



Review Article

INTEGRATED APPROACH FOR DIABETES THROUGH LIFE STYLE MODIFICATIONS AND YOGA: A CRITICAL REVIEW

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ABSTRACT

Diabetes mellitus is defined as multiple etiological disorder characterized by chronic hyperglycemia and disturbed of metabolism leads into defective insulin secretion, action or both. Research showed 150 million people have diabetes mellitus worldwide, which can be doubled by the year 2025. This tremendous sudden increase is due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyles. In contemporary science diabetes management includes uses of oral hypoglycemic agents and insulin injections still blood sugar level remains uncontrolled and may leads to further complications. In Ayurveda characteristic features of diabetes has been described under *Madhumeha* in which treatment principles have been explained beautifully in detail which includes *Shodhana* therapy, *Shamana* therapy, diet and Yogic exercise. Through various studies we come across that there have been lots of research works done on role of Ayurveda and yoga in diabetes mellitus. In this article an attempt has been made to collect various data published by CCRAS, Ministry of AYUSH, ICMR and CSIR has. Along with data available on PubMed, Medline, Google Scholar, AYUSH research portal and various online journals based on some clinical studies. So, that a multidimensional approach can be made through these resources and apply to cure the patient and improve quality of life.

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INTRODUCTION

Diabetes mellitus is described as multiple etiological disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, action or both which in long term effects can lead to progressive development of retinopathy, nephropathy, neuropathy, foot ulcers, features of autonomic dysfunction along with failure of various organs.^[1] In 2017, 425 million people were suffering from diabetes worldwide. According to the global population, the prevalence rate of diabetes is 8.8% among adults. As per WHO data diabetes mellitus resulted in 1.5 million deaths

in 2012, making it the 8th leading cause for death with 2.2 million deaths worldwide were attributable to high blood glucose and the increased risks of cardiovascular disease and other associated complications. Diabetes mellitus occurs throughout the world but is more common in developed countries. The increase in rate is due to changing trend of urbanization and lifestyle, including sedentary lifestyles, less physically works and the global nutrition transition, marked by increased intake of foods in which energy content are high but nutrient value is poor. The global number of diabetes cases might increase by 48% between

2017 and 2045^[2]. In *Ayurveda* Word "Prameha" means excessive and turbid urination and which includes all polyuric disorders^[3]. It is of three types namely *Kaphaj*, *Pittaj* and *Vataj* which are 10, 6 and 4 in number respectively^[4]. In *Ayurveda* characteristic features of diabetes mellitus resembles to *Madhumaeha* which a type of *Vataj Prameha* is considered as *Santarpanoth vikara* means which occurs due to consumption of excess and wrong dietary habits^[5]. According to *Acharya Sushruta* they classified *Prameha* as *Sahaj prameha* (due to genetic factors) and *Apathaya nimitaj* (due to faulty dietary practices)^[6]. Further on the basis of treatment aspects *Acharya Charak* classified them as *Sthoola Pramehi* (obese diabetic) and *krisha* (lean diabetic) person^[7]. Etiology of *Prameha* includes one who sits prolong in relax posture, who excessively sleeps, consume curd, flesh of animals who are living around water, under water and in village, excess consumption of milk, new crops, jaggery products and all those factors which vitiates *Kapha doshas* (like heavy diet, fatty food that increase body weight, cholesterol and causes obesity etc) in the body will lead to *Prameha*^[8]. Also, excessive consumption of dry substances (*Ruksha Ahara*), light food (*Laghu Ahara*), excess use of pungent, bitter, cool items, excessive fasting etc. increase *Vata* leads to pathogenesis of *Vataj prameha*^[9]. From the ancient time principles of *Ayurveda* focused on the concepts of *Dinacharya* (daily regimen for healthy living), *Ritucharya* (seasonal regimen for healthy living), *Sadvaritta* (moral conducts) and *Achara Rasayana* (social conducts) for the betterment and achievement of healthy life, but now in this era due to sedentary life style, urbanization and stress associated factors there has been lots of changes in living standard of the people. As a result, there is tremendous rise in lifestyle disorders as pandemics and diabetes is one the most threatening diseases among them^[10]. The line of treatment in contemporary medicine includes dietary management, insulin therapy and oral hypoglycemic therapy. But it has been observed that in spite of receiving anti diabetic drugs blood sugar levels are not under controlled and also there are lots of adverse effects faced by them. So people are now moving towards the principles of *Ayurveda*. According to *Ayurveda* there are two type of *Prameha* patient one is *Sthoola pramehi* and another one is *Krisha*. So, the line of treatment includes *Nidana parivarjan*, *Shodhan*, *Shamana*, diet and *Yogic* exercises which we are going to describe in this article in details with best possible collected evidences.

