Published online in http://ijam.co.in ISSN No: 0976-5921

International Journal of Ayurvedic Medicine, Vol 14 (2), 2023; 362-368

The Study of add on effect of *Madhusudan Vati* and *Arogyavardhini Vati* in *Prameha* with special reference to Type 2 Diabetes Mellitus

Research Article

Pallavi N Mane[1,2*], Dipankar DG[3], Pruthviraj P Ugale[4], Abhijit Shekhar[5,2], Jibi Varghese[3], Anupama Bathe[1,2], Abhilasha Lagad[1,2]

1. Assistant Professor, 2. Ph.D. Scholar, 3. Professor, 5. Associate Professor, Department of Kayachikitsa, Dr D. Y. Patil Vidyapeeth (Deemed to be University), Dr. D. Y. Patil College of Ayurveda and Research Centre Pimpri, Pune.
4. MBA Scholar, Consultant Shree Vishwaswasthya Ayurvedic Panchakarma Clinic, Nigadi, Pradhikaran, Pune. Maharashtra. India.

Abstract

Prameha (Diabetes mellitus) is an age long disease known from *vedic* period and now it is a leading lifestyle disorder. Diabetes mellitus is a group of metabolic syndromes of fat, protein and carbohydrate which is due to absolute or relative deficiency of insulin, characterized by hyperglycemia over a prolonged period with polyuria, polydipsia, and polyphagia like symptoms. The estimates in 2019 showed that 77 million individuals had diabetes in India, which is expected to rise to over 134 million by 2045. It has turned out to be the biggest "silent killer" in today's world. This is an Open label Comparative clinical study with pre-test and post-test design where in 60 patients suffering from *Prameha* (type 2 DM) of either gender between the age group of 25 to 75 years were randomly selected and grouped into Group A and Group B. The 30 patients in Group A were treated with *Arogyavardhini vati & Madhusudhan vati* with Metformin (500 mg) and Glimepiride (1mg) BD. Group B of 30 patients were given Metformin (500mg) and Glimepiride (1 mg) for 120 days. Results obtained in subjective and objective parameters were analyzed for the statistical significance by adapting paired T test, unpaired T test, Mann-Whitney Z and Wilcoxon Signed Ranks Test Z. The study revealed that Group A was found to be more effective in bringing symptomatic relief and improving biochemical markers in the patients of *Prameha.*

Key Words: *Ayurveda, Prameha, Type 2 Diabetes Mellitus, Madhusudhan Vati, Arogyavardhini Vati.*

Introduction

In *Ayurveda Prameha* (Diabetes mellitus) is included under *Ashtomahagada* (1) **(**Su.Su 33/4). In ancient treatise we find a vivid description of the disease solely attributed to metabolic derangement (2) along with genetic predisposition (3), *Prameha* is one of them. Diabetes Mellitus is a group of metabolic diseases (4) in which there are high blood sugar levels over prolonged period, symptoms include polyuria, polydipsia and polyphagia (5). According to World Health Organization (WHO), India had 69.2 million people living with diabetes in 2015(6). *Prameha* is the disease of civilization, due to lifestyle factor, lack of physical activity, stress, urbanization, improper unbalanced diet (7). It shows upwards trends in urban as well as rural area of India (8). Obesity, Hypertension, Hyperlipidemia are major risk factors for type 2 Diabetes mellitus (9), in Ayurveda it is described as *santarpanotth Prameha*(10)**.** The World Health Organization (WHO) projects that DM will be the 7th leading cause of death in 2030(11). In Diabetes Mellitus widespread pathological changes (12) are going on like vascular lumen narrowing, early Atherosclerosis, sclerosis of glomerular capillaries, retinopathy, neuropathy and peripheral vascular insufficiency (13) Synthetic oral hypoglycemic used in the treatment of Type 2 DM have been reported to possess prominent side effects and fail to manage DM complications. There is need of satisfactory therapeutic modalities free from side effects. Traditionally, DM is treated with diet, physical exercise and herbal remedies. *Nisha, Aamalaki, Shuddha Shilajatu (MadhusudhanVati)* (14,15) has been given for the treatment of *Prameha*. *Arogyavardhini vati* (16) described *as Dipani, Pachani, Medovinashani, Sarvarogprashamani.* It improves liver function; liver plays important role in pathophysiology of Diabetes mellitus type 2 (17). Efficacy of *Madhusudhan Vati* and *Arogyavardhini Vati* in management of *Prameha* needs to be proved by application of biochemical markers (HbA1C level, BSL level, urine sugar) along with it also clinical improvement. It also the aim for which study is undertaken to document the role of *Madhusudhan vati* and *Arogyavardhini vati*.

