, Modernization are the risk factors of Type 2 diabetes mellitus. Diabetes mellitus, often simply diabetes is a syndrome characterized by disordered metabolism and inappropriately high blood sugar (hyperglycaemia) resulting from either low levels of the hormone insulin or from abnormal resistance to insulin effects coupled with inadequate levels of insulin secretion to compensate. The characteristic symptoms (osmotic symptoms) are excessive urine production (polyuria), excessive thirst and increased fluid intake (polydipsia), and blurred vision; these symptoms may be absent if the blood sugar is mildly elevated. Chronic hyperglycaemia causes damage to the eyes (retinopathy), kidneys (nephropathy), nerves (neuropathy), heart (coronary artery disease) and blood vessels (vasculopathy). The adverse impact of hyperglycaemia and the rationale for aggressive treatment have recently been reviewed.[5]

The disease Madhumeha may be correlated to Diabetes Mellitus (DM) due to their similar clinical presentations and descriptions. With regard to diabetes mellitus, *Sahaja Prameha (sahaja, kulaja, jataja, adibala pravritta, anushangi) may be* correlated to type 1 diabetes mellitus. *Apathyanimittaja Prameha* may be correlated with T2DM.

Prakriti symbolize an interesting feature of fundamental principles of *Ayurveda* having immense impact on extrapolative medicine. *Prakriti* is characterised by combination of physiological, physical and mental characteristics of an individual, and is classified into two varieties namely *Sharirika Prakriti* and *Manasika Prakriti*. *Sharirika Prakriti* is of seven types depending on predominance of *dosha*[6].

It has been hypothesized through earlier studies that *Prakriti* has a genetic connotation that can provide a tool for classifying human populations based on broad phenotype clusters, and the human phenome based on *Ayurveda* can provide a genetic basis for the three major constitutions or *Prakriti*. [7]

The clinical study entitled "***The Clinicoetiopathological study of Madhumeha (Type-2 Diabetes Mellitus) with special reference to Deha Prakriti*** has been designed to evaluate the etio-pathogenesis of *Madhumeha* (Type -2 diabetes mellitus) along with to study the role of *Prakriti* (constitution) in 200 Type -2 diabetes mellitus (DM) patients.

Materials and Methods

AIMS AND OBJECTIVES

1- To evaluate etio-pathogenesis of *Madhumeha* (T2DM) on biochemical parameters and other subjective criteria.

2- To study role of *Prakriti* (constitution) in Type -2 diabetes mellitus (DM)

❖ Plan of study

Randomly 200 patients of *Madhumeha* (T2DM) patients were registered for the study from OPD & IPD of *Kayacikitsa*, *Vikriti Vigyan,* S.S. Hospital *Ayurveda* wing and Endocrine O.P.D of S.S. Hospital, B.H.U. Varanasi. Selection of patients will be done by using subjective and objective criteria mentioned for diagnosis of *Madhumeha* (Type2DM). 200 healthy samples were collected from the undergraduate and post graduate students from the Faculty of *Ayurveda*, BHU staff and other healthy individuals.

Statistical Analysis

A detailed protocol gathered from patients was prepared for recording the clinical findings and ancillary investigations to enable the appropriate statistical analysis by using the Statistical Package of Social Science (SPSS) version 20.0. Data was analyzed statistically in terms of Mean score (M), Standard Deviation (S.D.). Paired 't' test was carried out at the level of 0.05, 0.01, 0.001 of 'P' value. Results were interpreted as –

P<0.05 - Improvement

P<0.01 - Significant improvement

P<0.001- Highly significant improvement

Inclusion criteria

1. Age of patients in between 25-75 years.
2. Patients who fulfilled the criteria of Diagnostic features of *Madhumeha* (Type 2 Diabetes Mellitus).
3. Both male and female patients.

Exclusion criteria

1. Patients with Type 1 DM.

2. Patients above age of 75 yrs.
3. Patients with severe diabetic complications like cardiovascular diseases, nephropathy, and retinopathy.
4. Diabetes Mellitus associated with systemic Viral/Bacterial infections like HIV, Hepatitis, Tuberculosis, and Malignancy etc.
5. Diabetes due to endocrinopathies e.g. Phaeochromocytoma, Acromegaly, Cushing's syndrome, Hyperthyroidism etc.
6. Patients with certain genetic syndromes which are sometimes associated with diabetes mellitus e.g. Down's syndrome, Klinefelter's syndrome, Turner's syndrome etc.

Criteria for healthy individuals-

1) Age of individuals in between 16-50 years.

2) No history of diseases/no history of DM in the family

3) Both male and female individuals.

❖ **RESEARCH DESIGN**

Informed Consent

Patients who fulfilled the above mentioned criteria were convinced the purpose, duration, procedure and nature of the study in details. Consent form prepared for the present study was thoroughly narrated to the patient and then requested to understand and participate in the study. The study was continued only after taking sign in the consent form, thereby giving their free and informed consent.

Selection and distribution of patients

In present study the patients of *Madhumeha (*T2DM*)* have been registered from OPD & IPD of *Kayacikitsa*, *Vikriti Vigyan,* S.S. Hospital *Ayurveda* wing and Endocrine O.P.D of S.S. Hospital, B.H.U. Varanasi. The selection of cases has been done on the basis of fulfilment of diagnostic criteria of *Madhumeha* (T2DM)(Table 1).

SUBJECTIVE CRITERIA

Demographic profile

The patients fulfilling the diagnostic criteria of *Madhumeha* (T2DM) were taken for the study and interrogated thoroughly to collect the data for the study. The following points were recorded- Name, Age, Age of onset of disease, Sex, Address, Religion, Occupation, Profession types, Habitats, Socio-economic status, Dietary habits, Addiction etc.

Clinical profile

After preliminary registration, each patient was subjected to detailed medical history, clinical examination, and ancillary investigations. The method of clinical examination was based on *Ayurvedic* system of medicine as well as Modern system of medicine.

Table 1-Diagnostic criteria for the diagnosis of DM-

Classic symptoms (i.e. polyuria, polydipsia, polyphagia, weight loss) associated with following investigations

- A fasting plasma glucose (FPG) level of 126 mg/dl (7.0 mmol/L) or higher

OR

- A 2- hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75-g oral glucose tolerance test (OGTT),

OR

- A random plasma glucose of 200 mg/dL (11.1 mmol/L) or higher in a patient with classic symptoms of hyperglycaemia or hyperglycaemic crisis.

Criteria for assessment

The etio-pathological study on Subjective and Objective parameters are as follows:

The diagnostic criteria are as follows: *(Clinical Signs and Symptoms)*

- ***Pratyatma lakshana:*** **Yes/No** **Duration**

1. *Prabhuta-mutrata* (polyuria)
2. *Bahaushi* (polyphagia)
3. *Pipasa* (polydipsia)
4. *Gala-Talu-shosha* (throat dryness)
5. *Avila-mutrata* (turbid urine)
6. *Sthaulya* (obesity)
7. *Kara-Pada-Tala-daha* (burning in palm & sole)
8. *Kara-Pada-suptata*(numbness/tingling hand & foot)
9. *Avipaka*(indigestion)
10. *Daurbalya* (weakness)

- ***Samanya lakshana:*** **Yes/No** **Duration**

1. *Shaiyya Asana Swapneshu Sukhe Ratishcha* (feeling comfort in the bed)
2. *Sithilangata* (body becomes weak/laxity in the body)
3. *Netra-upadeha* (blurring of vision)
4. *Kaye-malam* (esp.genital candidiasis)

5. *Dantadinam-maladhyatvam* (teeth sensation)

6. *Svedo-angagandha* (sweating)

7. *Asyamadhurya* (taste in mouth)

8. Mood change (difficulty in concentrating)

9.*Jvara* (fever)

10.*Kesha-Nakha-ativriddhi* (enhanced growth of hairs & nails)

❖ **OBJECTIVE CRITERIA**

Laboratory Investigation [1]

A. Biochemical investigations

I. Fasting plasma glucose (FPG)

II. 2 Hour plasma glucose (2hPG)

III. Lipid profile

IV. Renal Function Test

a. Blood Urea

b. Serum Creatinine

B. Glycosylated hemoglobin (HbA_{1c})

C. Urine Examination:

a. Routine

b. Microscopic

Observation and Results

Present clinical study entitled "***The Clinicoetiopathological study of Madhumeha (Type-2 Diabetes Mellitus) with special reference to Deha Prakriti"*** was carried out in the OPD & IPD of *Kayacikitsa*, *Vikriti Vigyan,* S.S. Hospital *Ayurveda* wing and Endocrine O.P.D of S.S. Hospital, B.H.U. Varanasi from November 2016 to December 2017. Total 400 subjects were registered for the study comprises of 200 patients of *Madhumeha* (T2DM) and 200 healthy volunteers.

