Systematic Review of effects of Shodhana & Shmana Chikitsa in Ayurveda in the Management of Diabetes Mellitus Type-II (*Prameha*)

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Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Diabetes mellitus is a complex metabolic clinical condition. It induces some irreversible pathological changes in the body, which rise to multiple complications. Moreover, the side effects of the established anti-hyperglycemic agents in contemporary science on their long-term use make it more worst. Considering the higher incidence rate of Diabetes mellitus due to faulty lifestyle, it is essential to think over various safe but effective measures in alternative science, i.e., Ayurveda. In Ayurveda, diabetes mellitus can be correlated with *Prameha* or *Madhumeha* due to similarity in signs & clinical features.

Aim & Objective: The prime aim of this study is to study the efficacy and safety of different Shodhana & Shamana Chikitsa in Ayurveda for glucose control & improvement in clinical features during the management of Diabetes Mellitus Type II (*Prameha* W.S.R.).

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1. INTRODUCTION

Diabetes mellitus Type II is a metabolic disorder that causes high glucose levels in the blood. In non-insulin-dependent conditions characterized by peripheral insulin resistance at the cellular level. Diabetes Mellitus currently affects more than 62 million Indians, which is more than 7.2% of the adult population [1]. The average age onset is 42.5 years in India [2]. The prevalence of Diabetes has been rising more rapidly in low and middle-income countries than in high-income countries [1-4]. It is the leading cause of 2.6% of global blindness & kidney failure [4]. Many textual references & clinical shreds of evidence show more chances of recurrent complications due to uncontrolled sugar. Adults with Diabetes have a two- to three-fold increased risk of heart attacks and strokes.

Its current management includes dietary restrictions, physical activity, oral antidiabetic agents, and insulin regimen, but it offers no permanent relief. Most hypoglycemic agents have adverse effects like Gastrointestinal upset, dizziness, etc. Lactic acidosis induced by them have adverse effects like permanent relief. Most hypoglycemic agents, and insulin regimen, but it offers no restrictions, physical activity, oral antidiabetic agents, or their combinations due to uncontrolled sugar. Adults with Diabetes have a two- to three-fold increased risk of heart attacks and strokes.

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In Ayurveda, Madhumeha (type of Prameha) can be correlated with Diabetes II. It is a urinary disorder with an increased frequency of turbid urination. It is Bahudoshavasthajanya, Avaranajanya, or Tridoshaja Vyadhi, which is primarily hereditary or caused due to insalubrious activities [6]. In Ayurveda, Panchakarma is the essence of Ayurveda, and it includes five procedures viz. Vaman, Virechan, Basti, Nasya & Raktamokshana have immense potential to treat lifestyle disorders like diabetes mellitus because these procedures help remove toxins from the body at the cellular level. Therefore, it has become effective in curing many metabolic diseases. Previous clinical studies conducted with various Shodhana procedures or palliative treatments in the form of different herbal or herbo-mineral drugs with lifestyle regulations over diabetic patients showed encouraging results.

1.1 Aim and Objectives

Considering the above scenario, this systemic review study is planned to review various research articles based on the management of Prameha with various drugs(herbal or herbo-mineral) or Shodhana Karma (Vaman, Virechan, Basti, Nasya. etc.) & to make specific treatment protocol for it. The prime objective of this study is to assess the efficacy and safety of Shodhana & Shamana Chikitsa or their combinations for glucose control in patients with Prameha.

2. MATERIALS AND METHODS

2.1 Study Selection

Data regarding all previous Ayurvedic clinical studies conducted in patients with Prameha is collected from NCBI from 2004 to 2019. References of key articles in only the English language were hand searched. Review studies, Case studies, Animal studies, or Clinical studies in Ayurveda on Diabetic complications were excluded from this study.

3. OBSERVATIONS AND RESULTS

Details of the trials included in the study were discussed descriptively as follows:

**Materials & Methods**: This is a meta-analysis of Ayurvedic interventions in Shodhana, or Shamana Chikitsa used to manage Prameha (Diabetes mellitus type II). On extensive Review of the literature, 42 clinical studies (R.C.T. & N.R.C.T.) fulfilling inclusion criteria & conducted with 1743 participants at different places were critically analyzed. Adequate details of the individual studies were tabulated and discussed.

**Observations & Results**: It is reflected that the combinations of both these interventions are more effective than only Shamana Chikitsa in the management of Diabetes mellitus.

**Conclusion**: All of these interventions in Ayurveda reviewed through this study are appeared to be generally safe and effective, having a prime or adjuvant role. However, Ayurvedic physicians should prescribe them based on their clinical judgment, patient’s references, type of pathology, chronicity of the disease & strength of the patient.

**Keywords**: Ayurveda; prameha; diabetes mellitus, meta-analysis.; shodhana; shamana; chikitsa, safe, effective.
3.1 Neethu. K. J, et al. [7]

In this study, ten diabetic patients underwent Virechana with Trivrut Lehya, preceded by Udwartana with Triphala+Kolakulathadi Choorna, followed by Takra Dhara with Musta, Amlaki, Asnadi, and Takra for 14 days, followed by Shodhana Snehapana with Moorchita Til Taila and Sarvanga Abyanga with Moorchita Taila. After Sansarjana Karma, the patient was assessed for clinical features of Prameha, which showed significant results, which concluded that Rookshana Poorvaka Virechana Karma is highly beneficial in the management of Sthula Madhumeha [7].

3.2 Manjunath Akki et al. [8]

In this study, the study population (n=30) was equally divided into two groups, in which group A underwent Vanama with Madanphaladi Yoga & group B for Virechana with Kalyanaka Guda. Deepana Pachana preceded the main intervention in each Group with Trikatu Churna, Shodhana Arohi Snehapana with Dhanwantaram Ghrita, Abhangya with Murchita Tila Taila & Sweda with Sukoshna Jala Snana. During Samsarjana, the patient received placebo capsules and was advised to follow the diet plan. Group A shows highly significant results in all the parameters compared to Group B, except in parameters P.P.B.S., U.S.postprandial, and Pipasadhiyika [8].

3.3 Anchal Lalhal et al. [9]

In this study, the study population (n=20 patients) was equally divided into two. Among them, a group I underwent for Virechana preceded by Shodhana Snehapana with Triphala Ghrita and followed by Tryushnadi Gutika 1 gm T.D.S. with lukewarm water for 45 days. Group II was prescribed only for Shaman Yoga, i.e., Tryushnadi Gutika (Chikitsa). The clinical features Prabhuta Mutrata, Pipasadhiyika, Kshudhaadhiyke, Shaitihlya, Karapada Suptata, Pindiko Udveshtana, Mukha Shosha were statistically significantly reduced (p<0.05). Moreover, reduction in fasting blood sugar was significantly reduced by 29.88%. In objective parameters, a 29.88% reduction in fasting blood sugar was observed in Group I. In contrast, in patients of group II, a 1.88% reduction was observed, but the intergroup difference was insignificant statistically (p>0.05); Group I was found more effective than Group I [9].