*** Corresponding Author:**

Pallavi N Mane

Assistant Professor and Ph.D. Scholar, Department of Kayachikitsa, Dr D. Y. Patil Vidyapeeth (Deemed to be University), Dr. D. Y. Patil College of Ayurveda and Research Centre Pimpri, Pune -18 (Maharashtra) India.
Email Id: drpallavimane10@gmail.com

Aim and Objectives

- To find the add on effect of *Madhusudhan Vati* and *Arogyavardhini Vati* along with Metformin (500 mg)

and Glimepiride (1 mg) in *Prameha* with special reference to Type 2 Diabetes Mellitus.
- To document the changes in signs and symptoms of *Prameha. (Pipasa, Avilmootrata, Prabhutmutrata, Naktamootrata, Hastapadtaldaha*)
- To observe the changes in biochemical parameter HbA1C level, BSL level, urine sugar.

Materials and Methods

The total 60 patients were enrolled in study on the basis of inclusion criteria and classified into two groups.

Design

Open labelled Comparative Clinical trial of *Madhusudhan Vati* and *Arogyavardhini Vati* with Metformin (500 mg) and Glimepiride (1 mg) (Oral Hypoglycaemic Agent)

Inclusion Criteria

1. Patients with Signs & Symptoms of *Prameha*.
2. Patients between age group of 25 - 75 years.
3. Type-2 Diabetes mellitus (NIDDM) diagnosed.
4. HbA1C –6.4 % to 11 %
5. BSL (Fasting>120mg/dl, PP>200mg/dl)
6. Urine sugar level (+).

Exclusion Criteria

1. Known cases of Type -1 Diabetes Mellitus
2. Patients with any major systemic complications of DM.
3. Patients having any other major illness.

Criteria for Assessment

Table 1: Subjective Parameters

Sr.no	Parameter	Finding	Points
1	*Prabhutmootrata* (Polyuria)	Normal 6-7 times (day) 8-9 times (day) 9 & above (day)	0 1 2 3
2	*AvilaMootrata*– (turbidity)	Present Absent	0 1
3	*Naktamutrata* (Nocturia)	Normal Mild - 1 times/night Moderate - 2-3 times/night Severe - >3/night.	0 1 2 3
4	*Hastapadtala Daha* (Neuropathy)	Absent Mild - (no disturbance in routine work) Moderate - (routine work disturbed) Severe - (cannot do routine work)	0 1 2 3
5	*Pipasa* (Polydipsia)	Absent Mild - Increased thirst but can be controllable Moderate - Increased uncontrolled thirst with increased frequency of drinking water. Severe - Very much increased thirst with increased frequency &intake	0 1 2 3
6	*Kshudhaadhikya*	Absent Mild - Increased Hunger but can be controlled Moderate - Increased controlled hunger with increased frequency and intake	0 1 2

Objective Criteria
- BSL (Fasting, Post prandial)
- Urine Sugar Levels
- HbA1C

Schematic Representation of *Samprapti-Samprapti Ghataka*
- ***Dosha***: *Drava Shleshma Pradhan Tridosha, Apan Vyan Vayu*
- ***Dushya***: *Abadhya Meda, Mamsa, Kleda, Shukra, Shonit, Vasa, Majja, Lasika, Rasa, Oja*
- ***Agni***: *Dhatvagnimandya*
- ***Ama*** : *Aam Annarasa*
- ***Udbhavasthana*** : *Aantakoshta*
- ***Srotas***: *Mutravaha Strotas, Medovaha strotas*
- ***Srotodushti***: *Sang, Atipravruti*
- ***Adhishtan*** : *Basti, Sarvasharir*
- ***Swabhava*** : *Chirakari*
- ***Sadhyasadjyata***: *Yapya/ Asadhya*

Treatment Protocol

The 30 patients in Group A were treated with *Arogyavardhini vati & Madhusudhan vati* with Metformin (500 mg) and Glimepiride (1mg) BD. Group B of 30 patients were given Metformin (500mg) and Glimepiride (1 mg) for 120 days. **(Table No. 2)**

Table No. 2

Group- A	Group-B
30 Patients	30 Patients
Arogyavardhini vati (500mg) & *Madhusudhan vati*(500mg). + Metformin (500 mg) and Glimepiride (1mg)	Metformin (500mg) and Glimepiride (1 mg)
120days	120days