Nidana parivarjan (Avoidance of causative Factors)

This is the first line of treatment which has been mentioned in the *Ayurveda*^[11]. As we know that if the root cause will not diagnosed and treated properly then though we are using qualitative medicine but it will not work alone. So, first step is to find out the deep seated etiology and correct it.

Shodhana therapy (Purification Therapy)

Shodhana therapy mainly comprise of *Panchakarma* therapies which includes *Vamana*, *Virechana*, *Vasti*, *Nasya* and *Raktamokshana*. In case of diabetes mainly *Vamana*, *Virechana* and *Vasti* therapies are used. In the line of treatment itself *Acharya* says that when the person is having good strength *Shodhan* therapy should be given^[7]. Also, when the *Doshas* are in aggravated stage *Shodhana* therapies like *Vamana* and *Virechana* should be given. However *Vasti* is contraindicated in *Prameha* but some specific *Vasti* are indicated in *Prameha* like *Madhutailik Vasti*^[12] and *Panchprautiki Vasti*^[13]. *Vasti* mainly used in *Prameha* are *Rasnadi Niruha Vasti*, *Saindhavadi Niruha Vasti*, *Vidangadi Tail Vasti*, *Panchtikta Prasrutik Vasti*. *Acharya Vagbhata* mentioned that in *Prameha Pittaghan Mridu Niruha Vasti*, *Madhutailik Vasti*, *Kaphahara Vasti Kalpa*^[14].

Shaman therapy (Palliative Therapy)

Those who are contraindicated for *Shodhana* therapy then shaman therapy can be given to them^[15]. Some of the commonly used medications are^[16]

Single Drug: *Gurmar* (*Gymnema sylvestre*), *Giloy* (*Tinospora cordifolia*), *Methi* (*Trigonella foenum-graecum*), *Neem* (*Azadirachta indica*), *fever nut* (*Caesalpinia bonducella*), *Vijayisasar* (*Pterocarpus marsupium*), *Jamun* (*Syzygium cumini*), *Karela* (*Momordica charantia*), *Bilva* (*Aegle marmelose*), *bitter apple* (*Citrullus colocynthis*), *Bimbi* (*Coccinia indica*), *Saptachakra* (*salacia chinesis*)

Single formulations: *Guduchi swarasa* (*Tinospora cardifolia*), *Nisha* (*Haridra*), *Amalaki Churna* (*Phyllanthus emblica*), *Karavellaka Phala Churna* (*Momordia charantia*).

Medicated Ghee used in *Prameha* are- *Dhanvantara ghrita*, *Dadimadya ghrita*, *Sinhamrita ghrita* (doses-5 to 10 gm/day)

Avaleha- *Gokshuradyavaleha* (Dose: 3 to 5 mg/day).

Diet and exercise

In *Ayurveda* there is concept of wholesome and unwholesome diet. In classical text the detailed dietary guidelines has been given advised^[17].