3.4 Karda Rinku et al. [10]

In this study, the Group A (n=30) with Bhudhatrayadiyog(20ml Bhumyalakal Swaras with Churna of 20 Maricha in two divided doses at morning & evening) with lukewarm water orally) was compared with Group B (n=30) with standard control with modern Drug Metformin 500mg O.D. Patients were assessed with subjective and objective parameters before & after the treatment and percentage relief obtained, and statistical evaluation. It showed statistically significant results especially in PrabhutMutrata (25%), Atipipasa (36.84%), Bahuashee (33.96%), Alasya (30.19%), Karpada Daha (35.71%), Karpada Supti (42.22%) in Group A while & Group B is more effective in Prabut Mutrata (71.43%), Atipipasa (61.67%), Bahu Ashhee (61.40%), Alasya (62.5%), Karpada Daha (65.38%), Karpadsupti (61.54%) for p<0.0001 Bhudhatrayadiyog and Metformin are almost equally effective to reduce Ati Pipasa, Karpadal Daha & Karpadal Supti in Madhumeha. It shows that Group B (i.e., Metformin) has shown an overall good effect than Group B (i.e., Bhudhatrayadi Yog) to reduce the score of symptoms [10].

3.5 Kumar Sanju, et al. 2018

Total 45 Patients recruited in this clinical trial were equally divided into three groups in which Group A with 'Nisha Triphala Yoga'(Two Capsule of 500 mg B.D. in empty stomach for 30 days), Group B with ‘Panchatikta Panchaprasttika Niruha Vasti (350 - 400 ml/day) for 30 days & Group C with above both interventions. Group. C was found more effective to reduce clinical features and also statistically effective to reduce F.B.S., P.P.B.S., Blood urea, Sr. Creatinine, S.G.O.T., and S.G.P.T. 21.48%, 14.34%), 4.23%, 5.07%, 5.07% & 3.40% respectively than both Group A & B [11].

3.6 Pathak Mridula et al. 2018

30 Diabetic patients underwent Shodhana Chikitsa with Madhutailika Niruha Vasti 530ml for eight days, and assessment was done after eight days. The researchers concluded that Madhutailika Vasti found to be effective in clinical & statistical improvement and reducing F.B.S. & P.P.B.S. by 8.49% & 9.98%, & HbA1c by 2.25%, respectively [12].
3.7 Vardhan Vishnu et al. [18]

In the present clinical study, 27 patients out of 30 patients completed the study with the intervention with Niruha Vasti with Somavalkaja Kashayam & Anuvasana Vasti with Somavalkaja Tailam in Kala Vasti regime. Reduction in Subjective parameters e.g., Prabhutamutrata (47.80%), Avilamutrata (42.31%), Kshudhadhikya (26.45%), Pipasadhiyka (41.13%), Pindikodwestana (53.56%), Karapada Daha (46.63%), Karapada Suptata (41.63%), Atisweda (%) Daurbalya (44.81%) was observed and Objective parameters i.e. FBS & PPBS was decreased by 89.07% & 83.80% respectively [13].

3.8 Dimble Mangesh et al. [14]

Thirty patients underwent the Panchatikta-Niruha Vasti (medicated enema) 430 ml for four consecutive days. On the fifth day, Sarshapa-Taila(Mustard-oil) 60ml Anuvasana Vasti for 3 cycles preceded by Pachana with Hingvashak-Churna (1gm with lukewarm water, just before 2 meals/day for 5 days) and local Snehana with Tila Taila and Sarvang Bashpa Svedana (sudation). Subjective parameters e.g., Prabhutamutrata, Avilamutrata, were reduced by 14.20% and 14.28%, whereas F.B.S. and P.P.B.S. reduced by 55.13% and 60.54%, respectively [14].

3.9 Varsha Khot et al. [15]

Forthy patients were divided equally into two groups and advised to undergo, i.e., Group A with Shirodhara with Tila Taila daily once at 8 am and Group B with oral administration of Jatamansi Churna 1 gm with Kosha Jala for consecutive 21 days. Group B was found more effective than group A especially to reduce F.B.S. & P.P.B.S. by 91.06% and 75.78%, respectively [15].

3.10 Vikas Nariyal et al. [16]

A total of 30 diabetic patients were equally divided into three groups in this clinical study. Group A, group B, and Group C have prescribed Harishankar Ras (125 mg twice a day with lukewarm water), Khadir-Kramuk Kwath (40 ml B.I.D. in empty stomach), and a combination of both medicines, respectively. Group C was found significantly more effective in reducing the severity of clinical features, e.g., than group A & B Prabhutamutrata (71.42%), Pipasadhiyka (66.66%), Avilamutrata (60%), Karapad Suptata (84.21%), Sharir Gauravtva (53.84%), Tandra (63.15%), Sada (72%), Karapada Daha (80%), Pandurvama Mutrata (54.54%). Moreover, it is also more effective to improve various hematological and biochemical parameters such as E.S.R. (50%), F.B.S. (77.69%), P.P.B.S. (70.41%), Blood urea (96.06%), Sr. Creatinine (90.10%), S.G.O.T. (91.22%), S.G.P.T. (90.74%), Urine Sugar (27.27%), Urine Protein (66.66%) than rest if two groups. The Group effectively reduces blood sugar(both fasting & post-prandial) than group B [16].

3.11 Sija M/ et.al. [17]

In this study, Group A (n= 15) received Vidanga Rajanyadi Kashaya (50ml B.I.D. daily half an hour before food) whereas Grp. B (n=15) received Nishamalaki Churna (6gm twice daily half an hour before food with Ushna Jala) for 30 days. Both formulations were found more effective in Prameha. However, Vidanga Rajanyadi Kashaya was more effective than Nishamalaki Churna to reduce biochemical parameters such as F.U.S., F.B.S., P.P.B.S. by 86.7%, 36.4%, 38.7%, respectively & subjective parameters such as Polyuria, Polydypsia [17].

3.12 Tank B. et al. [18]

The Clinical trial was carried out with ten patients in each three groups, i.e., Group A with Darvyadi Kwath (50ml twice a day with empty stomach), Group B with Madhumehari Churna (5gm twice a day before half-hour for a meal with lukewarm water) & Group C with both drugs for 30 days. Though all three groups are found effective in reducing blood glucose levels, Grp. C is comparatively more effective in reducing FBS, PPBS & HbA1c by 21.71%, 25% & 5.49%, respectively [18].

3.13 Hakkandil Suresh et al. [19]

Thirty patients were equally divided into three groups. They underwent as Group-A with Somavalka Kashaya Niruha Yoga Vasti, Group-B with Niruha Yoga Vasti with Somavalka Kashaya with Aavapa Dravya & Group-C with Somavalka Kashaya Niruha Yoga Vasti in Trio-vasti pattern. In symptoms, Prabhutamutrata showed highly significant in all three groups (as p<0.001) after the treatment. In comparison, symptoms like Avilamutrata, Atisweda, Daurbalya & Gurugratata showed an insignificant response
(p>0.05) after the treatment in all three groups. Symptoms like Karapada Daha /Supta & Pipasadhikya showed a significant response (as p<0.01) after the treatment in all three groups. Group C was found more effective than the rest of the two groups to reduce F.B.S., F.U.S., P.P.U.S. & HbA1C by 25%, 73%, 83% & 5%, respectively, while Group B was more effective than group A & C to decrease P.P.B.S. by 23 [19].