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Drug Review

Table 3: Ingredients of *Arogyavardhini Vati* with their Guna and Karma

Name	BotanicalNames/ English Names	Guna	Karma
Shuddha Parad	Mercury	*Shadrasa, Guru, Snigdha, Sara*	*Yogvahi, Rasayana, Ativrishya,Balya, Dipana,Agnikari, Ayukara, Drisatibal, Tridoshaghna*
Shuddha Gandhak	Sulphur	*Katu, Tikta, Kahaya, Usna, Sara, Madhuravipak*	*Dipana, Pachana, Vishahara, Jantughna, Krimihara, Agnikari, Bhedi, Rasayana,Divyadrishtikara*
Loha Bhasma	Iron	*Tikta, Madhur, Kashaya, Sita, Sara, Guru, Ruksha*	*Lekhana, Balya, Ayusya, Yogvahi, Pramehagna, Medoroghara*
Abhraka Bhasma	Mica	*Kashaya, Madhura, Sita, Singdh*	*Dipana, Balya, Pachana,Yogvahi*
Tamra Bhasma	Copper	*Kashaya, Madhura, Sita, Sigdha*	*Lekhana, Hridvishodhana, Krimighana, Rasayan, Shodhana, Pramehgna*
Aamalaki (Fruit Rind)	*Emblica officinalis*	*Guru, Ruksha, Shit, Lavanrahitpancharasa*	*Tridoshahar, Rochan, Dipan, Anuloman, Rasayana, Yakruduttejak, Pramehagna*
Haritaki (Fruit Rind)	*Terminalia chebula*	*Laghu, Ruksha, Shit, Lavanrahitpancharasa*	*Tridoshahar, Rochan, Dipan, Rasayana, Anuloman, Yakruduttejak, Mrudurechan*
Bibhitaki (Fruit Rind)	*Terminalia bellerica*	*Laghu, Ruksha, Kashaya, Ushna*	*Tridoshahar, Rechan, Dipan, Anuloman, Kramighna*
Shuddha Shilajatu	Mineral pitch/ Asphalt	*Katu, Ushna*	*Rasayan, Mehaghna, Medochedkar*
Shuddha Guggulu (Resin)	*Commiphora mukul*	*Laghu, Ruksha, Tikta, Vishada, Sara*	*Tridoshhara, Medohar, Shothahar, Vedanasthapan, Vranaropan, Dipan,*
Chitrak (Root)	*Plumbago zeylanica*	*Laghu, Ruksha, Katu, Ushna, Tikshana*	*Dipan, Pachana, Grahi, Lekhan, Kaphavatashamak*
Kutaki(Root)	*Picrorhiza kurroa*	*Laghu, Ruksha, Katu Tikta, shita*	*Kaphapittahara, Dipan, Pachana, Pittasarak,Pramehgna*

Table 4: Ingredients of *Madhusudan Vati* and Properties

Name	Botanical Name	*Guna*	*Karma*
Dhatri (Fruit Rind)	*Emblica officinalis*	*Guru, Ruksha, Shita, LavanrasarahitaPancharas, Madhur /shitavirya*	*Tridoshahar, Pramehaghana, Rasayan, Dipana, Yakrutottejak, Rochak*
Nisha (Rhizome)	*Curcuma longa*	*Ruksha, Laghu, Katu , Tikta rasa, Katuvipak, Ushanavirya*	*Twagdosh-Meha-Pandu-Shothahar Mutravirejaniya*
Shilajatu	Mineral pitch/ Asphalt	*Katu, ushna*	*Rasayan, Mehaghna, Medochedk*

Result and Observations

The distribution of patients in both the groups showed that maximum number of patients having *Kaphapitta Prakruti* (19%), age group above 60yrs (40%) and those who have *Mandagni* (70%) and *Madhyam Koshta*(47%). Male patients those are obese and having sedentary nature of work had more prevalence rate in the present study. *Aahara Vidhi Viruddha hetus* like *Ajeernashan* (65 %), *Viruddhashan* (91.7%), *Adhyashan* (68.3%) and *Vishamashan* (80%), *Jalapan Vidhi viruddha hetu* like *Ushapana* (90 %), *Nishapana* (100 %), *Bhojanootar jalapana*(100%). *Aaharaj hetu* like *Dugdha vikar* (95%), *Viroodha dhanya* (78.3%), *Atiguru* (65 %), Paryushita (65 %), Bakery product (90 %) were found. Viharaj hetu like Avyayam (75%), *Diwaswap* (78.8%), *Ratrojagaran*(57%), *Manasik Hetu* like *Chinta* (100%) these were findings of study which indicate *Santarpanjanya* and *Apathyanimittaj* origin of disease. So, this study revalidates the concept of need of *Hetuviparit Chikitsa*. So, the *Nidan parivarjana* is mandatory for the results in the treatment. In Overweight or obese patients combined therapy show better results by reducing the body weight. In present study, 61.7% patients were having positive family history. It shows the strong genetic inheritance of the disease as mentioned in modern medicine.