(DEMOGRAPHIC PROFILE)

Table 1: Age wise distribution of 200 patients of *Madhumeha* (T2DM)

Age Group (in yrs)	**Total**	**Percentage (%)**
25-34	09	04.50
35-44	41	20.50
45-54	63	31.50

55-64 65-74	55 32	27.50 16.00
TOTAL	**200**	**100.00**
MEAN±SD	**51.88±10.704**	

Patients selected for study were in the range of 25-75 yrs of age. The above table shows that the age predominance of 45-54 yrs i.e. 31.50% and then 55-64 yrs, 35-44 yrs, 65-75 yrs, 25-34 yrs was 27.50%, 20.50%, 16.00%, 4.50% respectively.

Table 2: Sex incidence in *Madhumeha (T2DM)*

Sex	**No. of Patients**	**Percentage (%)**
Male	108	54.00
Female	92	46.00
Total	**200**	**100.00**

Out of 200 patients, 54.00% of the patients were males and 46.00%of them were females.

Table 3: Religion incidence in *Madhumeha* (T2DM)

Religion	**No. of Patients**	**Percentage (%)**
Hindu	190	95.00
Muslim	10	05.00
Total	**200**	**100.00**

In this clinical study, 95.00% of patients were belonging to Hindu religion while 5.00% of patients belonged to Muslim religion.

Table 4: Incidence of Caste status in *Madhumeha* (T2DM)

Caste	**No. of Patients**	**Percentage (%)**
Brahmana	42	21.00
Kshatriya	26	13.00
Vaishya	100	50.00
Shudra	22	11.00
Others	10	05.00
Total	**200**	**100.00**

Majority of Diabetic patients belongs to *Vaishya*[*] i.e. 50% followed by *Brahmana* i.e. 21%, *Kshatriya* 13%, and *Shudra* 11%, others 05.00%.

Note

Vaishya category comprises of -*(Ahir, Baniya, Bhumihar, Brahamana, Chaurasiya, Kumhar, Kurmi, Kushwaha, Lohar, Mall, Noniya, Pal, Patel, Prajapati, Rajbhar, Sharma, Sonar, Teli, Verma, Vishwakarma)*

Table 5: Incidence of Education in *Madhumeha* (T2DM)

Education	No. of Patients	Percentage (%)
Uneducated	54	27.00
Primary	15	07.50
High school	43	21.50
Intermediate	26	13.00
Graduates	62	31.00
Total	**200**	**100.00**

The above table shows that the education wise majority of the patients were graduates 31.00% and 27.00% were uneducated, 21.5% were high school, 13.00% of the patients had completed intermediate education and 7.5% had completed their primary education.

Table 6: Occupational Status in *Madhumeha* (T2DM)

Occupation	No. of Patients	Percentage (%)
Retired (Govt. employee)	23	11.05
Service in field work	20	10.00
Farmer	42	21.00
Businessman	24	12.00
Household work/Housewife	56	28.00
Labour	35	17.50
Total	**200**	**100.00**

Out of 200 patients, maximum no. of patients i.e.28.00% were belongs to house hold work/ housewife followed by 17.50% were belongs to labour group, 21% were farmer, retired govt. employee, field work, and businessman were 11.50%, 10.00%, and 12.00% respectively.

Table 7: Incidence of Marital Status in *Madhumeha* (T2DM)

Marital Status	**No. of Patients**	**Percentage (%)**
Married	195	97.50
Unmarried	05	02.50
Total	**200**	**100.00**

Clinical data shows that 97.50% of patients were married and 2.50% were unmarried.

Table 8: Socio-economic Status in *Madhumeha* (T2DM)

Socio-economic Status	**No. of Patients**	**Percentage (%)**
Lower Grade (<Rs. 10,000/month)	53	26.00
Middle Grade(Rs.10,000-20,000/month)	133	66.50
High Grade (>Rs. 20,000/month)	14	07.50
Total	**200**	**100.00**

The present clinical study covered a cross section of the society. It was found that majority of the patients were belongs to middle grade income group i.e. 66.50% followed by 26.00% patients were belongs to lower grade income group and 07.50% from higher income group.

Table 9: Habitat Status in *Madhumeha* (T2DM)

Habitat	**No. of Patients**	**Percentage (%)**
U.P.	172	86.00
Bihar	26	13.00
Other states	2	01.00
Total	**200**	**100.00**

The above table indicates that the majority of the patients were from U.P. (Varanasi, and other near places) i.e. 86.00% followed by Bihar i.e. 13% and 1% from other states.

Table 10: Duration of present illness in *Madhumeha* (T2DM)

Duration(in month)	**Total**	**Percentage (%)**
Within 1 month	65	32.50

2-3 month	81	40.50
3.5-5 month	21	10.50
6-8 month	18	09.00
12 month	13	06.50
24-36 month	02	01.00
Total	**200**	**100**

The above table shows that the duration of present illness. Majority of the patients belongs to 2-3 months duration category i.e. 40.50% followed by within 1 month i.e. 32.50%, in between 3.5-5 month i.e. 10.5%, in between 6-8 month i.e. 9%, illness of 12 month i.e. 6.5%,and between 24-36 month i.e. only1%.

Table 11: Duration of disease in *Madhumeha* (T2DM)

Duration (in yrs)	**Total**	**Percentage (%)**
Within 1 year	40	20.00
2-5	78	39.00
6-10	61	30.50
12-15	20	10.00
32	01	00.50
TOTAL	200	100.00

The above table shows duration of disease when it was first diagnosed. Majority of the patients were suffering from disease since 2-5 years i.e. 39% followed by 6-10 years duration i.e. 30.5%, within 1 year duration i.e. 20%, 12-15 years duration i.e. 10% and 0.5 % 32 year duration.

Table 12: Drug history in *Madhumeha* (T2DM)

Drugs	**No. of Patients**	**Percentage (%)**
1-OHA/Insulin	96	48.00
2-Anti-hypertensive	05	02.50
3-Hormone therapy	08	04.00
4-Others	10	05.00
5-Both1 and 2	71	35.50

6- All 1,2,3	10	05.00
Total	**200**	**100.00**

Maximum numbers of cases were taking oral hypoglycemic agents(OHA)/Insulin i.e. 48%, followed by both OHA and antihypertensive i.e. 35.50%, 5% cases were taking all three i.e. OHA, antihypertensive agents and hormone therapy (thyroid supplements), 5% cases were taking other drugs which include *Ayurvedic*, and other alternative medicines. 2.50% were taking only antihypertensive drugs and 04.00% were taking hormonal therapy i.e. Thyroid supplement.

Table 13: Family history of *Madhumeha* (T2DM) in Ist degree relatives:

Relation	**No. of Patients**	**Percentage (%)**
Father	38	19.00
Mother	19	09.50
Father+Mother	10	05.00
Brother+Sister	10	05.00
No family history	123	61.50
Total	**200**	**100.00**

Above clinical data reveals that Father, Mother and Father + Mother i.e. 19.00%, 9.50%, and 5.00% respectively, Brothers and Sisters are sufferers i.e. 5.00%. No family history observed in 61.50% of cases.

Table 14: Incidence of dietary habit in *Madhumeha* (T2DM)

Diet	**No. of Patients**	**Percentage (%)**
Vegetarian	82	41.00
Mixed	118	59.00
Total	**200**	**100.00**

Out of 200 patients, 59.00% were taking Mixed (Veg. & Non-veg.) diet and 41.00% of patients were purely vegetarian.

Table15: Quantity of Rice per Day

Quantity of Rice in Gms	Total	Percentage (%)
201-250	24	12.00
251-350	34	17.00
351-400	48	24.00
401-450	29	14.50
451-500	34	17.00
501-600	13	06.50
601-700	18	09.00
Total	**200**	**100.00**

From the above table it was observed that patients i.e. 24.00% were having 351-400gms, 451-500gms of rice 17.00% and, 251-350gms17.00% followed by 401-450 gms i.e. 14.50%, intake of 601-700 gms, i.e. 9.00%, and 501-600gms, i.e. 06.50% respectively.

Table16: Quantity of Wheat per week

Quantity of wheat	Total	Percentage (%)
100-150	77	38.50
151-200	58	29.00
201-250	39	19.50
251-300	26	13.00
Total	**200**	**100.00**

From the above table it was found that maximum number of patients i.e 38.50% were using amount 100-150 gms/day followed by 151-200 gms/day, 201-250 gms/day and 251 - 300 gms/day i:e 29.00%, 19.50% and 13.00% respectively.

Table 17: Amount of Pulses, Vegetables & Fruits

	Quantity in gms	Total	Percentage (%)
Pulses	25-50	172	86.00
	51-100	28	14.00
Vegetables	25-50	154	72.00
	51-100	46	23.00

Fruits	25-50	132	66.00
	51-100	68	34.00

Above table reveals that maximum number of patients consuming 25-50gms of Pulses, Vegetables and Fruits i.e. 86.00%, 72.00% and 66.00% respectively followed by 51-100gms i.e. Pulse 14.00%, Vegetables 23.00%, and Fruits 34.00%.