S.no.	Groups	Food to be consumed
1.	Grains	<i>Yava</i> (barley)- <i>Hordeum vulgare</i> , <i>Godhuma</i> (Wheat)- <i>Triticum sativum</i> , <i>Shashtika Shali</i> (rice)- <i>Oryza sativa</i> , <i>Kodrava</i> (grain variety)- <i>Paspalum Scrobiculatum</i> , <i>Uddalaka</i> , <i>Shyamaka</i> , <i>Bajara</i>
2.	Pulses	<i>Chanaka</i> (bengal gram)- <i>Cicerarietinum</i> , <i>Adhaki</i> (toor dal)- <i>Cajanus cajan</i> , <i>Mudga</i> (green gram)- <i>Phaseolus aureus</i> , <i>Kulattha</i> (Horse gram)- <i>Dolichos biflorus</i>
3.	Vegetables (bitter and astringent)	<i>Methika</i> (fenugreek)- <i>Trigonella foenum</i> , <i>Patola</i> (pointed gourd)- <i>Trisanthus dioica</i> , <i>Karvellaka</i> (bitter gourd)- <i>Momordica charantia</i> , <i>Tanduleyaka</i> (<i>Choulayee</i>)- <i>Amaranthus spinosus</i> , <i>Vastukam</i> (<i>Bathuva</i>), <i>Shobhanjana</i> (drum stick)- <i>Moringa oleifera</i> , <i>Karkotaka</i> – <i>Momordica dioica</i> , <i>Rasona</i> (garlic)- <i>Alium sativum</i> , <i>Kadali</i> (raw banana)- <i>Musa paradisiaca</i> .
4.	Fruits	<i>Jambu</i> (Jamun)- <i>Eugenia jambolana</i> , <i>Talaphala</i> - <i>Borassus flabellifer</i> , <i>Amalaki</i> (goose berry)- <i>Emblica officinalis</i> , <i>Kapittha</i> (monkey fruit)- <i>Limonea acidissima</i> , <i>Dadima</i> (pomegranate) – <i>Punica granatum</i> , <i>Tinduka</i> – <i>Disospyros embroyoptesis</i> .
5.	Seeds	<i>Methika</i> , <i>Kamala</i> - <i>Nelumbo nucifera</i> , <i>Utpala</i> – <i>Nymphaea stellate</i>
6.	Flesh (fat free meat; forest animals, forest birds)	<i>Harina</i> (deer flesh), <i>Shashaka</i> (rabbit), Birds likes – <i>Kapota</i> (pigeon), <i>Titira</i> , <i>Lavaka</i>
7.	Fermented or alcoholic liquids	<i>Madhveeka Sura</i> , <i>Madhasava</i> (in <i>Kapha Pittaja Prameha</i>), <i>Purana Sura</i> - old wine Other natural products <i>Madhu</i> (honey), <i>Madhudaka</i> (honey mixed with water)
8.	Oils	<i>Nikumba</i> (<i>Danti</i> - <i>Baliospernum montanum</i>), <i>Ingudi</i> (<i>Balanitis egyptica</i>), <i>Atasi</i> (<i>Linum usitatisimum</i>), <i>Sarshapa</i> (Mustard)
9.	Others food articles and spices	<i>Dhaniya</i> (pop corn of jowar), <i>Laja/Murmura</i> (puffed rice), <i>Maricha</i> - (<i>Piper nigrum</i>), <i>Saindhava</i> - (rock salt), <i>Hingu</i> - (<i>asafoetida</i>), <i>Haridra</i> - (<i>Turmeric</i>), <i>Ardraka</i> - (<i>Ginger</i>)

Exercise

Through recent studies it is clearly understood that physical inactivity may leads to progression of disease. For diabetic person, exercise is equally important as diet and medication. In fact, the American Diabetes Association recommended at least 30 minutes of physical activity daily for five days per week increases the heart rate [18]. Even in ancient time also it was already mentioned by *Acharya Sushruta* that one should walk regularly without wearing shoes and umbrella, walk at least hundred *Yojan*[19].

Yoga

Lifestyle changes plays important role in the development of Diabetes. *Yoga* provides natural and effective remedies with less toxic side-effects, and with benefits more beyond the physical. *Yoga* is a simple and natural programme works on five main principles: exercise, breathing, relaxation, diet and positive thinking with meditation. It is a cost effective lifestyle intervention technique[20].

List of *Asanas* (Yogic postures) benefits in diabetes[21]

<i>Asanas</i>	Benefits
<i>Paschimottanasana</i>	Tones the abdominal pelvic organs. Reduces fatty deposits in the abdomen. Remove anxiety, anger and irritability. Calms the mind. It acts as a stress reliever.
<i>Padahasthasana</i>	Useful in the toning of the abdominal organs. Blood circulation improved. Improved blood circulation will also help in keeping the hormone balance.
<i>Ardhamastyendrasna</i>	Massages abdominal organs, Simultaneously stretches the muscles on one side of back & abdomen.

<i>Bhujangasana</i>	It helps in giving a gentle massage to the internal organs and will stimulate the digestive system to function well. Useful in treating the symptoms of stress like fatigue, headache and weakness.
<i>Vajrasana</i>	Calms the mind and bring stability in mind.
<i>Savasana</i>	It relaxes whole body. Releases stress, fatigue, depression and tension. Calms the mind and improves mental health.
<i>Suryanamaskara</i>	Harmonizes the endocrinal system helping to remove any irregularities by directly massaging the relevant glands and improving their blood flow.

Materials and methods

The whole study is made on the basis of available literary material includes *Brihatrayee*, *Laghutrayee*, *Ayurvedic* classics, related topics from modern texts, available resources from the internet. In this article an attempt has been made to collect various data published by CCRAS, Ministry of *Ayush*, ICMR and CSIR has been complied. Also, various data has been collected available on pub med, Medline, Google scholar, *Ayush* research portal and various online available journals based on some clinical trials along with some research works done in Gujrat *Ayurveda* University since 2001-2013.