The conclusions are presented here with, the Group A was found Significant when compared with Group B in reduction of *Prabhutamutrata, Avilmutrata, Naktamutrata, Pipasa, Hastapadtal Daha, Kshudhaadhikya* symptoms ($p<0.001$) (Table No. 5, 6). In this study Group A is significant when compared with group B in Fasting Blood Sugar level (Table No. 7), HbA1C (Table No. 11), Urine sugar Fasting (Table No. 13) & post-prandial urine sugar level (Table No. 15).

Table 5: Effect of Therapy on cardinal symptoms in Group A (n=30)

Sr No	Symptoms	Mean Score		% Relief	SD	Z	p value
		BT	AT				
1	*Prabhutmutrata*	1.83	0.23	87.4%	0.498	4.949	<0.001
2	*Aavilmutrata*	0.80	0.07	91%	0.521	4.491	<0.001
3	*Naktamutrata*	0.86	0.07	91.8%	0.901	4.730	<0.001
4	*Pipasa*	1.03	0.0	100%	0.320	5.231	<0.001
5	*Hastapadtaldah*	1.30	0.07	94.6%	0.568	4.824	<0.001
6	*Kshudhaadhikya*	1.13	0.03	97.3%	0.481	4.963	<0.001

Table 6: Effect of Therapy on cardinal symptoms in Group B (n=30)

Sr. No	Symptoms	Mean Score		% Relief	SD	z	p
		BT	AT				
1	*Prabhutmutrata*	1.50	0.23	84.7%	0.450	5.035	<0.001
2	*Aavilmutrata*	0.93	0.33	64.5%	0.498	4.243	<0.001
3	*Naktamutrata*	1.54	0.19	87.5%	0.901	6.202	<0.001
4	*Pipasa*	1.23	0.26	78.9%	0.718	4.284	<0.001
5	*Hastapadtaldah*	1.20	0.13	89%	0.740	4.407	<0.001
6	*Kshudhaadhikya*	1.57	0.14	91.1%	0.568	4.849	<0.001

Table 7: Statistical observations of BSL Fasting before and after treatment in both groups

BSL-F	Day-0		Day-120		Paired t	p
	Mean	SD	Mean	SD		
Expt. Group A	178.10	45.961	140.00	36.051	5.967	<0.001 HS
Control Group B	167.00	28.191	143.03	15.199	6.567	<0.001 HS

Table 8: Comparison of statistical observation of BSL Fasting between two groups

BSL-F mean	Mean difference	SD	Unpaired t	p
Expt. Group A	30.10	27.630	0.985	0.003
Control Group B	23.97	19.989		

The result between two groups was compared by unpaired t Test for fasting BSL and found to be significant with p value (0.003) and t value 0.985 with group A showing more good result.

Table 9: Statistical observations of BSL Postprandial before and after treatment in both groups

BSL-PP	Day-0		Day-120		Paired t	p
	Mean	SD	Mean	SD		
Expt. Group A	268.40	71.050	210.73	56.975	6.725	<0.001
Control group B	248.37	37.990	216.93	30.168	12.379	<0.001

Table 10: Comparison of statistical observation of BSL Postprandial between two groups

BSL-PP	Mean difference	SD	Unpaired t	p
Expt. Group A	57.67	46.969	0.179	0.859
Control group B	55.93	24.748		

The result between two groups was compared by unpaired t Test for BSL Postprandial and found to be not significant with p value 0.859 and t value 0.179 with group A showing more good result.

Table 11: Statistical observations of HbA1c before and after treatment in both groups

HbA1C%	Day-0		Day-120		Paired t	P
	Mean	SD	Mean	SD		
Expt. Group A	7.99	1.081	7.02	0.968	7.300	<0.001 HS
Control group B	7.73	0.685	7.21	0.747	8.510	<0.001 HS

Table 12: Comparison of statistical observation of HbA1c between two groups

HbA1C%	Mean difference	SD	Unpaired t	p
Expt. Group A	0.96	0.723	3.049	0.003 **S**
Control group B	0.52	0.335		

The result between two groups was compared by unpaired t Test and found to be significant with t value 3.049 and P value 0.003.