Table 18: Amountof Milk, Curd & Buttermilk:

	Quantity in ml	**Total**	**Percent (%)**
Milk	100-150	165	82.50
	151-200	35	17.50
Curd	100-150	112	56.00
	151-200	88	44.00
Buttermilk	100-150	139	69.50
	151-200	61	30.50

From the above table it reveals that maximum number of patient's consuming100-150ml of Milk, Curd and Buttermilk i.e.82.50 %, 56.00% and 69.50% respectively followed by 151-200ml in a day i.e. Milk 17.50%, Curd 44.00%, and Buttermilk 30.50%.

Table: 19 Amount of Butter, Ghee & *PanÍra* in a week:

	Quantity in gms	**Total**	**Percentage (%)**
Butter	10-25	104	52.00
	26-50	96	48.00
Ghee	10-25	124	62.00
	26-50	76	38.00
PanÍra	10-25	128	64.00
	26-50	72	36.00

From the above table it reveals that maximum number of patients consuming 10-25gms of Butter, Ghee and *PanÍra* i.e. 52.00%, 62.00% and 64.00% respectively followed by 26-50gms in a day i:e Butter 48.00%, Ghee 38.00%, and *PanÍra*36.00%.

Table 20: Amount of Tea, Coffee & Cold Beverages:

	Quantity in ml	Total	Percent (%)
Tea/day	50-100	180	90.00
	101-150	20	10.00
Coffee/day	50-100	30	15.00
	101-150	02	01.00
	Not using	168	84.00
Cold Beverages/week	500-1000	26	13.00
	1001-2000	16	08.00
	Not using	158	79.00

From the above table it reveals that maximum number of patients consuming 50-100ml of tea/day i.e. 90.00% followed by patient's not using coffee/day and Cold Beverages/week i.e. 84.00% and 79.00% respectively. Followed by consumption of 101-150ml of tea and coffee/day i.e. 10.00%, 01.00% respectively. Some patients were using Cold Beverages/week i.e. 500-1000ml and 1001-2000ml i.e. 13.00% and 08% respectively.

Table 21: Quantity of Deep fried foods, Sugar& Vegetable Oil:

	Quantity	Total	Percentage (%)
Deep Fried Foods/day	50-100gms	142	71.00
	101-150gms	34	17.00
	Not using	24	12.00
Sugar/day	10-25gms	110	55.00
	26-50gms	90	45.00
Vegetable Oil/week	50-150ml	160	80.00
	151-300ml	40	20.00

From the above table it shows that 71.00% of the patients were using 50-100gms of deep fried foods, 17.00% were using 101-150gms and remaining 12.00% were not using deep fried foods in a day.

In case of sugar the maximum numbers of patients i.e. 55.00% were using 10-25gms and remaining 45.00% were using 26-50gms.

Above table reveals that 80.00% of patients were using 50-100ml of Vegetable Oil and remaining 20.00% were using 151-200ml of Vegetable Oil in a week.

Table 22: Study of Habitual consumption of Roasted or/and dry Barley (*Yava*) *flour*, *Mudga* and *Amalaka*:

S. No.	Item no.	Present	Absent
1.	Roasted or/and dry Barley(*Yava*) flour	00	100.00
2.	*Mudga*	00	100.00
3.	*Amalaka*	00	100.00

Above table shows that habitual consumption of Roasted or/and dry Barley (*Yava*) flour, *Mudga* and *Àmalaka* absent in all the cases.

Table 23: Frequency of food intake in *Madhumeha* (T2DM)

Frequency	Total	Percentage (%)
3-4 times per day	17	08.50
2 times per day	179	89.50
1 times per day	04	02.00
Total	**200**	**100.00**

Above table reveals that maximum number of patients were eating food 2 times per day i.e. 89.50% followed by 3-4 times per day i.e. 08.50% and 1 times per day i.e. 2%.

Table 24: *Vihara Sambandhi* (before manifestation of disease) in *Madhumeha* (T2DM):

Vihara		Total	Percentage (%)
*Samyak Nidra(*Normal Sleep)		120	60.00
*Asamyaka Nidra (*Disturbed Sleep)		80	40.00
*Diva Svapna (*Day sleep)	0.5-1hr	126	63.00
	1-2hrs	64	32.00
	2-3hrs	10	05.00
*Ratri Jagarana (*Vigil at night)	Present	20	10.00
	Absent	180	90.00
Stress	Mental	78	39.00

	Physical	30	15.00
	Both	92	46.00
Professions	Sedentary	153	76.50
	Physical	22	11.00
	Both	25	12.50
*Vyayama(*Physical Exercise)	Present	25	12.50
	Absent	175	87.50

Above clinical data shows that 60.00% of the patients were belong to *Samyak Nidra* and 40.00% were belongs to *Asamyak Nidra* before manifestation of diseases.
Maximum number of patients i.e. 63.00% were belongs to *DivaSvapna*.
Above table also reveals that maximum numbers of patients i.e. 90.00% were not indulging in *Ratrijagarana*.

Above table also shows that maximum numbers of patients i.e. 46.00% were having both physical and mental stress.

Above table also reveals that maximum number of patients i.e. 76.50% had sedentary life style followed by physical and both (sedentary and physical) i.e. 11.00% and 12.50% respectively. Before manifestation of disease there was only 12.50% cases were involved in *Vyayama* (physical exercise).

Table 25: *Vihara Sambandhi* (after manifestation of disease) in *Madhumeha* (T2DM)

VihÁra		**Total**	**Percentage (%)**
*Samyak Nidra(*Normal Sleep)		113	56.50
*Asamya Nidra(*Disturbed Sleep)		87	43.50
*Diva Svapna(*Day sleep)	0.5-1hr	132	66.00
	1-2hrs	60	30.00
	2-3hrs	8	04.00
*Ratri Jagarana(*Vigil at night)	Present	16	08.00
	Absent	182	91.00
Stress	Mental	90	45.00
	Physical	85	42.50

	Both	25	12.50
Professions	Sedentary	79	39.50
	Physical	42	21.00
	Both	79	39.50
*Vyayama(*Physical Exercise)	Present	49	24.50
	Absent	151	75.50

Above clinical data shows that 56.50% of the patients were belong to *Samyak Nidra* and 43.50% were belongs to *Asamyak Nidra*. Maximum number of patients i.e. 66.00% were belongs to *Diva Svapna*. Above table also reveals that maximum numbers of patients i.e. 91.00% were not indulging in *Ratrijagarana*. Above table also shows that maximum numbers of patients i.e. 45.00% were having mental stress. Above table also reveals that maximum number of patients i.e. 39.50% had sedentary life style followed by physical and both (sedentary and physical) i.e. 21.00% and 39.50% respectively. 24.50% were involved in *vyayama* after manifestation of disease.

Table 26: Distribution of patients according to Bowel Habits (Before manifestation of disease) in *Madhumeha* (T2DM):

Bowel Habit	**No. of Patients**	**Percentage (%)**
Regular	95	47.50
Irregular	105	52.50
Total	**200**	**100.00**

Present clinical study shows that out of 200 cases 47.50% were belong to regular bowel habit category followed by Irregular bowel habit category (constipation and incomplete evacuation) i.e. 52.50%.

Table 27: Distribution of patients according to Bowel Habits (After manifestation of disease) in *Madhumeha* (T2DM)

Bowel Habit	**No. of Patients**	**Percentage (%)**
Regular	125	62.50
Irregular	75	37.50

Total	**200**	**100.00**

After the manifestation of disease 62.50% were belongs to regular bowel habit category followed by Irregular bowel habit category (constipation and incomplete evacuation) i.e. 37.50%.

Table 28: Distribution of *Kostha in Madhumeha* (T2DM)

Kostha	**No. of Patients**	**Percentage (%)**
Krura	98	49.00
Madhyama	90	45.00
Mridu	12	06.00
Total	**200**	**100.00**

Present clinical study shows that maximum cases were belongs to *Krura* Kostha i.e. 49.00% followed by 45.00% were belong to *Madhyama* Kostha and *Mridu* Kostha i.e. 06.00%.

Table 29: Incidence of Addiction (before manifestation of diseases) in *Madhumeha* (T2DM):

Addiction	**No. of Patients**	**Percentage (%)**
Alcohol	05	02.50
Smoking	14	07.00
Tobacco	50	25.00
Alcohol+ Smoking+ Tobacco	25	12.50
Alcohol+ Smoking	10	05.00
Tobacco + Smoking	13	06.50
No addiction	83	41.50
Total	**200**	**100.00**

Out of 200 registered cases majority of cases were belongs to Tobacco addiction i.e.25% followed by addiction of Alcohol+ Smoking+ Tobacco i.e.12.50%, Smoking i.e.7 %, alcohol and smoking together i.e. 6.50%, tobacco and smoking tobacco and smoking i.e.

5.00% and alcohol i.e. 2.5% respectively. No history of addiction was observed in 41.50% cases.