3.14 Gupta V. et al. [20]

In this study, 90 recruited patients were randomly divided into two groups and Group A with cap. Shilajit (500 mg twice daily) and Group B with Asanadi Ghana Vati (2 Vati twice daily) were studied for three months. Ten patients were dropped from the study.

Group A is statistically more significant than group B, i.e., 79.62%, 74.48%, 80.76%,79.23%, 75.79%,86.84%, 92.85% of the patients had symptomatic relief in case of polyuria, polyphagia, polydipsia, generalized weakness, burning sensation and numbness, and loss of libido respectively. At the same time, group B effectively reduces joint pain & cramps by 87.50% & 94.33%, respectively. Both groups are statistically highly significant (P < 0.001) to reduce F.B.S. and P.P.B.S. However, group A is more effective for P.P.B.S. (20.23%) and group B for F.B.S. (26.03%) [20].

3.15 K. V. Narasimha et al. [21]

One hundred ten clinically diagnosed Madhumeha patients were divided randomly into two groups, i.e., Group A (among 54 recruited, 44 patients completed the trial) was subjected for Vamana with Madanphaladi Yoga & Virechana with Trivrit, Haritaki, Aragwadha, Sanaya + Placebo & Group B (among 56 registered, 18 patients were dropped out) underwent for Vamana & Virechana with same drugs F/B Shilajit Yoga 1 cap.(1000mg) twice daily before food with Anupana Salasarasadi Gana Kashaya. Grp. B was found more effective as compared to Grp.A to reduce FBS & PPBS by 33.05% & 28.60 respectively[21].

3.16 Deshpande SV et al. [22]

It is a retrospective study of 15 patients who are newly diagnosed or known cases of Diabetes or Diabetes having for less than a year who were subjected to Vamana with Madanphaladi Yoga preceded by Dipana-Pachana with Hingvastak Choorna (3 grams before food for three days) F/B Shodhana Snehapana with Cow ghee, Bahya Snehana with Tila Taila and Swedana. After Samsarjana Karma, patients were assessed. Significant relief was observed in: Subjective parameters Daurbalya, Kshudha vriddhi, Pipasavridddhi, Avilamutrata, Naktamutrata, Pindikodweshtana, Swedatipravritti, Hasta Padatala Daha, Shwasasakshata, Pipilika Sancharavat Prachiti, and Ksheena Kamechcha. Moreover, highly significant decrease in FBS & PPBS by 86.74% & 81.88%, respectively was observed after Vamana (p<0.005). The researchers concluded that patients receiving such bio-purification as Vamana treatment, as the first line of treatment, may respond better to further Shamana treatment, leading to better relief from symptoms and sugar and lipid control [22].

3.17 Jena Sonalika et al. [23]

This clinical study was carried out with 50 patients equally divided into three groups with different interventions for one month, i.e., Group I with Phalatrikadi Kwatha 50gm+ 1gm of Haridra Churna+ 10 ml honey twice daily before a meal (Trial Drug), Group II with Metformin 500mg1 tab O.D. (control drug) and Group III with placebo 50ml +1gm of Haridra Churna + 10 ml of Honey twice daily before a meal. Though all three groups effectively correct signs and symptoms of diabetes mellitus, a group I was found more effective to reduce Daurbalya, Pipasadhikya, Pindikoveshtam, P.P.B.S. by 74.58%, 94.34%,84.78% & 16.66%, respectively. Group II was more effective than the rest of the two groups to decrease F.B.S. by 20.36% & group III significantly reduced Prabhutamutrata by 54.48% for p-value 0.001 [23].

3.18 Agarwal Prateek et al. [24]

Among 46 patients recruited in this study are equally divided into two groups with different interventions for one & a half months, i.e., Grp. A underwent Virechana Karma with Trivritadi Leham (50gm) in a classical manner followed by Oral Hypoglycemic Agent & Grp. B subjected to Classical Virechana Karma with Trivritadi Leham (50gm) followed by oral administration of Ayanskriti (20 ml B.I.D. after meal). Among them, 06 patients dropped out in this study. In both groups, A & B, Polyphagia, Polyuria, Polydipsia, Burning sensation, and Weakness were highly significantly reduced after the completion of...
treatment. Moreover, both interventions were effective in relieving blood glucose levels by FBS, PPBS, Sr. triglycerides & Sr. cholesterol 46.23%, 43.26%,56.01% &54.14% respectively. HbA1c shows a significant difference of 1.75 ± 1.08 in both groups [24].

3.19 Kumar S. et al. [25]
Total 84 Patients were randomly divided into three groups, i.e., Group A (n=33) was treated with the trial Drug, i.e., Mamajjaka (500mg twice a day), Group B (n=23) was subjected to Shilajatu (500mg twice a day) and Group C (n=28) with the modern antidiabetic Drug. After assessment for three months, it was observed that the trial treatment could produce a statistically significant favorable shift in grade scores (p<0.01) in most of the symptoms (polyuria, polyphagia, polydipsia, weight loss, weakness, loss of libido, joint). The Mamajjaka treated patients have shown a better percentage of fall in F.B.S. (19.47%), in comparison to Shilajatu treated patients (8.93%), while in the case of P.P.B.S., the percentage of reduction was almost equal in both the groups, that is, 24.03% [25].

3.20 Kolhe N. S et al. [26]
Total 30 patients completed the study in which those were randomly and equally divided into three groups, i.e., Grp.1 with Katak Khadiradi Kashyayam (20 ml twice daily before meal), Grp.2 with Niruyadi Gullika (500 mg 2 tablets with lukewarm water twice daily before meal) & Grp.3 with combinations of both drugs. After the interventions for 30 days, it was observed that Group 1 was found comparatively more effective to reduce HbA1C by 3.27% than the other two groups, while Group 2 was significantly effective in decrease the severity of clinical symptoms, e.g., Prabhatamutrata, Kshudhadhikya, Kara Pada Suptata, Atisweda, Krama & E.S.R. by 50%,27.3%,42.7%,42.9%,46.2%, 40% respectively. On the other hand, Group 3 was found comparatively more effective to improve subjective parameters, e.g., Avilamutrata, Pipasadhikya, Karapada Daha, Alasya by 44.4%,41.7%,28.6% &53.3% respectively and to decrease F.B.S., P.P.B.S., F.U.S., P.P.U.S. by 18.51%,18.65%,66.7%, 88.9% respectively. Both Group 1 & group 2 are effective in reducing Avilamutrata, Pipasadhikya [26].

3.21 Jindal N. et al. [27]
In this study, 20 diabetic patients were randomly but equally subdivided into two groups, i.e., group A with Vamana using Ikshwaku Beeja Choorna mixed with Honey in a dose of 4-8 gm as per the requirement of the patient) and group B with Virechana using Snuhbibhavita Katuki in a dose of 6-10 g as per the Kostha). Deepana Pachana preceded both these interventions with Trikatu Churna(3-6 g/day in two divided doses for 3-5 days), which was followed by Aabhyantara Snehapana with Triphaladi Ghrita in increasing dose as per the Kosttha and Agni of the subject for 3-7 days, Sarvanga Abhyanga with Tila Taila and whole body Swedana for two & 3 days for group A & B respectively. After Shodhana followed by 3-7 days of Samsarjan Karma, all patients were assessed for biochemical parameters of Diabetes mellitus. The FBS & PPBS was reduced by 42.3% & 47% respectively after Vamana. While the FBS & PPBS was decreased by 51.5% & 34.8% respectively after Virechana. It can be summarized that Vamana and Virechana cause a marked reduction in F.B.S. and P.P.B.S. levels [27].