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Table 13: Statistical observations of Urine sugar Fasting before and after treatment in both groups

Urine sugar levels –F	Day-0		Day-120		Wilcoxon Signed Ranks test z	p
	Mean Score	SD	Mean score	SD		
Expt. Group A	0.87	0.507	0.37	0.490	3.638	<0.001 HS
Control Group B	0.60	0.675	.0.30	0.466	2.183	0.029 S

Table 14: Comparison of statistical observation of Urine Sugar Fasting between two groups

Urine sugar levels –F	Mean difference score	SD	Mann-Whitney z	P
Expt. Group A	0.50	0.572	1.293	0.019 S
Control group B	0.30	0.702		

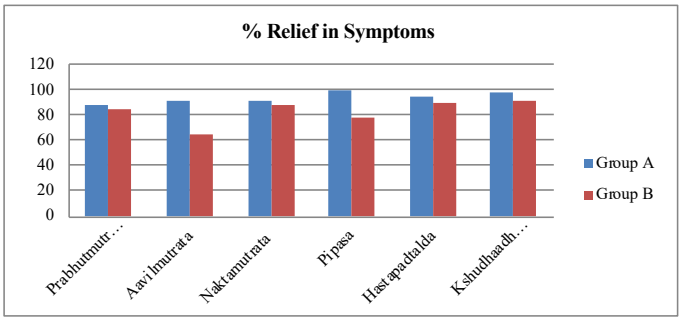
Table 15: Statistical observations of Urine sugar post prandial before and after treatment in both groups

Urine sugar levels –PP	Day-0		Day-120		Wilcoxon Signed Ranks Test z	p
	M e a n	SD	Mean score	SD		
Expt. Group A	2.03	0.615	1.13	0.571	4.838	<0.001 HS
Control group B	1.50	0.630	0.80	0.610	3.871	<0.001 HS

Table 16: Comparison of statistical observation of Urine Sugar post prandial between two groups

Urine sugar levels –PP	Mean difference score	SD	Mann-Whitney z	p
Expt. Group A	0.90	0.481	1.299	0.001 S
Control group B	0.70	0.702		

Graph no-1



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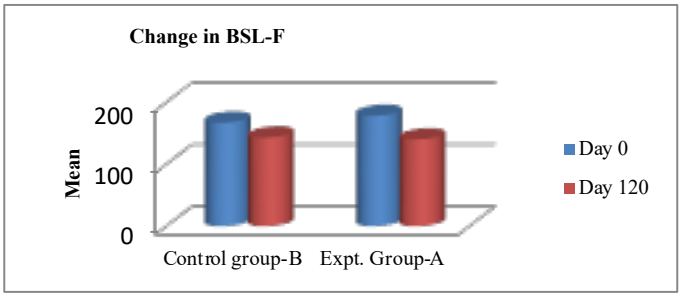

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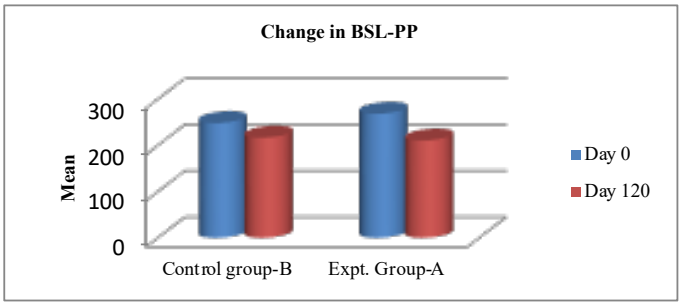

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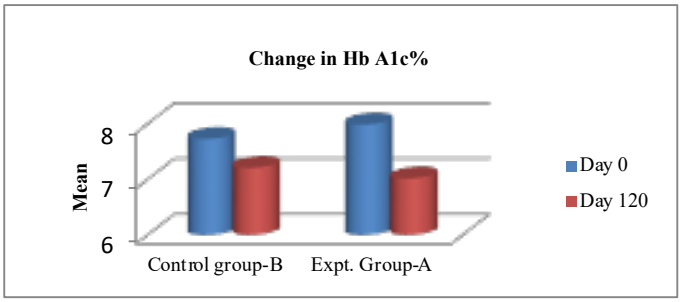