Table 30: Incidence of Addiction (after manifestation of diseases) in *Madhumeha* (T2DM)

Addiction	**No. of Patients**	**Percentage (%)**
Alcohol	02	01.00
Smoking	07	03.50
Tobacco	40	20.00
Alcohol+ Smoking+ Tobacco	02	01.00
Alcohol+ Smoking	01	00.50
Tobacco + Smoking	12	06.00
No addiction	136	68.00
Total	**200**	**100.00**

After manifestation of disease out of 200 registered cases majority of cases were belongs to Tobacco addiction i.e.20% followed by addiction of tobacco and smoking i.e. 6.00%, Smoking i.e.3.5%, Alcohol+ Smoking+ Tobacco i.e.1%, alcohol i.e. 1%, alcohol and smoking together i.e. 0.50% respectively. No history of addiction was observed in 68% cases.

Table 31: Classical Signs and Symptoms in *Madhumeha* (T2DM):

Lakshanas	**Total**		**Percent (%)**
1.Prabhuta mutrata (polyuria)	Present	165	82.50
	Absent	35	17.50
2.Bahushi (polyphagia)	Present	139	69 .50
	Absent	61	30.50
3.Pipasa (polydipsia)	Present	137	68.50
	Absent	63	31.50
4. Gala –Talu shosha (polydipsia)	Present	125	62.50
	Absent	75	37.50
5. Avilamutrata (abnormality in urine)	Present	38	19.00
	Absent	162	81.00
6. Sthaulya	Present	109	54.50

(obesity)	Absent	91	45.50
7. Kara-Padadaha (burning in palm & sole)	Present	119	59.50
	Absent	81	40.00
8. Kara -PadaSuptata (tingling/numbness-hand&foot)	Present	124	62.00
	Absent	76	38.00
9. Avipaka (indigestion)	Present	119	59.50
	Absent	81	40.50
10. Daurbalya (weakness)	Present	180	90.00
	Absent	20	10.00

Above table reveals the observations of Classical Signs and Symptoms in *Madhumeha* patients. Data shows that *Prabhuta mutrata* and *Avilamutrata* were found in 82.50% and 38.00% of patients respectively. *Pipasa (Trishnadhikya), Gala–Talu shosha,* and *Bahushi(Kshudhadhikya)* were found in 68.50%, 62.50% and 69.50% of the patients respectively. *Sthaulya, Kara–Pada Suptata,* and *Kara-Padadaha* were found in 54.50%, 62.00% and 59.50% of the patients respectively. 90.00% of the patients were experiencing *Daurbalya*.

Table 32: General Sign and Symptoms in *Madhumeha* (T2DM):

Lakshanas	**Total**		**Percentage (%)**
1. Angashaithilya (recent change in weight)	Present	142	71.00
	Absent	58	29.00
2.Alasya	Present	169	84.50
	Absent	31	15.50
3. Netraupadeha (blurring vision)	Present	101	50.50
	Absent	99	49.50
4. Kayemalam (esp.genital candidiasis)	Present	08	04.00
	Absent	192	96.00
5. DantauMalotpatti (teeth sensations/pyorrhea)	Present	51	25.50
	Absent	149	74.50
6. Svedadhikya- Angagandha	Present	105	52.50

(sweating with smell)	Absent	95	47.50
7. Asyamadhurya (taste in mouth)	Present	90	45.00
	Absent	110	55.00
8. Mood change (difficulty in concentration)	Present	73	36.50
	Absent	127	63.50
9. Jvara (fever)	Present	12	06.00
	Absent	188	94.00
10. Kesha-Nakhativriddhi (more increases hairs&nails)	Present	11	05.50
	Absent	189	94.50

Above table reveals the observation of General Signs and Symptoms in *Madhumeha* (T2DM) patients. 71.00% of the patients were experiencing *Angashaithilya* and 84.50% had *Alasya*. *Netra-upadeha, Kayemalam* (especially genital candidiasis), and *Dantau Malotpatti* were seen in 50.50%, 04.00% and 25.50% of the patients respectively. *Svedadhikya-Angagandha,* and *Asyamadhurya* were seen in 52.50% and 45.00% of the patients respectively. *Mood change, Jvara,* and *Kesha-Nakhativriddhi* was observed in 36.50%, 06.00% and 05.50% of the patients respectively.

Table 33: *Aharaja nidan* observed in 200 patients of *Madhumeha* (T2DM):

Aharaja nidan	**Total no. of Patients**	**Percentage (%)**
Madhura	148	74.00
Amla	68	34.00
Snigdha	102	51.00
Guru	76	38.00
Drava-bahula	24	12.00
Dadhi	98	49.00
Payamsi	16	08.00
Navannapana	88	44.00
Guna	80	40.00
Pistanna	72	36.00
Potato	192	96.00
Rice	194	97.00
Anupamamsa	118	59.00

Observation of ***Aharaja nidan*** in 200 patients shows that indulgence of *Snigdha, Guru, Madhura ahara* was found in 51.00%, 38.00% and 74.00% of patients respectively. *Amla and Drava-bahula nidanas* were observed in 34.00% and 12.00% of patients respectively. Indulgence of *Rice, Potato, Guna, Dadhi* was found in 97.00%, 96.00%, 40.00% and 49.00% of patients respectively. *Nidanas* like *Navannapana, Pistanna, Anupamamsa, Payamsi* were observed in 44.00%, 36.00%, 59.00% and 08.00% of patients respectively.

Table 34: *Viharaja nidan* observed in 200 patients of *Madhumeha* (T2DM):

Viharaja nidan	**Total no. of Patients**	**Percentage (%)**
Asyasukha	114	57.00
Atinidra	64	32.00
Divasvapa	88	44.00
Ratrijagarana	20	10.00
Vegasandharana	72	36.00
Ativyavaya	12	06.00

Asyasukha aetiology observed in 57.00% of patients. 44.00% of patients were indulging *Divasvapa* followed by *Atinidra* i.e. 32.00%. 10.00% of patients were indulging in *Ratrijagarana. Vegasandharana nidan* was observed in 36.00% of patients. *Ativyavaya nidanas* were found in 06.00% and 8.00% of patients respectively.

Table 35: *Manasa nidana* observed in 200 patients of *Madhumeha* (DM):

Manasa nidana	**Total no. of Patients**	**Percentage (%)**
Cinta	144	72.00
Shoka	56	28.00
Udvega	00	00.00
Total	**200**	**100.00**

Observation of *Manasa nidan* shows that 72.00% of patients were belongs to *Cinta* as a causative factor and 28.00% were belongs to *Shoka.*

Table 36: Distribution of patients according to *Desha*:

Desha	**Total**	**Percent (%)**
Sadharana	200	100.00

Jangala	00	00.00
Anupa	00	00.00
Total	**200**	**100.00**

The above table shows that maximum 100.00% patients belonged to *Sadharana Desha*.

Table 37: Involvement of *Srotas (Abhyantara)* in *Madhumeha*(DM-2)

Séotas	**Present**		**Absent**	
	No.	**%**	**No.**	**%**
Udakavaha	172	86.00	28	14.00
Rasavaha	190	95.00	10	05.00
Møđovaha	110	55.00	90	45.00
Mutravaha	172	86.00	28	14.00
Svedavaha	85	42.50	115	57.50

Above table reveals that the involvement of *rasavaha, udakavaha, mutravaha, medovaha,* and *svedavaha* srotas are 95.00%, 86.00%, 86.00%, 55.00%, and 42.00% respectively**.**

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Table 38: Height measurement in *Madhumeha* (T2DM)

Height (centimeter)	**No. of patients**	**Percentage %**
139-150	50	25
151-165	72	36
161-170	54	27
170-180	24	12
MEAN±SD	(157.84±9.60)	
Total	**200**	**100**

The majority of the patients were belongs to 151-165 cms. i.e.36% followed161 to 170 cms i.e. 27%, 139 to 150 cms i.e. 25% and 170 to 180 cms i.e. 12% respectively.

Table 39: Weight measurement in *Madhumeha* (T2DM):

Weight	**No. of patients**	**Percentage**
30-40 kg	00	00.00
41-50 kg	22	11.00
51-60 kg	40	20.00

61-70 kg	70	35.00
71-80 kg	40	20.00
80-100 kg	24	12.00
>100 kg	04	02.00
MEAN±SD	(66.28±12.54)	
Total	**200**	**100**

The above table shows that majority of the patients were belongs to 61-70 kg i.e. 35.00% followed by the incidence of patients in the weight group of 51-60 kg, 71-80kg i.e. 20.00%, 80-100 kg was 12.00%, 41-50 kg i.e. 1100%. Only 2% patients had >100 kg of weight respectively.

Table 40: Incidence of BMI in *Madhumeha* (T2DM):

B.M.I. (kg/m^2)	**No. of patients**	**Percentage %**
< 18.5 (Underweight)	04	02.00
18.5-24.9 (Normal)	68	34.00
25.0-29.9 (Over weight)	90	45.00
30.0-39.9 (Obese)	35	17.50
> 40 (Severe Obese)	03	01.50
MEAN±SD	(26.66±4.73)	
Total	**200**	**100**

The above table shows that the majority of the patients were belongs to overweight group (25.0-29.9 kg/m^2) i.e. 45.00% followed by normal weight group (18.5-24.9 kg/m^2) i.e. 34.00%, Obese group (30.0-39.9 kg/m^2) i.e. 17.50%, underweight group (< 18.5 kg/m^2) i.e. 2.00% and severe obese (>40 kg/m^2) i.e. 1.50% respectively.