3.22 Dass R. K. et al. [28]
Total 22 Obese patients(both pre-diabetes & Diabetes) were subjected to Vamana procedure preceded by Abhyantara Snehapana with Shudha Ghrita, Sarvanga Abhyanga with Bala Taila & Sarvanga Baspa Sweda. For Vamana, all patients were advised to take Ghrita- Yukta Yavagupana (Ghee Mixed with Boiled Rice) = 200 - 400 gms approximately according to Kostha +Yastimadhu Kwath (Decoction of Glycyrrhiza glabra) in the approximate quantity of 3 – 5 liters+ Madanphala Pippali in Quantity present in Fist according to patient's hand added with sufficient amount of Honey (50 - 100ml approximately)+ Saindhav Lavana (Rock Salt)in 20–30gms approximately and then all are assessed after Samsarjan Karma was according to the Shuddhi after Vamana Karma. It was observed that Vamana Karma provided a statistically significant reduction (P<0.05) in S. Triglycerides by 21.66%, but there were insignificant reductions in Fasting blood sugar & S. Cholesterol level by 4.31% & 4.99%, respectively (P>0.05). The researchers concluded that emesis therapy has a better role in the prevention of NIDDM in pre-diabetic subjects and also capable of maintaining
long-lasting glycemic control in NIDDM subjects [28].

3.23 Karhade Mukund [29]

A total of 30 patients were subdivided into two groups with two distinct interventions, i.e., Group A with Vaman Karma by Ikshubabeesa Majaa Yoga & Group B with Virechan Karma induced by Abhayadi Modak. Deepana Pachana precedes both types of interventions with Trikata Churna, Snehapana with Nimba Taila, Abhangya with Moorchita Tila Taila, and Sweda with Sukoshna Jala Snana. Samsarjana Karma followed both Shodhana therapies, and during the follow-up period, the patient received placebo capsules for one month.

This study shows that Group B is more highly significant & effective than group A in the case of Pipasadhikya (p<0.05), Karapada Daha & Supta (p<0.001), while no statistically significant difference seen in-between group A & Group B in the case of Prahuha Mutrata, Avila Murata & objective parameters. The case of objective parameters, in F.B.S., the mean of Group A is 35.87 & group B is 35.21, while the mean of P.P.B.S. of Group A is 75.67 & group B is 88.60. The mean value of F.U.S. & P.P.U.S. of Group A is 0.233 & 0.60 resp. that of group B is 0.17 & 0.83 respectively [29].

3.24 Tanna Ila et al. [30]

Total 16 patients were subjected to four different interventions, i.e., Virechana Group 1 with Virechana with 40 ml of decoction of Aragavadha Majaa-15 gm+Haritaki Churna 15 gm+ Katuki Churna 5 gm mixed with 20 ml of castor oil along with 250 mg of Ichchabhedhi Rasa, Oral group1 with Shamana Yoga, i.e., Madhumehahara Yoga, Vasti group2 with Pramehahfna Vasti (Decoction of Vijayasara, Jambu Beeja, Arjuna, Vitkhandira +Kalka of Amalaki, Methibeeja, Tojapatra + Tila Taila+ honey+ rock salt) & Oral group2 with Pramehah Ghana Vati.

After two months, all groups are found effective in relieving Subjective& objective parameters, but mark improvement in the oral Group and Basti group are observed 73.3% and 75%, respectively. Virechana group1 was found comparatively more effective than other groups to reduce Avila Mutrata, Mutra Madhurya, Pipasa & Bahu Ashanata by 87.50%, 80.12%,75% & 80% respectively, and Vasti group2 was observed comparatively more effective than other groups to decrease Prabhutamutratra by 60% [30].

3.25 Singh K. S. et al. [31]

Total 72 patients were divided into two groups, i.e., Grp. A (n=36) with Saptarangyadi Ghanavati 5 tabs(each200 mg) T.D.S. after food with Luke warm water and Grp. B (n=36)-Saptarangyadi Ghanavati (same dose) in addition to the antidiabetic (Allopathic) medication. Five patients were dropped out of the study. After two months, Group A was found comparatively more effective to improve clinical symptoms, i.e., Prabhutamutratra, Alasya, Avilamutratra, Kshudhadhikya, Pindikodweshtana by 69%, 59%, 82.3%,56%, 67%, respectively, and to reduce biochemical parameters such as F.B.S., P.P.B.S. by 12%,24% respectively. On the other hand, Group B was more effective in improving subjective parameters, e.g., Pipasadhikya, Shrama, Atisweda, by 64.3%,58%, 32.2%, respectively[31].

3.26 Pandey RK et al. [32]

This clinical study is conducted over 38 Sthula Pramehni patients in which they were divided into two groups, viz. Group A (18 patients) with Vamana with Shamana(Neem Giloy Satva capsule500 mg twice daily after meals) and Group B(20 patients) with Virechana with Shamana as group A. After 30 days. Grp B was observed comparatively more effective than Grp A in reducing subjective parameters e.g. Prabhutamutratra, Avilamutratra, Naktamutratra, Pipasadikya, Swedahdikya, Daurbalya, Kahudhadhikya, Atinidra, Sramaswas, Mukhamadhurya, Vibandha, Atinidra, Hastapada Daha, Karapada Suptata, Pipilika Sanchari by 81.51%, 63.46%, 77.59%, 71.74%, 67.75%,36.23%, 56.52%,29.03%, 33.85%, 77.91%, 55.41%, 29.03%, 81.25%, 69.64% & 66.2% respectively. The researchers quoted that Vamana very well manages Kapha dominant symptoms such as Prabhutamutratra, and Avilamsutrata. On the other hand, Pitta dominant symptoms Kara Pada Tala Daha and Virechana can easily correct Atisweda. Vamana Virechana significantly controls symptoms like Kara-pada Suptata, Kshudhadhikya, Trishnaadhipkya, Gala Talu Shosha, and Pindikodweshtana. Though both the procedures relieve the symptoms, it is Vamana that provides more relief than Virechana. Vamana reduces the levels of F.B.S., P.P.B.S. by 9.86% & 29.525% compared to Virechana [32].
3.27 Tanna I. et al. [33]

Total 94 patients were divided equally into two groups, i.e., Grp. A with *Mehumadgara Vati* (250 mg 3 tabs. T.D.S. after food with lukewarm water) & Grp. B with the modern antidiabetic Drug. After three months, Group A was found more effective to reduce *Prabhumrutra, Kshudhadhikya, Pipasadhi& P.P.B.S.* by 81.48%, 83.33%, 78.79% & 17% respectively, while Group B was observed more effective to reduce *Pindikodwestan, Karapada Dada, Karapada Suptata, Atisweda, Daurbalya and F.B.S.* by 84.37%, 78.95%, 84.93%, 67.39%, 80.55% & 15% respectively [33].