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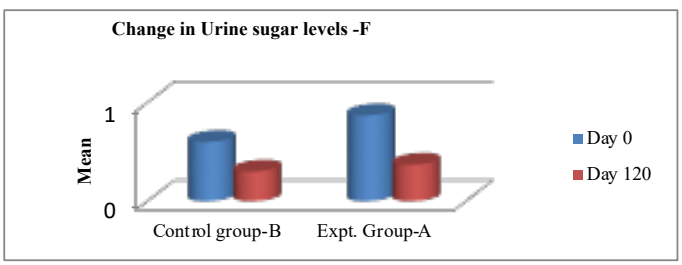

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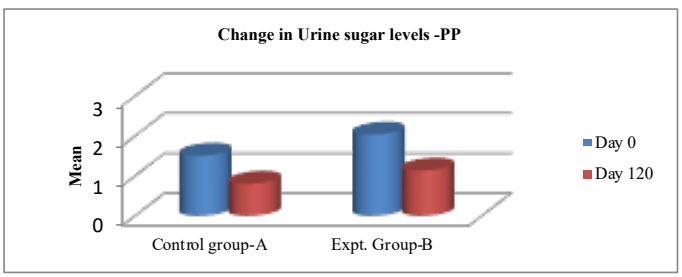

Discussion

The reason behind the selection of *Prameha* i.e., Diabetes mellitus was that more than 382 million people are suffering from this 'silent killer' and still the evidence of *Prameha* in increasing day by day. The complications of diabetes are more dreadful than the disease itself. The syndrome of Diabetes Mellitus is largely covered under the broad heading of *Prameha.* In Ayurvedic literature *Apathyanimittaja Prameha* is explained by *Aacharya Sushruta* (18)*, Sthula Pramehi* is explained by *Aacharya Charaka* and we found description of *Avaranjanya Prameha*, all these have similarity with Type-2 Non-Insulin Dependent Diabetes Mellitus (NIDDM). Here the study is focused on Type-2 DM patients only to understand its *Hetu, Samprapti* (etiopathogenesis) and treatment as per Ayurveda.

Aacharya Charaka has explained *Santarpanjanya Prameha* in which due to excessive indulgence in *hetus* of *santarpana* causes *dushti* of *Kapha* and *Pitta*. These *doshas* causes *dushti* of *dhatus* similar to them and this all results in vitiation of all types of *Agni (Jatharagni, Dhatvagni and Bhutagni)*. Due to *agni dushti* there is excessive formation of deranged quality of *dhatus – Rasa, Rakta, Mamsa, Meda, Majja, Vasa, Kleda* etc (19). Further vitiation of *kleda* causing *Mutravaha Srotas Dushti* having *Basti* affinity leads to symptoms like *Prabhutmutrata, Avilmutrata, Naktamutrata, Pipasa, Dourbalya* etc. In virtually all populations with higher fat diets, decreased physical activity and sedentary occupational habits have accompanied the process of modernization which has resulted in the doubling of the prevalence of obesity and type2 diabetes. The aim of *chikitsa* is *Samprapti bhanga, Dosha Samya, Dhatu Sthapana, Srotas Shodhana, and Agni Vruddhi.*

In this study *Arogyavardhini vati* and *Madhusudan vati* is used along with Oral Hypoglycemic Agent. The OHA Glimepiride lowers the blood sugar level and increases the release of insulin from the pancreas and Metformin decreases the absorption in the intestine and the production of sugar in the liver. The *Arogyavardhini vati* having *Dipana, Pachana, Lekhana* properties which help for correcting the *Agnimandya* and to remove *Aam*. *Triphala* (20)*, Shilajatu, Kutaki* reduces *Kleda* (fluidity) and *Meda* (21), *Guggulu* remove *Avarana* of *Vata* and clear the channels of lipid transportation (22). *Tamra Bhasma* plays an important role in carbohydrate metabolism by stimulating insulin binding, hexose transport and lipogenesis (23). *Kutaki* (*Picrorhiza kurroa*) increases the insulin-mediated translocation of glucose transporter type 4 from the cytosol to the plasma membrane which results in better glucose uptake by skeletal muscles and improves glycemic control (24). *Triphala* lowers fasting blood sugar and inhibit lipid peroxide formation and scavenge hydroxyl and superoxide radicals (25).