Table 41: Waist measurement in *Madhumeha* (T2DM)

Waist (in inches)	**No. of patients**	**Percentage**
26-30	50	25.00
31-35	100	50.00
36-40	37	18.50
> 40	13	06.50

MEAN±SD	(32.70±3.84)	
Total	**200**	**100**

The above table shows that the majority of the patients were belong to 31-35inches i.e. 50% followed by 26-30 inches i.e. 25%, 36-40 inches i.e. 18.50% and > 40 inches i.e. 6.50% respectively.

Table 42: Pulse measurement in *Madhumeha* (T2DM):

Pulse rate (per minute)	**No. of patients**	**Percentage**
60-100	200	100.00
MEAN±SD	(73.79±6.18)	
Total	**200**	**100**

All the patients were belongs to pulse rate lies in between 60-100 beats per minute.

Table 43: Systolic Blood Pressure measurement in *Madhumeha* (T2DM):

Systolic B.P. (mmHg)	**No. of patients)**	**Percentage %**
110-129	74	37.00
130-139	78	39.00
140-149	32	16.00
150-169	11	05.50
170 & above	05	02.50
MEAN±SD	(133.84±17.21)	
Total	**200**	**100.00**

The above table shows that the majority of the patients were belongs to 130 – 139 mmHg systolic blood pressure range i.e. 39.00% followed by 110-129 mmHg systolic blood pressure range i.e. 37.00%, 140 – 149 mmHg systolic blood pressure range i.e. 16.00%, 150 – 169 mmHg systolic blood pressure range i.e. 05.50% and >170mmHg and above systolic blood pressure range i.e. 02.50% respectively.

Table 44: Diastolic Blood Pressure measurement in *Madhumeha* (T2DM):

Diastolic B.P. (mm/Hg)	**No. of patients**	**Percentage (%)**
50-69	06	03.00

70-79	67	33.50
80-89	54	27.00
90-99	62	31.00
>100	11	05.50
MEAN±SD	(82.01±11.01)	
Total	**200**	**100**

The above table shows that the majority of the patients were belongs to 70 – 79 mmHg diastolic blood pressure range .i.e. 33.50% followed by 90-99 mmHg diastolic blood pressure range i.e. 31.00%, 80 – 89 mmHg diastolic blood pressure range i.e. 27.00%, 100 and above diastolic blood pressure range i.e. 5.50% and 50-69 mmHg diastolic blood pressure range i.e. 3.00% respectively.

Table 45: General examination findings in *Madhumeha* (T2DM):

	Total		**Percent (%)**
Built	Moderately built	68	34.00
	Poorly built	31	15.50
	Well built	101	50.50
Facies	Normal	198	99.00
	Abnormal	02	01.00
Pallor	Present	09	04.50
	Absent	191	95.50
Icterus	Present	02	01.00
	Absent	198	99.00
Cyanosis	Present	00	00.00
	Absent	200	100
Temperature	Afebrile	188	94.00
	Febrile	12	06.00
Oedema	Present	06	03.00
	Absent	194	97.00
Lymph node	Palpable	00	00.00
	Non palpable	200	100
Pigmentation	Present	03	01.50

	Absent	197	98.50
Clubbing	Present	01	00.50
	Absent	199	99.50

On general examination 50.50% were belongs to well built category followed by moderately built i.e. 34.00% and poorly built i.e. 15.50%.

99% cases facies of the patients were normal.

Pallor present only in 4.50% cases and absent in remaining cases.

Icterus, cyanosis, oedema, lymph node, pigmentation, and clubbing were present only in 2%, 00%, 06%, 00%, 03%, 0.50% respectively

Table 46: Physical examination findings in *Madhumeha* (T2DM):

	No. of patients		**Percentage%**
Central obesity	Present	115	57.50
	Absent	85	42.50
Hypertension	Present	96	48.00
	Absent	104	52.00
Eye hemorrhage	Present	25	12.50
	Absent	175	87.50
Skin infection	Present	75	37.50
	Absent	125	62.50
Muscles atrophy	Present	00	00.00
	Absent	200	100
Ulcer	Present	20	10.00
	Absent	180	90.00

Out of 200 cases 57.50 % cases had central obesity, 48% had hypertension, and 12.50% cases had eye hemorrhage, 37.50% cases had skin infection(fungal infection), 10% cases had ulcer(foot ulcer) respectively

Table 47: Fasting Plasma Glucose (FPG) findings in *Madhumeha* (T2DM):

FPG (mg/dl)	**No. of patients**	**Percentage**
80-120	18	09.00
120-140	32	16.00

140-200	74	37.00
200-300	60	30.00
>300	16	08.00
MEAN±SD	(198.39±77.76)	
Total	**200**	**100**

The above table shows that the majority of the patients Fasting Plasma Glucose (FPG) level were belongs to 140-200 mg/dl i.e. 37.00% followed by 200-300 mg/dl i.e. 30.00%, 120-140 mg/dl i.e. 16.00%, 80-120 mg/dl and >300 mg/dl i.e. 08.00% respectively

Table 48: 2-hour plasma glucose (2hPG) findings in *Madhumeha* (T2DM):

2hr PG (mg/dl)	**No. of patients**	**Percentage**
120-200	54	27.00
200-400	122	61.00
>400	24	12.00
MEAN±SD	(277.73±101.21)	
Total	**200**	**100**

The above table shows that the majority of the patients 2-hour plasma glucose (2hPG) level were belongs to 200-400mg/dl i.e. 61.00% followed by 120-200 mg/dl i.e. 27.00% and >400 mg/dl i.e. 12.00% respectively.

Table 49: *Glycosylated hemoglobin (HbA_{1c}) findings in *Madhumeha* (T2DM):

Category	**Range**	**No. of patients**	**Percentage %**
Non diabetic	4-6 %	18	09.00
Good control	6-7 %	65	32.50
Poor control	7-8 %	56	28.00
	8-9 %	22	11.00
	9-10 %	14	07.00
	10-15 %	25	12.50
MEAN±SD	(8.27±7.44)		

	Total	**200**	**100**

****Ramnik Sood:*** Text book of Medical Laboratory Technology, 1st edition.

The above table shows that the majority of the patients Glycosylated hemoglobin (HbA1c) level were belongs to poor control category i.e. 58.50% followed by good control category i.e. 32.50% and non-diabetic category i.e. 09.00% respectively.

Table 50: Serum Cholesterol levels in *Madhumeha* (T2DM):

Serum Cholesterol(mg/dl)	**No. of patients**	**Percentage %**
Desirable <200	140	70.00
Borderline 200-240	32	16.00
High risk >240	28	14.00
MEAN±SD	(175.55±50.64)	
Total	**200.00**	**100.00**

The above table shows that the majority of the patients Serum Cholesterol levels were belongs to <200mg/dl i.e. 70.00**%** followed by200-240mg/dl i.e. 16.00**%** and **>**240mg/dl i.e. 14.00**%** respectively.

Table 51: Serum Triglyceride levels in *Madhumeha* (T2DM):

Serum TG(mg/dl)	**No. of patients**	**Percentage %**
Normal (60-149 mg/dl)	110	55.00
Borderline 150 mg/dl- 199 mg/dl	54	27.00
High 200 mg/dl- 499 mg/dl	32	16.00
Very high Over > 500 mg/dl	04	02.00
MEAN±SD	(139.49±71.74)	
Total	**200.00**	**100.00**

The above table shows that the majority of the patients Serum Triglyceride levels were belong to 60-149 mg/dl i.e. 55.00**%** followed by150 mg/dl - 199 mg/dl i.e. 27.00**%,** 200 mg/dl - 499 mg/dl i.e. 16.00**%**and >500 mg/dl i.e. 02.00**%**respectively.

Table 52: Serum Low Density Lipoprotein (LDL) levels in *Madhumeha* (T2DM):

Serum LDL(mg/dl)	**No. of patients**	**Percentage %**
Desirable <130	148	74.00
Borderline (130-159)	27	13..50
High(>160)	25	12.50
MEAN±SD	(113.56±38.8)	
Total	**200**	**100.00**

The above table shows that the majority of the patients Serum Low density lipoprotein (LDL) levels were belong to <130 mg/dl i.e. 74.00**%** followed by130 mg/dl - 159 mg/dl i.e. 13.50**%** and >160mg/dl i.e. 12.50**%** respectively.

Table 53: Serum High Density Lipoprotein (HDL) levels in *Madhumeha* (T2DM):

Serum HDL(mg/dl)	**No. of patients**	**Percentage %**
High risk <34	42	21.00
Borderline 35-44	106	53.00
Desirable < 65	52	26.00
MEAN±SD	(40.55±10.70)	
Total	**200**	**100.00**

The above table shows that the majority of the patients Serum High Density Lipoprotein (HDL) levels were belong to 35-44 mg/dl i.e. 53.00**%** followed by65mg/dl i.e. 26**%** and <34mg/dl i.e. 21**%** respectively.