3.28 Thirunavukkarasu M S et al. [34]

It is a single group study of over 20 patients treated with *Kathaka Khadiradi Kashaya* (50ml before food twice daily for 28 days). Due to this intervention, clinical symptoms e.g. *Prabhoota Mootrata, Avila Mootrata, Pipasa, Kara Pada Tala Daha, Kara Pada Tala Supta Mootramadhurya, Atisweda, Daurbalya and F.B.S.* were significantly decreased by 38.46%, 80.95%, 43.2%, 60.71%, 50%, 69.23%, 51.3%, 55.26% respectively for *p*<0.001. This study also shows effective results in reducing blood glucose levels FBS & PPBS by 32.55% & 14.71% respectively with Significance= *p*<0.001. The researchers concluded that the Kathaka Khadiradi Kashaya is an ideal remedy in patients suffering from Mild to Moderate Madhumeha [34].

3.29 Parmar Darshan et al. [35]

Total 92 diabetic patients were studied within two groups with intervention with mineral compound orally that is prepared with two distinct methods, i.e., Group A (n=27) with *Vanga Bhasma* by *Arddhagaja Puta, B* (n=25) with *Vanga Bhasma* by *Gaja Puta, & C* (n=23) with *Sahapana* (control group). 250 mg from each sample of Bhasma and 250 mg Sahapana was given in capsule form to open it on palm & mixer made by adding previously given Honey. This mixture was given to licking twice before 45 min of meals study reveals the better effect of Group A than Group B [35].

3.30 Khedekar S et al. [36]

In this clinical study, a total of 126 patients were treated with *Makaradhwaja* prepared from three different types of *Swarna* with *Sahapana*, i.e., Grp A (n=42), *Makaradhwaja* prepared by *Swarnavarkha* (M.K.V.), Grp B (n=42)- *Makaradhwaja* prepared by *Swarna Bhasma* (M.K.B.) & Grp C (n=42)- *Makaradhwaja* prepared by *Swarnapatra* (M.K.P.). After 60 days, Significant relief in all signs – symptoms & blood glucose level (fasting and 2 hr) was found in both Drug treated groups. *Makaradhwaja* prepared by *Swarna Varkha* and *Swarna Bhasma* was found more effective than that prepared by *Swarna Patra*, while *Makaradhwaja* prepared by *Swarna Varkha* is slightly more effective than the prepared by *Swarna Bhasma* [36].

3.31 Pandharkar Gaurangi et al. [37]

In this study, 05 diabetic patients underwent *Virechana* with *Aravigadha Kapila Vati* or *Abhayadi Modaka*, preceded by *Arohi Snehpana with Mahatiktaka Ghrita* for three days. *Virechana* was repeated every 15 days for three months. After the first cycle of *Shodhana, Shaman Chikitsa*, i.e. *Vasant Kusumakara Rasa* (125mg & *Dhatrinisha Choorna* (500+250mg) were given. Simultaneously, specific diet regimens and exercises like *Suryanamaskara* were also advised to all Study subjects. During this period, Blood Sugar Levels were monitored, and accordingly dosage of OHA was adjusted. *Shodhanottara Shaman Chikitsa* was found to be effective in lowering Blood Sugar Levels as well as HBA1C levels, as well as it reduces the OHA dependency of type II diabetic patients. Significant improvement was observed in specific symptoms such as *Prabhumrutra* (83.33%), Frequency of urine (75%), *Pipasadhi* (81.82%), *Bahavashi-Kshudha-Adhika* (76.92%), *Daurbalya* (69.23%), *Karpadataladaha* (91.67%) after three months of treatment. The relief % of FBS, PPBS & HbA1c were 52.30%, 42.85% & 70.99% respectively [37].

3.32 Tate P. [38]

Total 56 patients equally divided into two groups, i.e., Group A with *Naga Bhasma* orally (60 mg B.D.) & Group B with *Naga Bhasma* with placebo capsules (1 cap.). After 28 days, significant relief in all signs and symptoms were observed, along with a significant decrease in blood glucose level (fasting and 2 hr) was found in both Drug treated groups. & *Naga Bhasma* prepared by both methods is equally effective [38].
3.33 Thirunavukkarasu MS, et al. [39] Jyothi Kumari [24]

In this trial, the 42 patients were equally divided into two groups and underwent, i.e., group 1 with Nyagrodhadi Ghanavati alone and group 2, Virechana 200 ml of Kwatha prepared with coarse powders of each Triphala (100 gms)+ Katuki (5 gms)+Trivrit (5 gms) along with Eranda Taila (50 ml) and Ichchabedi Rasa 250 mg preceded by Goghrita Snehapana & followed by Nyagrodhadi Ghanavati. The Virechana and Nyagrodhadi Ghanavati group (Combined Therapy) provided statistically highly significant (P<0.001) relief in all subjective parameters of Prameha. Post-Prandial Blood Sugar was reduced by 6.43% at statistically insignificant (P<0.10). The researchers concluded that results obtained in the Combined Therapy group are better than the Shamana therapy [39].

3.34 Dave Dyauti et al. [40]

Thirty-five patients were divided into two groups, i.e., Group A with Medoghna Rasayana Vati (1gm B.D. with lukewarm water) and Group B with Medoghna Rasayana Vati with modern antidiabetic medicine same schedule as in Group A. Both groups have provided better relief in signs and symptoms of the Madhumeha [40].

3.35 Shilpa G. et al. [41]

In this clinical trial, 30 patients were equally divided into two groups & underwent i.e. Group A with both Bahya and Abhyantara Rupertana (till attainment of Samyak Rookshana Lakshana) followed by Virechana & Group B with both Bahya and Abhyantara Snehana (till attainment of Samyak Snehana Lakshana) followed by Virechana. After 3 month, Group A was found comparatively more effective than group B to reduce FBS, GTT, BMI & Total Cholesterol by18.73%,18.76% ,12.43% & 19.45% respectively [41].

3.36 Thirunavukkarasu MS et al. [42]

This clinical study has been carried with Group A(n=21) subjected to Nishakatakadi Churna alone. Group B(n=16) was advised to undergo Virechana with Decoction made up of coarse powder of Triphala(100gms)+ Katuki Churna (20-25gms) added with Eranda Taila (5-40ml) & Ichchabedi Rasa 1-2 tabs (125-250mg) preceded by Snehapana with Shuddha Goghrita. Nishakatakadi Churna followed ita for 30 days. Carbohydrate and fat-restricted diets were advised for both groups.

Statistically highly significant results were observed in Prabhatamutrata (13.69%), Pipasa Adhika (13.69%), and Kshudha Adhika (20.53%) for P<0.05. Virechana provided statistically significant reduction in FBS& PPBS by 10.63% & 23.64% respectively for value P<0.01. The researchers interpreted that the Virechana combined with Nishakatakadi yoga effectively controls Madhumeha [42].

3.37 Aithal P et al. [43]

In this clinical trial, a total of 24 patients underwent for Group A (n=12) with Abhaya and Abhyantara Rupshana (till attainment of Samyak Rookshana Lakshana) followed by Vamana procedure whereas in Group B (n=12) with Bahya and Abhyantara Snehana (till attainment Samyak Snehana Lakshana) followed by Vamana procedure. After 3 months, Rukshana Purvaka Vaman (FBS- 12.96%, PPBS-12.13%, urine sugar- 34%, BMI- 4.44% & weight in kgs-4.40%) is more effective than Snehana Purvaka Vaman (FBS - 5.09%, PPBS- 3.38%, urine sugar- 15.82%, BMI- 1.27% & weight in kgs-1.69%). this study reveals that Rukshana Karma alone is effective than Snehana Purva Karma, followed by Vamana [43].