Observations

Researches based on guidelines of diet^[10]

In classics concept behind unwholesome diet is that because these foods items are predisposing factors for diabetes and causes immediate burden on beta cells of Langerhans leads to insulin resistance. According to reports in bovine serum albumin (BSA) antibodies and diabetes suggest that milk protein have a strong diabetogenic effect which proves that the excessive use of milk and milk products may cause diabetes. Researchers have proved that simple carbohydrates are broken down easily and increases blood glucose levels fast. Hence they are contraindicated, while complex carbohydrates like cereals, whole grains, and vegetables are recommended in at least 50% of diabetic diet. *Yava* (barley) is high in fiber content (4 g in 100 g) that's why it is recommended in diabetic diet. Honey supplementation was found to reduce hyperglycemia in rodents and humans with diabetes mellitus. Type 2 diabetics can enjoy fruits which are having low glycemic index.

Shodhana therapy

Various researches have been done on *Basti*, *Vamana* and *Virechana* these are discussed here. A clinical trial has been done on *Somavalkal Vasti*, *Mustadi Yapna Vasti*, *Madhutailam Vasti* proven that *basti* has major role in control of diabetes^[14]. *Gokshura-Punarnava Vasti* found effective in microalbuminuria in DM as compared to control group^[21]. *Aardhamatrika Vasti* presents a window of opportunity in the clinical management of Diabetes

Neuropathy proves significant results^[22]. Comparative study on *Vasti* (enema therapy) and *Shamana* therapy in which *Pramehaghna Vasti* given for 16 days (*Kala Vasti*) provided significant results as compared to oral administration of *Pramehaghna Ghanavati* (2 g TDS with Luke warm water for 2 months) *Virechana* (therapeutic purgation) followed by *Medohara Rasayana Vati* (1 g TDS) for 30 days was reported to provide satisfactory results. *Vamana* followed by *Nisha Amalaki Churna* (2 g TDS for 30 days) showed better results as compared to *Virechana* with *Nisha Amalaki Churna*^[23].

Shamana Therapy

Shamana therapy is given to those contraindicated for *Shodhana* and in which *Doshas* are not in aggravated stage. Various researches have been done by various institutes which are collected here. In one of the study affects of three traditional herbal plants products in human on metabolic disorder disease viz. diabetes type-2 has been observed and analyzed up to 90 days showing significant depletion in the level of blood glucose (plasma glucose). Those patients who were found insulin resistant, also showed a significant reduction in blood sugar.^[24] Evidence also suggest that the single herbs *Coccinia indica*, holy basil, fenugreek, and *Gymnema sylvestre* and herbal formulas such as *Ayush-82* and *D-400* showed glucose-lowering effect. In *Kaphaja prameha* followings herbs are mentioned *Haridra*, *Daruharidra*, *Katphala*, *Katurohini*, *Indravaruni*, *Kampillaka* and *Devdaru* can be recommended. Likewise in *Pittaja prameha* *Nimba*, *Arjuna*, *Khadira*, *Gokshura*, *Beejaka* can be used. While in *Vatja prameha*: *Guduchi*, *Pippali*, *Shunthi* can be used^[25]. According to Ahmed et al. Diabetic rats given fruit juice of *Momordia charantia* showed regeneration or increase in beta cells. *Momordia charantia* also exhibits properties as extra-pancreatic effects and help in improving peripheral glucose utilization. Some other herbs like *Trigonella foenum graecum* and *Tinospora cordifolia* possess activities on enzymes involved in carbohydrate and lipid