Table 54: Incidence of Serum Creatinine levels in *Madhumeha* (T2DM):

Serum Creatinine (mg/dl)	**No.of patients**	**Percentage %**
< 1.0	167	83.50
1.1– 1.5	21	10.50
>1.5	12	06.00
MEAN±SD	(0.89±0.42)	
Total	**200**	**100.00**

The above table shows that the majority of the patients Serum Creatinine levels were belong to < 1.0 mg/dl i.e. 83.50% followed by 1.1– 1.5 mg/dl i.e. 10.50% and >1.5 i.e. 06% respectively.

Table 55: Incidence of Blood Urea levels in *Madhumeha* (T2DM):

Blood Urea (mg/dl)	**No. of patients**	**Percentage %**
10-20	60	30.00
21-30	79	39.50
31-40	23	11.50
> 40	38	19.00
MEAN±SD	(28.62±16.61)	
TOTAL	**200**	**100.00**

The above table shows that the majority of the patient's Blood Urea levels were belong to 21-30mg/dl i.e. 39.50% followed by 10-20 mg/dl i.e. 30.00%, > 40 mg/dl i.e. 19.00%, and 31-40 i.e. 11.50% respectively.

Table 56: Routine/microscopic examination of urine findings in *Madhumeha* (T2DM):

	Total		**Percentage%**
Urine pus cells	**Present**	98	49.00
	Absent	102	51.00
Urine sugar	**Present**	160	80.00
	Absent	40	20.00
Urine albumin	**Absent**	138	69.00
	Traces	54	27.00
	Present	08	04.00

Majority of cases had presence of sugar in the urine i.e. 80%. In 49% cases presence of pus cells observed in the urine sample.

Presence of albumin in urine sample was observed in 4%.

Trace amount of albumin were observed in 27% cases and albumin were absent in 69 % cases.

Table 57: Incidence of predominance of *Deha Prakriti* in *Madhumeha* (T2DM):

Deha Prakriti	**No. of Patients**	**Percentage (%)**
Vata-Pittaja	97	48.50
Pittaja-Kaphaja	90	45.00
Vata- Kaphaja	13	06.50
Total	**200**	**100.00**

The above table shows that the majority of the *patient Deha Prakriti* were belongs to *Vata-Pittaja* i.e. 48.50% followed by followed by *Pittaja-Kaphaja* i.e. 45.00% and *Vata-Kaphaja* i.e. 06.50% respectively.

Table 59: Assessment of 200 healthy individual's *Deha Prakriti-*

Deha Prakriti	**No. of healthy individuals**	**Percentage (%)**
Vata-Pittaja	72	36.00
Pittaja-Kaphaja	116	58.00
Vata- Kaphaja	12	06.00
Total	**200**	**100.00**

The above table shows that the majority of the healthy individual's *Deha Prakriti* were belongs to *Pittaja-Kaphaja*.i.e. 58.00% followed by *Vata -Pittaja*-.i.e. 36.00% and *Vata-Kaphaja*.i.e. 06.00% respectively.

Discussion

The present study entitled "***"The Clinicoetiopathological study of Madhumeha (Type-2 Diabetes Mellitus) with special reference to Deha Prakriti"*** was carried out in the OPD & IPD of *Kayacikitsa*, *Vikriti Vigyan,* S.S. Hospital, *Ayurveda* wing and Endocrine O.P.D of S.S. Hospital, B.H.U. Varanasi from November 2016 to December 2017. Total 400 subjects were registered for the study comprises of 200 patients of *Madhumeha* (T2DM) and 200 healthy volunteers. Clinical study comprises of subjective and objective criteria.

Present clinical study reveals that indulgence of *Madhura, Snigdha, Guru Ahara* was found in 74.00%, 51.00%, and 38.00% of patients respectively. *Amla* and *Drava-bahula nidanas* were observed in 34.00% and 12.00% of patients respectively. Indulgence of Rice, Potato, *Guda, Dadhi* was found in 97.00%, 96.00%, 40.00% and 49.00% of patients respectively.

Nidanas like *Navannapana, Pistanna, Anupa mamsa, Payamsi* were observed in 44.00%, 36.00%, 59.00% and 08.00% of patients respectively. It indicates that majority of the patients indulging diabetogenic diet which causing *Madhumeha* (DM).

asyasukha was observed in 57.00% of patients. 44.00% of patients were taking *Divasvapa* and 32.00% were having *Atinidra.* 10.00% of patients were doing *Ratrijagarana. Vegasandharana nidana* was observed in 36.00% of patients. *Ativyavaya nidanas* were found in 06.00% of patients. It indicates that most of the patients adopting activities which support the development of *Madhumeha* (DM).

Out of 200 registered cases majority of cases were belongs to Tobacco addiction i.e.25% followed by addiction of Alcohol+ Smoking+ Tobacco i.e.12.50%, Smoking i.e.7 %, alcohol and smoking together i.e. 6.50%, tobacco and smoking tobacco and smoking i.e. 5.00% and alcohol i.e. 2.5% respectively. No history of addiction was observed in 41.50% cases.

The study reveals that 72.00% of patients were having *Cinta* as a causative factor and 28.00% were found to have *shoka*. It indicates that excessive worry leads to stress thus support the development of *Madhumeha* (T2DM).

The study reveals that *Prabhuta mutrata* and *Avila mutrata* were found in 82.50% and 19.00% of patients respectively. *Pipasa (Trishnadhikya), Gala–Talu shosha,* and *Bahaushi (Kshudhadhikya)* were found in 68.50%, 62.50% and 69.50% of the patients respectively. *Sthaulya, Kara -Pada Suptata,* and *Kara-Pada daha* were found in 54.50%, 62.00% and 59.50% of the patients respectively. 90.00% of the patients were experiencing *Daurbalya*. Classical signs and symptoms mentioned in *Ayurveda* were observed in most of the patients of *Madhumeha,* it indicates that our *acharyas* observation regarding *pratyatma lakshana* of *Madhumeha* was accurate and found true.

The present clinical study reveals that 71.00% of the patients were experiencing *Anga shaithilya* and 84.50% had *alasya*. *Netra upadeha, Kaye malam* (especially genital candidiasis), and *Danteshu Malotpatti* were seen in 50.50%, 4.00% and 25.50% of the patients respectively. *Svedadhikya-Anga gandha,* and *asyamadhurya* were seen in 52.50% and 45.00% of the patients respectively. *Mood change, Jvara,* and *Kesha-Nakhativriddhi* were observed in 36.50%, 06.00% and 05.50% of the patients respectively. General Signs and Symptoms of *Madhumeha* (DM) found in majority of the patients. It indicates that there is

abnormal interaction of three *doshas* and ten *dushyas* in *Madhumeha* (DM) causing genesis of such symptoms.

The present clinical study shows that maximum 100.00% patients belonged to *sadharana desha*. Patients visiting S.S. Hospital IMS, BHU are mostly from *sadharana desha*. It indicates that *desha* (land) does not have much role in the development of disease. However *Anupa desha* person if adopts diabetogenic diet and activities causing diabetes early in comparison to other *desha* people because it support the aggravation of diabetogenic pathogenic factors.

Present clinical study reveals that the involvement of *rasavaha, udaka vaha, mutravaha, medovaha,* and *svedavaha* srotas are 95.00%, 86.00%, 86.00%, 55.00%, and 42.00% respectively**.** Involvement of more number of *srotas* indicates the nature of the disease and it also requires special attention while prescribing management techniques. It indicates that *Madhumeha* manifest due to involvement of more number of *srotas*. Hence, this disease is very difficult to cure or only manageable.

Objective criteria assessment

In the height measurement majority of the patients were belongs to 151-165 cms. i.e.36% followed 161 to 170 cms i.e. 27%, 139 to 150 cms .i.e. 25% and 170 to 180 cms .i.e. 12% respectively. Measurement of height is necessary for calculation of BMI.

Weight measurement data reveals that majority of the patients were belongs to 61-70 kg .i.e. 35.00% followed by the incidence of patients in the weight group of 51-60 kg, 71-80kg .i.e. 20.00%, 80-100 kg was 12.00%, 41-50 kg .i.e. 1100%. Only 2% patients had >100 kg of weight respectively. Weight measurement is also important to know obesity, which major factor for development of type 2 diabetes. Weight greater than 120% of desirable body weight or overweight individual with family history of DM in the family are at more risk of development of diabetes.

BMI data reveals that the majority of the patients were belongs to overweight group (25.0-29.9 kg/m^2) .i.e. 45.00% followed by normal weight group (18.5-24.9 kg/m^2).i.e. 34.00%, Obese group (30.0-39.9 kg/m^2) .i.e. 17.50%, underweight group (< 18.5 kg/m^2) .i.e. 2.00% and severe obese (>40 kg/m^2) .i.e. 1.50% respectively. It indicates that maximum cases were in obese group, which also indicates central obesity and lead into insulin resistance. The body mass index (BMI) at which excess weight increases risk for diabetes varies with different racial groups.