3.38 Pakanikar Satish et al. [44]

In this clinical study, 26 patients were subjected to Group I (n=09) with kernel powder of the Kuberaeksha seeds in the capsule form & Group II (n=17) with Kuberaeksha Ghanavati of the kernel with Lukewarm water each for six weeks. Both Kuberaeksha Ghanavati and the kernel powder of the seed had induced a reduction in blood sugar at a low dose. Still, in the Ghanavati group, the blood sugar level was increased but statistically significantly decreased in the kernel powder of the seed at a high dose [44].

3.39 Patel Asha et al. [45]

Total 28 patients were equally divided into two groups, i.e., Group A subjected to a combination of Virechana with Abhayadi Modaka (preceded by Deepana Pachana with Trikata Churma+ Abhyantara Snehana with Triphala Ghrita) but followed by Vidangadi Ghanavati with Ushnodak & Group B received only Vidangadi Ghanavati. The total duration of the study was 12 weeks.
**3.40 Harish Ahuja et al. [46]**

Total 42 diabetic patients of Madhumeha were treated with Medoghna Rasayana Vati for 30 days in the first Group (n=27). In the second Group (n=15), the patients were given Virechana(preceded by Snehapana with Goghrita) with 220 ml of decoction of coarse powder of Triphala (50gm)+ Kutaki (5gm) followed by Medoghna Rasayana Vati for 30 days.

After evaluating the total effect of therapies, it was observed that Group 2 was found highly significant (P<0.001) to reduce F.B.S. & P.P.B.S. by 12.83% &15.08% respectively & to improve chief complaints than the first Group. The researchers stated that the Virechana and Medoghna Rasayana Vati provided better relief in the patients of Madhumeha in comparison to Medoghna Rasayana Vati alone [46].

**3.41 Anand M. et al. [47]**

Twenty-nine patients were divided into three groups, i.e., Group-I with Pramehghna Ghana Vati orally (2 gm a day thrice with lukewarm water for 1 ½ month), Group-II with Pramehghna Basti for 16 days including Niruha and Anuvasana, and Group-III with Placebo capsule -500mg thrice a day. The study duration was two months. Strict diet control and exercise were advised to all groups. The researchers concluded that both Basti and Pramehghna Ghana Vati offered more encouraging results. Still, percentage relief was more in Basti group than rest of two groups & Basti can prove better treatment modality for Avariyanranya Madhumeha because the drugs used in it acts against the Kapha, Meda, and Kleda and Sneha helpful to normalize Vata [47].
4.3 Assessment Parameters

All these studies were critically analyzed based on the type of Subjective or objective criteria used, type of intervention subjected & their therapeutic outcomes reported. Assessment in meta-analysis will be done by comparison of various research findings and their interpretations only. Overview of all clinical studies, it is reflected that objective criteria in the form of hematological parameters such as C.B.C., E.S.R., Biochemical parameters such as Blood sugar both fasting & post-prandial (F.B.S. & P.P.B.S.), HbA1c, GTT Liver profile(LFT), Renal profile(RFT), Lipid profile; anthropometric parameters such as B.M.I. & Weight, Urine sugar (U.S.F. & U.S.P.P.), Turbidity of urine was adopted by most of the studies for the assessment of the result. Whereas subjective parameters, e.g., Hastapadattalaha, Kshithilangata, Daurbalya, Pippasadhikya, Karpadynosupta, Taluvinhadantmaliotpati, Prabhumutratra, Kshudhahikya, Naktamutratra, Atisweda, Sthauyla, Alasya, Avilamutratra, Pindikodweshtana, Bahu Ashhe, Aruchi, Agnimandya, Mukha Shotha, Pada Shotha, Shwasa Kashtata, Panduta, Mutralpta, Shayyasana Sheela, Swapna Sheela, Durgandhaja, Savoparodha, Gurugratara, Shramashwasa, Mukhamadhurya, Vibandha, Pipilike Sancharati (Tingling Sensation), Klaibya, Klama, Sandhishool, Kandu, Anasarka (Sarwangashotha), Shirasshool, Hrillas ,Chhardi, Kriyahani, Hridgraha, Baddha Pushishata were evaluated. The status of Oja & Agni was also taken into consideration. These details are given in Table 2.

4.4 Type of Intervention

Recruited trials are classified based on the type of treatment modalities or intervention (Shodhana Chikitsa, Shamana Chikitsa, or their combination) used to manage Prameha. The number of studies with these different interventions is tabulated in Table 3. Among Shodhana, these trials are again sub-classified under heads of Only single therapy of Panchkarma, i.e., Only Vamana, Virechana, Vasti, or comparison/combinations of any two or three that is depicted in Table 4. Among the use of Shamana Chikitsa, these trials are again sub-classified under heads as Only herbal drugs, mineral drugs, or combination, i.e., herbo-mineral drugs or Lifestyle modifications with details of the dosages and duration of treatment that are provided in Table 5.

| S.N. | Type of methodology | Number of studies |
|------|---------------------|------------------|
| 1    | Studies with single Group | 06               |
| 2    | Studies with comparative groups | 35               |
| 3    | Study with Placebo | 03               |
| 4    | Study with diet control lifestyle modifications | 05               |
| 5    | Study with an oral hypoglycemic agents | 24               |
| 6    | Open study | 02               |
| 7    | Single-blind Studies | 01               |
| 8    | Double-blind Studies | 01               |
| 9    | Single-center study | 41               |
| 10   | Multi-center study | 01               |

| S.N. | Assessment parameters | Number of studies |
|------|-----------------------|------------------|
| 1    | Studies conducted with only Symptoms of Prameha | 01               |
| 2    | Studies conducted with only objective criteria | 04               |
| 3    | Studies with combinations of both | 37               |

| S.N. | Various treatment modalities | Number of studies |
|------|-------------------------------|------------------|
| 1    | Only Shodhana Chikitsa | 12               |
| 2    | Only Shamana Chikitsa, including Lifestyle modifications | 15               |
| 3    | Combination of both Shodhana & Shamana Chikitsa | 15               |
Table 4. Number of trials with a specific type of Shodhana Chikitsa