metabolism. In animal studies, herbal drugs like *Curcuma longa* have shown reduction in dyslipidemia as its effect on lipid peroxidation^[10]. One study showed that *Varadi Kwatha* with Ayurvedic *Ahara* and *Vihara* (group A) proven better than only *Varadi Kwatha* (group B) helps in relieving most of the cardinal symptoms with improving biochemical parameters also^[26]. Further in one study *Kuberaksha Ghana* (dried aqueous extract *Caesalpinia bonduc* [L.] Roxb.) failed in reducing blood sugar level, on the other hand the kernel powder shown significant ($P < 0.001$) hypoglycemic activity at a higher doses (540 mg/kg body weight of rats). *Mamajjaka Ghana* (aqueous extract of *Enicostemma littorale* auct. non Bl) exhibit weak anti hyperglycemic and no hypoglycemic activity. In FBS and PPBS levels *Guduchi Ghana* was found to be statically significant as compared to *Satva*. Effect of *Medoghna Rasayana Vati* (1 g BD with LUKE warm water for 60 days) also found to be effective in DM. *Triphaladi Vati* and *Shilajatwadi Vati* (750 mg/day in TDS doses with Luke warm water for 8 weeks) provided better results with improved QoL. Blood glucose levels and diabetes symptoms were significantly improved ($P < 0.01$) by *Triphaladi Vati* as comparison to *Shilajatvaadi Vati*. *Triphaladi* granules (5 g BD daily before meals with Luke warm water for 2 months) along with *Pathya Palana* (dietary regulations) showed significant reduction in FBS, PPBS along with insignificant decrease in serum HbA1c level. *Nyagrodhadi Vati* and *Gokshuradi Guggulu* (6 g/day BD with water given 8 weeks) showed mild reduction in glycemic levels. In comparison *Nyagrodhadi Vati* found more effective against reducing signs and symptoms of diabetes. *Saptavimshati Guggulu* (1 g BD for 12 weeks) and *Haridra Churna* (3 g BD daily) showed significant improvement in HbA1c%, urine albumin, polyuria and fatigue, while insignificant result in FBS and PPBS. *Vanga Bhasma* (Tin calx) for 28 days was effective in DM. Highly significant improvement ($P < 0.001$) was observed in *Prabhutmutrata*, *Avilamutrata*, *Kshudhadhikya*, *Trishnadhikya* and *Pindikoudvestana*, with minimal reduction in FBS and PPBS. *Laghu Malini Vasanta Rasa* at a dose of 250 mg BD daily for 8 weeks showed maximum relief in both subjective and objective parameters. *Makaradhwaja* at a dose of 125 mg, with *Guduchi Ghana* (125 mg) and honey, BD for 28 days reduces FBS, PPBS and all other signs and symptoms of DM significantly. *Triguna Makaradhwaja* and *Shadguna Makaradhwaja* prepared with *Ashtasamskarita Parada* at a dose 17.5 mg with *Anupana Guduchi Ghana* and honey BD for 28 days result into 40.38%

and 67.92% with moderate improvement respectively^[25].

Pathya vihar (Exercise)

One study reported that a daily brisk walk of 7.5 km (brisk is walking with speed of at least 5 km/hr) for 100 days can reverse Glucose Tolerance Test to normal. Lack of exercise can be one of the main factors in uncontrolled diabetes. Exercise improves insulin sensitivity, glucose absorption, transport and uptake, increases perfusion in skeletal muscle reduces the insulin requirement^[27].

Researches on Yoga

Stress is one of the main contributor for chronic hyperglycemia in diabetes. It releases various hormones result into high blood glucose level^[28]. Meditation practice has shown effects on controlling blood sugar levels as it effects pancreas level. Practice of *Asanas* improves functioning of internal organs, strengthening Heart, Lungs, Kidneys, Excretory and Reproductive organs^[29]. One study was carried out to see the effect of *Yoga* exercise in diabetic patient and they found that 15 used *Yoga asanas*, 12 used *Pranayama*, and 1 each used *Shatkriyas* (cleansing exercises) and *Yoga nidra* (relaxation). Of the 11 studies that measured changes in fasting blood glucose, 9 showed significant decrease^[30].

Results

In this article 54 articles containing the results of 62 human clinical studies for using Ayurvedic therapy in diabetes were reviewed. Further these studies analyzed in detail to determine existed efficacy and effectiveness of Ayurvedic therapy in diabetes. It was found that common single herbs studied were *Gymnema sylvestre*, *Coccinia indica*, fenugreek (*Trigonella foenum-graecum*), and *Eugenia jambolana*. Data published in CCRAS showed that experimental studies were done on *Aegle marmelos*, *Tejpatra*, *Twaka*, *Coccinia indica*, *Gymnea sylvestrea*, *Momordia charantia* and *Vijaysara*. clinical studies were done on *Vijaysara*, AYUSH-82 and Shudha Shilajita, *Coccinia indica*, combination therapy in diabetic retinopathy, *Nishaamlaki*, *Amrita-pippali* and *nimbi yoga* and *Coccinia cordifolia*. Recently BGR-34 was prepared by CSIR with collaboration with NBRI showed effective results in lowering blood sugar level. Various studies have been done in yoga practices regarding holistic approach in management of diabetes.

CONCLUSION

Need of *Ayurveda* is to increase awareness about the role of diet, exercise and *Yoga* in disease prevention. The specially designed *Ayurvedic* diet

and lifestyle plan has the potential that can be used as a Standard *Ayurvedic* Protocol in *Madhumeha* (DM). In this article it has been found that traditional system of medicine has treasure of remedies to treat diabetes at various level in which collaborative approach includes purification, oral medication, diet exercise and *Yoga* along with the main need of hour to create valid evidence and publish it.

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