Waist measurement data reveals that maximum waist measurement seen in 31-35 inches in 50% cases, it also indicated central obesity. Central obesity is the main cause of insulin

resistance. Research has been shown that waist line measurement is a good indicator of diabetes risk and is generally more accurate than a BMI reading. Another research findings indicates that fat deposited around the waist has been shown to increase diabetes more significantly than fat deposited at other parts of the body such as around the hip.

Pulse measurement data reveals no significant variation seen in pulse rate. All cases were pulse rate in between 60-100/minute. There is no direct relation in between diabetes and pulse rate but in case of cardio-vascular complications there is variation in pulse rate according to cause.

Systolic Blood Pressure measurement study shows that the majority of the patients were belongs to 130 – 139 mmHg systolic blood pressure range .i.e. 39.00% followed by 110-129 mmHg systolic blood pressure range i.e. 37.00%, 140 – 149 mmHg systolic blood pressure range i.e. 16.00%, 150 – 169 mmHg systolic blood pressure range i.e. 05.50% and >170mmHg and above systolic blood pressure range i.e. 02.50% respectively.

Hypertension and diabetes generally coexist because both share similar risk factors .i.e. overweight, unhealthy diet, and living an inactive lifestyle.

Uncontrolled diabetes is not one of the risk factor for hypertension. The chances of having a heart attack or stroke are further multiplied if other risk factors exist, in addition to diabetes.

Raised systolic blood pressure is common in type 2 diabetes patients, and a major risk factor for cardiovascular disease. In our study more than 50% cases were high systolic blood pressure which indicates risk for cardio-vascular disease.

Diastolic Blood Pressure measurement study shows that majority of the patients were belongs to 70 – 79 mmHg diastolic blood pressure range .i.e. 33.50% followed by 90-99 mmHg diastolic blood pressure range i.e. 31.00%, 80 – 89 mmHg diastolic blood pressure range i.e. 27.00%, 100 and above diastolic blood pressure range i.e. 05.50.00% and 50-69 mmHg diastolic blood pressure range i.e. 03.00% respectively. Uncontrolled diabetes and other risk factors contributed greatly and act as a one of the risk factor for hypertension. In many cases, blood pressure measurement disclosed hypertension, which is particularly common in patients with diabetes. In our study 63.50% patients had high range of diastolic blood pressure which indicates increased peripheral resistance[8].

On general examination 50.50% were belongs to well-built category followed by moderately built i.e. 34.00% and poorly built i.e. 15.50%.

99% cases facies of the patients were normal.

Pallor present only in 4.50% cases and absent in remaining cases.

Icterus, cyanosis, oedema, lymph node, pigmentation, and clubbing were present only in 2%, 00%, 06%, 00%, 03%, 0.50% respectively.

Majority of patients had well-built indicates obesity, which is major cause of type 2 diabetes due to insulin resistance. Other findings like facies, Icterus, cyanosis, oedema, lymph node, pigmentation, and clubbing also indicates complication due to uncontrolled diabetes, any of all these sign if any present that indicate that particular complication in diabetes.

Physical findings shows that out of 200 cases 57.50 % cases had central obesity, 48% had hypertension, 37.50% cases had skin infection (fungal infection), 12.50% cases had eye hemorrhage, and 10% cases had ulcer (foot ulcer). All these finding shows complication of uncontrolled diabetes like retinopathy, cardio-vascular complication, decrease immunity so opportunistic infections etc.

Patients with diabetes mellitus (DM) have infections more often than those without DM. One of the possible causes of this increased prevalence of infections is defects in immunity. Different disturbances (low complement factor 4, decreased cytokine response after stimulation) in humoral innate immunity have been described in diabetic patients. Concerning cellular innate immunity most studies show decreased functions (chemotaxis, phagocytosis, and killing) of diabetic polymorphonuclear cells and diabetic monocytes/macrophages compared to cells of controls. In general, a better regulation of the DM leads to an improvement of these cellular functions. Furthermore, some microorganisms become more virulent in a high glucose environment. Another mechanism which can lead to the increased prevalence of infections in diabetic patients is an increased adherence of microorganisms to diabetic compared to nondiabetic cells[9].

Accumulation of intra-abdominal fat or visceral fat is associated with insulin resistance and is a major feature of metabolic syndrome, which confers a 1.5-2 fold increased risk of developing diabetes and cardio-vascular disease. Other possible findings like skin infections is due to decreased immunity in case of diabetes most commonly genital candidiasis is sign of uncontrolled hyperglycemia, in long standing uncontrolled hyperglycemia complications like retinopathy which manifest as eye hemorrhage and also neuropathy develop which causes diabetic foot ulcer.

Central obesity is known to predispose individuals for insulin resistance. Abdominal fat is especially active hormonally, secreting a group of hormones called adipokines that may possibly impair glucose tolerance. Insulin resistance is a major feature of Diabetes Mellitus Type 2 (T2DM), and central obesity is correlated with both insulin resistance and T2DM

itself. Increased adiposity (obesity) raises serum resistin levels, which in turn directly correlate to insulin resistance. Studies have also confirmed a direct correlation between resistin levels and T2DM and it is waistline adipose tissue (central obesity) which seems to be the foremost type of fat deposits contributing to rising levels of serum resistin[10].

Fasting Plasma Glucose (FPG) findings data reveals that the majority of the patients Fasting Plasma Glucose (FPG) level were belongs to 140-200 mg/dl .i.e. 37.00% followed by 200-300 mg/dl .i.e. 30.00%, 120-140 mg/dl .i.e. 16.00%, 80-120 mg/dl and >300 mg/dl i.e. 08.00% respectively. Uncontrolled blood sugar level reveals that there is no proper medication and also irregular life style. The normal level according to ADA (American Diabetes Association) is 70-100 mg/dl, so our study reveals that almost all cases except some cases there is impaired and diabetic condition which indicates poor control.

The prognosis in patients with diabetes mellitus is strongly influenced by the degree of control of their disease. Chronic hyperglycaemia is associated with an increased risk of micro vascular complications. In our study it was found that many patients were suffering from uncontrolled DM and it may be due irregular medication, diet pattern, genes, environment and other factors.

2-hour plasma glucose (2hPG) findings data reveals that the majority of the patients 2-hour plasma glucose (2hPG) level were belongs to 200-400mg/dl .i.e. 61.00% followed by 120-200 mg/dl i.e. 27.00% and >400 mg/dl i.e. 12.00% respectively.

Post prandial blood sugar indicates level of sugar 2 hour after intake meal. Maximum cases had uncontrolled level of 2hr PG level. Patient fails to maintain the proper diet regime and exercise regimen are the foundations of uncontrolled level of 2hr PG level.

Glycosylated hemoglobin (HbA_{1c}) findings reveals that HbA_1c tells about details of sugar level of last 2.5-3 month, so it is best indicator if sugar control. The data shows that the majority of the patients Glycosylated haemoglobin (HbA1c) level were belongs to poor control category i.e. 58.50% followed by good control category i.e. 32.50% and non-diabetic category i.e. 09.00% respectively. Mean of all cases were 8.27. It reveals that maximum no. of cases were uncontrolled diabetes.

Poor glycemic control was found significantly associated with duration of diabetes, age of onset, family history, job status, educational status, antidiabetic drugs, body mass index, abdominal circumference, hypertension, lipid and fasting plasma glucose levels. There was a significant relationship between the glycemic control and dietary compliance, physical activity, self-blood glucose monitoring and drug compliance. While there is a significant relationship between the poor glycemic control and nephropathy, retinopathy, neuropathy and

cardiovascular diseases. The higher level of HbA1c shows higher risk of having complication related to diabetes. So in our study it indicates irregular life style and dietary pattern[11]. Our study also supports that irregular life style and dietary pattern is the important factor for poor glycemic control.

Serum Cholesterol levels shows that the majority of the patients were having the Serum Cholesterol level <200mg/dl .i.e. 70.00% followed by 200-240mg/dl .i.e. 16.00% and >240mg/dl .i.e. 14.00% respectively. In our study maximum patients had serum cholesterol within normal limit, some cases had raised level which indicates a higher risk of heart disease and stroke. High cholesterol level over a period of year is often associated with a greater risk of health problems. Life style modification is necessary for reducing high level of cholesterol along with medications like statins.

Serum Triglyceride levels data study reveals that the majority of the patients Serum Triglyceride levels were belong to 60-149 mg/dl .i.e. 55.00% followed by 150 mg/dl - 199 mg/dl .i.e. 27.00%, 200 mg/dl - 499 mg/dl .i.e. 16.00% and >500 mg/dl .i.e. 02.00% respectively. one of the component in metabolic syndrome, so if any individual which have TG level more than normal, in future they have maximum chance to develop diabetes. In case of type 2 diabetes there is high level of triglyceride level commonly found which indicates poorly controlled diabetes. High level increases risk factors for heart disease, stroke and nerve damage.