| S.N. | Type of Shodhana Chikitsa | List of drugs                                                                                                                                                                                                 | Number of studies |
|------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 1    | Only Vamana              | Madanphaladi Yoga, Ikshubeeja Churna with Honey. Trivruta Lehya, Manibhadra Guda with Ushnajala, Abhayadi Modak                                                                                               | 04                |
| 2    | Only Virechana           | Prameghna Basti, Guduchi Taila (Anuvasan Basti), Ruksana Basti, Dhanwantari Taila, Madhutailika (Niruha Basti). Niruha & Anuvasan With Somavalkaja Kashayam & Somavalka Taila respectively, Somavalka Niruha Yoga Basti & Somavalka Niruha with Avapa Dravya & Somavalka Trio-Basti, Panchatikta Basti. | 08                |
| 3    | Only Vasti               | List of drugs: Vaman with Madanphaladi Yoga(M.Y.) followed by Virechan with Trivrita Churna - 5g & Danti Churna- 1g mixed in Triphala Kwath 100 ml, Vaman & Virechan, Vaman with M.Y. followed by Virechan with Trivrita + Haritaki + Aragwadha. | 06                |
| 4    | Only Shirodhara          | Tila Taila                                                                                                                                                                                                   | 01                |
| 5    | Comparisons of any two   | Vaman with Ikshwakubeeja Choorna mixed with Honey & Virechan with Snubhavita Katuki, Vaman with Ikshwakubeeja Majja Yoga & Virechan with Abhayadi Modak, Vaman with Madanphaladi Yoga & Virechan with Kalayanaka Guda, Vaman & Virechan, Virechan with Aragvadh Maaja-15 gm, Haritaki Churna-15 gm, Katuki Churna-5 gm along with castor oil (20ml) & Ichhabhed Rasa (250 mg) and Vasti with Pramehaghnira Niruha & Anuvasana Basti (Kalabasti), Panchatikta Basti. | 06                |
| 6    | Combinations of two or three therapy: | List of drugs: Vaman with Madanphaladi Yoga(M.Y.) followed by Virechan with Trivrita Churna - 5g & Danti Churna- 1g mixed in Triphala Kwath 100 ml, Vaman & Virechan, Vaman with M.Y. followed by Virechan with Trivrita + Haritaki + Aragwadha. | 02                |

4.5 Outcome Measures

All subjective & objective criteria were significantly improved with maximum extent. In clinical studies with Shaman Chikitsa, a Single or combination of drugs given to the patients came out to be effective in Prameha Chikitsa. Clinical trials with a combination of both Shodhana & Shaman Chikitsa to assess their effects over Objective variables, i.e., F.B.S., P.P.B.S. & HbA1C is found to be highly significantly effective in almost all studies with no undue effects.

5. RESULTS AND DISCUSSION

Diabetes mellitus is a clinical condition that is strongly characterized by elevated blood sugar levels due to primary or secondary deficiency of insulin. Acharya Sushruta has classified the Prameha as Asantarpanoth & Santhoparsthanoth Prameha based on its pathology & he also narrated their specific management according to Hetu [49]. Therefore, the selection of any regime, procedure, or Drug for the management of Prameha should be meticulously after assessing this cause. Increased demand for Ayurvedic medicines or interventions due to the high cost and innumerable side effects of allopathic medications is vital.

5.1 Role of Shodhana Chikitsa

Panchakarma plays a vital role in preventing & manage Diabetes mellitus successfully as all recommended procedures detoxify the body by eliminating the stagnated, vitiated Doshas out of the body in a smooth manner. Shodhana therapy is the first line of treatment for the diabetic patient who is obese or overweight, according to various texts. The role of Panchakarma for the management of Prameha can be discussed one by one as follows:

5.1.1 Role of Vamana

Vamana is generally indicated by Acharya Charak, in Prameha especially in obese persons or people with Kapha –Meda predominance Vamana induces Apatarapanama as it minimizes peripheral insulin resistance and increases the utilization of glucose by muscles. It also alleviates Bahudrava Kapha & Meda, which are
chief pathological factors in the Prameha. Madanphala Yoga is primarily used as Vamaka Yoga in these previous studies as it is Madhura, Tikta, Laghu, Ruksha, Ushna, and its Lekhana properties subside Kapha & Vata Dosha. According to Nitin Jindal et al. 2013, Ikshubejja Churna with Honey is also effective for Vamana in Prameha due to its action similar to other Vamana (emetic) drugs [27].

According to Dr. Karkand Mukund. et al. 2012, Ikshwabeeja Majja (fruit) used as Vamaka Yoga removes excessive Kleda from the body, lowers down the insulin resistance due to its Tikta Rasa, Laghu & Ruksha Guna, Katu Vipaka, Hypolipidemic, Kapha-Pittaghna actions & its Immune modulatory, anti-oxidant & anti-hyperglycemic nature [29].

5.1.2 Role of Virechana

Virechana is used in disorders originated from the vitiation of Pitta &Rakta, i.e., Dosha & Dushya, respectively, which is indicated in Prameha. Virechana reduces various enzymes responsible for this mechanism, and so reduces hepatic glucose production. It is especially useful in the management of Pittaja Prameha & its associated complications. Mainly Pitta Rechak Dravyas, e.g., Katuka, Triphala, Trivrutta Leha (Tikta, Katu Rasa, Kapha Pittahara, and Rechaka properties), Eranda Taila are helpful in this condition [7]. Tikshna Virechana with Snuhi, Abhayadi Modak are useful Kaphaja Prameha &Prameha Pidika. Dhatwagnidipana is induced by Ushna & Tikshna properties of Snuhi & Tridoshagghna properties of Abhayadi Modak [29,45]. All these Virechak drugs are cholagogues in nature which reduces various enzymes responsible for hepatic glucose production & ultimately, reduction in hepatic glucose production occurs. Virechana effectively reduces the symptoms of metabolic syndrome as it evacuates several waste products from the body & significantly decreases the levels of fasting blood glucose & serum triglycerides.

| S.N. | Shamana Chikitsa | List of Drugs                                                                 | Number of studies |
|------|-----------------|-------------------------------------------------------------------------------|-------------------|
| 1    | Only Herbal drugs | Mustadi Kwath, Vidangadi Ghanavati, Prameha ghna Ghanavati, Nishakatadi Yoga, Kernel Seeds Powder Capsules, Amrutadi Guggula, Kathakadi Khadiradi Kashaya, Nyayagrodhadi Ghanavati, Pathadi Ghanavati, Neem Giloy Satva Capsules, Trayushnadi Gutiika, Phalatrikadi Kwatha, Vidanga Rajanyadi Kashaya, Nishalyalaki Churna, Darvyadi Ghritam & Kwath, Asanadi Gana Kashaya, Medoghna Rasayana Vati, Trivritadi Leham, Ayaskriti, Mamajjak Churna, Dhatrinisha Churna, Bhuddhatrayadhi Yoga (Bhumyamlika & Maricha), Madhumehari Churna, Harishankhar Rasa, Nisha Triphala Yoga, Katak Khadhiradi Kashaya, Niruryadi Gutiika, Mehamudgara Vati, Jatamansi Churna, Somavalka Kashaya. | 20                 |
| 2    | Only Mineral drugs | -                                                                             | 00                |
| 3    | Only Herbo- Mineral drugs | Shilajit, Naga Bhasma, Vanga Bhasma, Vasantkusumakar Rasa, Swarna Patra, Swarna Bhasma, Swarna Varkha. | 03                |
| 4    | Only Lifestyle modifications | Exercise, Control Diet plan, Pathya- Apathya.                                  | 01                |
| 5    | Comparison of two or three drugs | Mamajjaka Churna & Tab.Shilajit, Asanadi Ghanavati & Tab.Shilajit, Placebo Capsule & Tab.Shilajatu, Darvyadi Ghritam & Tab.Shilajit. | 03                |
| 6    | Combination of two or three drugs | Vasantkusumakar Rasa with Dhatrinisha Churna, Madhumehari Churna with Darvyadi Kwath. | 02                |
5.1.3 Role of Basti

According to Kumar Sanju et al. 2018, drugs used in the Panchatikta Panchaprasrttika Niruha Vasti possess predominance of Tikta & Madhura Rasa, Laghu & Ushna Guna & Kapha-Meda-Kledaghna properties. Therefore, these drugs directly induce Lekhana & regulate glucose metabolism [11]. Such type of Vasti formulation cleanses the Koshtha by eliminating vitiated toxins(Malarupi Abadha Meda) and corrects the intestine’s functioning, which in turn regulates the proper absorption of glucose. It also corrects the Jatharagnimandya & Dhatavagnimandya (glucose metabolism) and enhances glucose absorption in the body. Prasanta Kumar Sahoo, Shamsa Fiaz, proves Raktaprasadana, Chakshyushya, Rasayana properties with anti-inflammatory, lipid-lowering activities Panchatikta Panchaprasrttika Niruha Vasti. et al. 2016 & Dr. Mangesh Ganpat Dimble et al. [17].