Madhusudhan vati is proprietary medicine Contents *Nisha Aamalaki* and *Shilajatu*, *Nisha Aamalaki* possess antihyperglycemic, insulinomimetic, α-Amylase inhibitory and α-glucosidase inhibitory, antioxidant properties.(26,27) It improves insulin sensitivity, increases glucose uptake by skeletal muscles and is beneficial in the management of Prameha and prevents its complications microvascular- like diabetic nephropathy, neuropathy, retinopathy, gastropathy and macrovascular like atherosclerosis, *Shilajatu* (Asphaltum Punja-Bianum) reduces uptake of sugar and lipid from the gut(28) act as a Rasayan. Lifestyle modifications like; daily exercise improve the function of *Agni* and reduce *Kapha*, *Meda*, and *Mamsa*, avoidance of *Adhyashana* helps to maintain the normal function of *Agni* and prevent *Ama* formation; avoidance of day time sleep (*Divaswap*) improves functions of *Meda Dhatvagni* and *Medavaha Srotasa (29).*

As mentioned, *Madhusudhan Vati* and *Arogyavardhini Vati* having all these properties helps in *Samprapti bhanga* (breakdown of Pathogenesis), & *Prakruti Sthapana* by *Samya avastha* of *Doshas, Dhatvagni deepan* & reducing the *Abaddhatu* of *Shleshma* & *Meda*. So, it's given better effect on the patients of *Prameha* with significant reduction in the symptoms of *Prameha* like *Prabhutmutrata, Avilmutrata, Naktamutrata, Pipasa, kshudaadhikya, Hastapadtaldaha* and biochemical parameter. The study has shown fairly good changes in blood sugar levels and HbA1C levels throughout the follow up of 120 days but extended follow up is needed to lower down the dose of conventional hypoglycemic agents and to prevent the complication of Diabetes mellitus type 2.

Conclusion

Conclusion in a nutshell is the essence of any study. A scientific discussion on the study gives rise to some fruitful conclusions. As per the observation drawn from this study, we can conclude that, *Arogyavardhini Vati* and *Madhusudan Vati* along with OHA are effective in the treatment of *Prameha* with special reference to type 2 Diabetes mellitus. It is observed in this study that the add on effect of Ayurvedic drug with sedentary life style modification like *Pathyakar Aahar*-rosted barley, old rice, green gram, black gram, bitter vegetables and *Vihar* with other treatment modalities in Ayurveda like *Udavartana, Abhyanga,* daily exercise along with modern medication may give better result in reducing the clinical and biological parameters and to reduce the complication of DM Type 2.

The present study was carried out on the small sample size for limited period and it showed encouraging results in patients of *Prameha* (Type 2 DM). So further study is needed with extended follow up with large sample size for reduction of dose of conventional hypoglycemic agents.

Reference

1. Sushruta, Sushruta Samhita, by Kaviraj Ambikadattashastri, Varanasi, Ayuravedtatava sandipika, Chaukhamba Prakashana, 2013, Sutrasthana, Viparitaviparitaswapanadarshniya, Adhyaya 33 (4), page no.126.
2. Agnivesha, Charaka samhita, Charaka Drudhabala pratisanskruta, by Brahamananda Tripathi, Varanasi, Chaukhamba Surabharati Prakashana 2010,