Serum Low Density Lipoprotein (LDL) levels data shows that the majority of the patients Serum Low density lipoprotein (LDL) levels were belong to <130 mg/dl .i.e. 74.00% followed by 130 mg/dl - 159 mg/dl .i.e. 13.50% and >160mg/dl .i.e. 12.50% respectively. LDL level also contribute in developing cardio-vascular disease. Insulin resistance and type 2 diabetes are associated with a clustering of interrelated plasma lipid and lipoprotein abnormalities, which include reduced HDL cholesterol, a predominance of small dense LDL particles, and elevated triglyceride levels. Each of these dyslipidemic features is associated with an increased risk of cardiovascular disease[12].

Serum High Density Lipoprotein (HDL) levels data reveals that the majority of the patients Serum High Density Lipoprotein (HDL) levels were belong to 35-44 mg/dl .i.e. 53.00% followed by 65mg/dl .i.e. 26% and <34mg/dl .i.e. 21% respectively. In our study maximum patients were on high risk and in borderline, which increases cardio-vascular risk due to low levels of HDL.

Type 2 diabetes is commonly accompanied by a low level of high density lipoprotein cholesterol (HDL-C) that contributes to the increased cardiovascular risk associated with this

condition. Given that HDLs have the ability to improve increase the uptake of glucose by skeletal muscle and to stimulate the secretion of insulin from pancreatic beta cells the possibility arises that a low HDL concentration in type 2 diabetes may also contribute to a worsening of diabetic control. Thus, there is a double case for raising the level of HDL-C in patients with type 2 diabetes: to reduce cardiovascular risk and to improve glycemic control. Approaches to raising HDL-C include lifestyle factors such as weight reduction, increased physical activity and stopping smoking. Of currently available drugs, the most effective is niacin. Newer formulations of niacin are reasonably well tolerated and have the ability to increase HDL-C by up to 30%. The effect of niacin on cardiovascular events in type 2 diabetes is currently being tested in a large-scale clinical outcome trial.[13] Our findings indicated that overweight, decreased physical activity, irregular diet pattern and stress greatly contributed in low levels of HDL.

Incidence of Serum Creatinine levels reveals that the majority of the patients, Serum Creatinine levels were belong to < 1.0 mg/dl .i.e. 83.50% followed by 1.1– 1.5 mg/dl i.e. 10.50% and >1.5.i.e. 06% respectively. Increase level of creatinine from long time indicate that chronic kidney disease, which is most common complication in long standing cases of uncontrolled diabetes i.e. Diabetic nephropathy. Diabetes is the most common cause of kidney failure, accounting for nearly 44 percent of new cases. Even when diabetes is controlled, the disease can lead to chronic kidney disease (CKD) and kidney failure. Kidney failure is the final stage of chronic kidney disease. Nearly 24 million people in the United States have diabetes and nearly 180 000 people are living with kidney failure as a result of diabetes. The prevalence of nephropathy in India was less (8.9% in Vellore, 5.5% in Chennai) when compared with the prevalence of 22.3% in Asian Indians in the UK. In chronic renal failure patients the prevalence of diabetic nephropathy was 30.3% followed by chronic interstitial nephritis (23%) and chronic glomerulonephritis (17.7%) [14]

Blood Urea levels in the present study shows that the majority of the patient's Blood Urea levels were belong to 21-30mg/dl .i.e. 39.50% followed by 10-20 mg/dl i.e. 30.00%, > 40 mg/dl i.e. 19.00%, and 31-40 i.e. 11.50% respectively. Mean was 28.62.

In a two-stage residual inclusion analysis, the research group confirmed an elevated BUN concentration was independently linked with an increased diabetes risk, with every 10 mg/dL increase tied to an increased diabetes risk[15]

Experimental evidence suggests that higher levels of urea may increase insulin resistance and suppress insulin secretion. However, whether higher levels of blood urea

nitrogen (BUN) are associated with increased risk of incident diabetes mellitus in humans is not known. [16]

Routine/microscopic examination of urine findings reveals that urine pus cells in 49% cases had presence of pus cells indicates urinary tract infection, normally 2-3 pus cells seen in urine microscopic examination but > 2-3 cells/hpf indicates urinary tract infection which indicate opportunistic infection in diabetic patients due to decrease immunity and also due to presence of sugar in the urine which provide favorable environment for the bacterial growth. Diabetes impairs some parts of your immune response. You have fewer white blood cells and T cells to fight off invading bacteria, viruses, and fungi. For the same reason, diabetics often develop UTIs caused by less commonly encountered germs. Routine antibiotics may be ineffective. Nerve damage can keep your bladder from emptying, either by weakening muscles or scrambling the signals between your brain and urinary system. Urine that remains in your body too long poses a greater infection risk. Sugar in your blood and urine can also contribute to a greater risk for UTI.[17]

Urine sugar levels reveals that 80% of cases had presence of sugar in the urine, means 80% cases had more than 180 mg/dl blood sugar level which is the threshold value to come in urine i.e. Renal Threshold Value. So presence of sugar in the urine indicates uncontrolled sugar level.

Although not as accurate as a blood glucose test, urine testing can be used as a screening tool in patients known to have diabetes. Even in patients with no ketoacidosis, high glucose levels may be an indication that their diabetes is poorly controlled.[18]

Urine albumin data reveals that 27% cases had presence of albumin in urine in trace amount, which indicate early damaging of nephron in diabetic patients which lead into massive proteinuria in long standing cases if blood sugar level is not controlled. In 4% of cases the presence of albumin was noted. It indicates the renal impairment .ie. development of diabetic nephropathy as a complication in diabetic population. Albuminuria is a well-known predictor of poor renal outcomes in patients with type 2 diabetes and in essential hypertension . Albuminuria has also been shown more recently to be a predictor of cardiovascular outcomes in these populations. There is emerging data that reduction of albuminuria leads to reduced risk of adverse renal and cardiovascular events. It has become increasingly clear that albuminuria should not only be measured in all patients with type 2 diabetes and hypertension, but also steps should be taken to suppress albuminuria to prevent future renal and cardiovascular adverse events.[19]

Incidence of predominance of *Deha Prakriti* data shows that *Vata-Pittaja* (48.50%) predominant *Prakriti* has greater risk for developing the disease, followed by *Pittaja-Kaphaja* (45.00%), than the *Vata-Kaphaja* (06.50%). *Madhumeha* is a type of *Vatik Prameha, and in our study the maximum no. of Prakriti is Vata-Pittaja* i.e. 48.50%, it indicates greater risk in *Vata-Pittaja Prakriti and Pittaja-Kaphaja* to develop *Madhumeha* in future.

Assessment of *Sara* data reveals that the majority of the patient's *Sara* were belongs to *Rakta Sara i.e.* 62.50% followed by *Tvak Sara, Mamsa Sara, Asthi Sara, Majja Sara, Satva Sara, shukra Sara and Meda Sara* 55.00%, 44.50%, 30.00%, 29.00%, 20.00%, 11.50%and 7.50% respectively. In the case of *Madhumeha*, the main *dushya* is *meda*, and study reveals that only 07.50% cases were *meda*.

Rakta Sara, Tvak Sara and *Mamsa Sara* individuals are more prone to develop T2DM because these individuals *meda* gets vitiated early by T2DM etiological factors. Present study also reveals that *Meda sara* individuals are less prone to develop the disease because of purity in the *meda dhatu.*

Assessment of 200 healthy individual's *Deha Prakriti data* study shows that the majority of the healthy individual's *Deha Prakriti* was belongs to *Pittaja-Kaphaja*.i.e. 58.00% followed by *Vata -Pittaja*-.i.e. 36.00% and *Vata-Kaphaja* .i.e. 06.00% respectively.

Sara wise distribution of 200 healthy individuals data study reveals that majority of the healthy individuals were belongs to *Tvak Sara .i.e.* 82.50% followed by *Rakta, Sara, mamsa Sara, Majja Sara, Asthi Sara, shukra Sara, , Meda Sara* and *Satva Sara, and* 68.50%, 46.50%, 39.00%, 37.00%, 32.50%, 25.00% and 24.00% respectively.

CONCLUSION

After thorough observation of our clinical findings it can be concluded that most of the T2DM patients were indulging diet rich in glycemic index (*Kapha Vardhaka ahara*) associated with decreased physical activity, irregular diet pattern and stress greatly contributed in the disease development. It can be concluded that most of the T2DM patients were belonged to uncontrolled category inspite of treatment due to consumption of diet rich in glycemic index (*Kapha Vardhaka ahara),* overweight, decreased physical activity, irregular diet pattern and stress greatly contributed the lack of blood plasma glucose control. From the family history it can be concluded that T2DM (*Madhumeha*) is a hereditary disease observed in 40% of the patients. It may be concluded that the *Vata-Pittaja* and *Pittaja-Kaphaja prakriti* individuals are more prone for the development of T2DM (*Madhumeha*).

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