Dr. Mridula Pathak discusses the Prameghrna effect of Madhyutika Vasti et al. 2018 based on its Dhatusanrakshan (immune-modulatory), Srotoshodhan as well, as Dhatuvardhana (maintain tissue regeneration) properties [12]. Antihyperglycemic properties of Somavalka is proved by Vishnu Vardhan Narayanam et al. 2018 & Dr. Suresh Hakkandil, et al. 2017 based on its Kashaya and Tikta Rasas, Ushna Guna & Virya and Katu Vipaka, along with the predominance of Vayu, Agni, and Akasha Mahabhusas, Kapha-Medohara, Kledahara properties [13,19].

5.2 Role of Shamana Chikitsa

From an overview of all these trials, it is reflected that mostly Kaphghna, i.e., Tikta, Katu & Kashaya Rasatamaka Dravyas, are helpful for the management of Prameha for Shamana purposes. Many research shows that a combination of Shodhana and Shamana is more effective in controlling Diabetes clinically than the only Shaman. Prameghnha action of these Shamana drugs can be explained as follows:

- Tikta, Katu & Kashaya Rasatamaka Dravyas induce Agnivardhaka, Kledanashana &Stroshodhana effects by their Dipana –Pachana & Kapha-Medohara, Rukshana, Shoshan properties. Their Kaphaghnha and Medoghana Prabhava reduces the weight that decreases insulin resistance. It also reduces Abdhatu Dushti, which is the chief pathogenesis in the Prameha. Due to improvement in Jatharagni & Dhatavagni by Dipana –Pachana properties & Katu Vipaka, it leads to normalization of carbohydrate, Fat & protein metabolism, increase in the peripheral glucose utilization & also increases insulin sensitivity. It decreases insulin resistance & insulin insensitivity.

- Prabhatamurata, Pipasa, Mukha Shosha, Karapada Daha get reduced by Pitta and Kapha Shamaka effect of the predominance Kashaya Rasa of these drugs.

- Laghu, Vishada & Ruksha properties of such drugs bring Kledanashana &Stroshodhana as these properties are opposite of Guru, Pichhila & Snigdha Guna of vitiated Kapha & Meda in the Prameha. These properties also correct Dhatushalthiya.

- Laghu, Vishada & Ruksha properties & Tikta, Katu & Kashaya Rasa, subsides Kapha (Bahudrava Shleshma) and Abaddha Meda involved in the pathogenesis by their Virukshana and Chedaneeya actions. Their Lekhana properties increase the metabolism of Meda, i.e., Fat, due to their anti-inflammatory, lipid-lowering activities.

- Stotoshodhak properties of Vishad Guna decrease the Kapha with Meda & corrects Dhatu Shalthila.

- Ushna Virya of such drugs corrects the disturbances in the Samana Vayu & corrects the Jatharagni and Dhatvagni. Karpada Suptata and Sandhi Shoola get reduced by Ushna Veerya by its Valanulomak & Vata Shamak property.

- Agnivardhana (Improves metabolism) & removes Kapha Avarana over Vata due to Katu Vipaka & Ushna Virya.

- The impairment of Jatharagni and Dhatwagni is corrected by Ushna Veerya & Tikta Rasa.

- Most of the drugs act over the Mootravaha Srotasa due to Kledahara & Grahn properties that subside the Sthana Vaigunya. Mootra Sangraheenya action may occur due to their Kashaya & Tikta Rasa, Laghu & Ruksha Guna, Katu Vipaka, which reduces the excessive urination. The nephroprotective action of these drugs avoids renal tissue damage due to diabetes mellitus; therefore, it becomes helpful to prevent diabetic
nephropathy in the future. Excretion of sugar or Oja through urine is also avoided by Vrushya properties of such drugs, which prevents further Dhatu-Shaithilya.

- Drugs having Madhura Rasa acts as a Rasayana in the Prameha, which induces the Ojavardhana effect by nourishing the tissues, pacifying the vitiated Vata Dosha, correcting Apanvayu & giving strength to the tissues & Mootravaha Srotas. Replenishment of Ojus diminished in Prameha takes place by Sheeta Virya and Madhura Vipaka by doing Ojovriddhi. Ultimately it corrects Dhatukshaya by their Rasayana, Yogavahi & Vatashamaka properties & avoids the formation of complications of Prameha or its conversion into Madhumeha. Yogavahi Guna promotes the deep penetration of the medicine at the level of Uttaraottara Dhatu & gives strength to them.

- Rasayana, Anti-oxidant & immunomodulatory improve metabolism, anti-inflammatory properties of such drugs (due to its Rasayana Guna), which may stimulate the Beta cells in the pancreas, which secretes the hormone insulin insufficient amount or may increases secretion of endogenous insulin by regeneration or revitalization of the residual beta cells or may check over the destruction of βcell or their necrosis. Improvement in better sensitivity of pancreatic β- cells with the prompt secretion of a large quantity of insulin in response to hyperglycemia due to their pancreatotrophic action can be explained.

- Lekhana Dravyas are useful in Sthula Pramehi, which are also helpful skin lesions induced in Prameha due to its Rakthaprasadana, Kushtahara, and Vranaropana properties. In a nutshell, as Shodhana Chikitsa destroys the root of disease, it is easily possible to check over the pathogenesis of Prameha to avoid the recurrence of diseases & to avoid the side-effects of oral allopathic hypoglycemic agents with the help of above various Ayurvedic measures. These drugs may also become helpful to minimize doses of contemporary OHA or even to stop their use in a person with good control by using them in the early stage of the disease [50-56].

6. CONCLUSION

After critical analysis of all studies, it is found that Ayurvedic interventions, i.e., Shodhana Or Shamana Chikitsa, can successfully manage this condition and significant improvement in clinical features of D.M. This study proves that rational use of Ayurvedic interventions can successfully manage D.M. in primary stage or newly diagnosed cases. Moreover, these interventions also proved their supportive or adjuvant role with the contemporary treatment protocol. All reported interventions are pharmacological or non-pharmacological in approach. They have assessed their effectiveness in both prevention & management of the disease to avoid progression of disease & further complications of D.M. Other multi-centric trials with a large sample size are expected in the future to generate more substantial clinical evidence regarding the above interventions.

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CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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