Sutrasthana, Santarpaniya Adhyaya 23 (5), page no.122
3. Aganivesha, Charaka samhita, Charak Drudhabala pratisanskruta, by Brahamanand Tripathi, Varanasi, Chukhamba Surbharti prakashan, 2010, Chikitasasthan, Pramehachikitsadhya, Adhyay 6 (57), page no. 449
4. Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: Findings from the third National Health and Nutrition Examination Survey. *JAMA*. 2002; 287:356–9. [PubMed] [Google Scholar]
5. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Report of a WHO Consultation; 1999: 20.
6. World Health Organisation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: report of a WHO/IDF consultation. Geneva, Switzerland; 2006.
7. Innovative care for chronic conditions: Building blocks for action. WHO global Report. 2002; 103.
8. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Medicine. 2006; 3(11): 442.
9. World Health Organization. Global status report on non-communicable diseases 2010. Geneva. 2011; 1-176.
10. Agnivesha, Charaka samhita, Charaka Drudhabala pratisanskruta, by Brahamananda Tripathi, Varanasi, Chaukhamba Surabharati Prakashana 2010, Sutrasthana, Santarpaniya Adhyaya 23 (5), page no.122
11. Kannel WB and McGee DL. Diabetes and cardiovascular disease. The Framingham study. The Journal of American Medical Association 241;1979: 2035–8.
12. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Report of a WHO Consultation; 1999: 20.
13. 13. Kannel WB and McGee DL. Diabetes and cardiovascular disease. The Framingham study. The Journal of American Medical Association 241;1979: 2035–8.
14. Aganivesha, Charaka samhita, Charak Drudhabala pratisanskruta, by Brahamanand Tripathi, Varanasi, Chukhamba Surbharti prakashan, 2010, Chikitasasthan, Pramehachikitsadhya, Adhyay 6 (26), page no. 447
15. Sushruta, Sushruta Samhita, by Kaviraj Ambikadattashastri, Varanasi, Ayuravedtatava sandipika, Chaukhamba Prakashana, 2013, Chikitasasthan, Madhumeha chikitsa Adhyaya 13 (3), page no.126.
16. Vagabhata, Ashtanaga Hridyam, by Brahamananda Tripathi, Delhi, Chaukhamba Sanskrita Pratishthan, 2014, Chikitasasthana, Pramehachikitasa, Adhyaya 12 (5), page no. 678
17. To study the effect of Nisha-Amalaki Churna and Shilajeet Vati in Prameha (Pre-Diabetic)CTRI/ 2021/01/030660 https://trialsearch.who.int/Trial2.aspx?TrialID=CTRI/2021/01/030660, 2021 | added to CENTRAL: 31 March 2021 | 2021 Issue 3
18. Alberti KG, Zimmet PZ. New diagnostic criteria and classification of diabetes again. Diabetic Medicne. 1998; 15(7): 535–536.
19. Shri Madhavakara, Madhava Nidanam with Madhukosha Sanskrita commentary, by Sri vijayarakshita and srikanthadatta, Varanasi, Chaukhamba Sanskrita Sansthana, 2005, part 2, Pramehanidanam, Adhyaya 33 (7-12) page no. 10
20. Prativadibhayankaram VS, Malhotra S, Pandhi P, Singh A. Anti-diabetic activity of triphala fruit extracts, individually and in combination, in a rat model of insulin resistance. *Natural Product Communications*. 2008;3:1934578. [Google Scholar]
21. Ambikadatta shastri. Rasaratna Samuchchya. 9th edition. Chapter no-20. Verse no-87. Varanasi: Chaukhamba Sanskrit Publisher;1994. p. 400.
22. Kumar G, Srivastava A, Sharma SK, Gupta YK. Safety evaluation of an Ayurvedic medicine, Arogyavardhini vati on brain, liver and kidney in rats. J Ethnopharmacol. 2012;140:151–60.
23. Fields M, Reiser S, Smith JC., Jr Effect of copper and zinc on insulin binding and glucose transport by isolated rat adipocytes. *Nutrition Rep Int.* 1983;28:163–9. [GoogleScholar]
24. Prentki M, Nolan CJ. Islet β cell failure in type 2 diabetes. J Clin Invest. 2006;116(7):1802-1812.
25. Gonçalves RV, Costa AMA, Grzeskowiak L. Oxidative stress and tissue repair: mechanism, biomarkers, and therapeutics. Oxid Med Cell Longev. 2021; 2021:12-14. doi:10.1155/2021/6204096
26. Yadav RK, Mishra R, Chhipa RP, Audichya KC. Clinical trial of an indgenous compound drug nishaamalki in the management of madhumeha vis-à-vis diabetes mellitus. *Ancient Science of Life*. 2001;21(1):18. [PMC free article] [PubMed] [Google Scholar]
27. Rao G, Bhat S, Rao GS, Bhat GP. *Antidiabetic and antioxidant efficacy of a powdered mixture of curcuma longa and Emblica officinalis In Diabetic Rats In Comparison with glyburide*. http:// www.webmedcentral.com on 25-Feb-2013 [Google Scholar]
28. Lamba N, Chaudhary P, Sharma YK. Clinical evaluation of Shilajatu in Madhumeha. *Int J Ayurvedic Med.* 2015;6:152–59. [Google Scholar]
29. Magkos F, Yannakoulia M, Chan JL, Mantzoros CS. Management of the metabolic syndrome and type 2 diabetes through lifestyle modification. *Annu Rev Nutr*. 2009;29:223–56. [PMC free article] [PubMed] [GoogleScholar]doi:10.1172/ JCI29103
30. Kooti W, Farokhipour M, Asadzadeh Z, Ashtary-Larky D, Asadi-Samani M. The role of medicinal plants in the treatment of diabetes: a systematic review. Electron physician. 2016;8(1):1832-1842. doi:10.19082/1832.

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