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# A Review on Role of *Vyayama* (Physical Exercise) in the Prevention and Management of *Madhumeha* (Diabetes Mellitus-Type 2)

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**Abstract**

Diabetes mellitus is a life style disorder prevalent in both developed and developing countries and has increased alarmingly, giving the disease the dimension of an epidemic. The aim of present study is to review the role of *Vyayama*(physical exercise) in the prevention and management of diabetesmellitus. In *Ayurveda,* the role of *Vyayama*(physical exercise) has been described elaborately as a part of *Dinacharya*(daily routine)and in the prevention as well as management of *Madhumeha* (diabetesmellitus). One classical quotation i.e. "Withdrawing of luxury to create happiness" mentioned by *AcharyaVagbhatta* is very classical for preventing D.M. During recent years, the association between physical activity and type 2 diabetes mellitus management has been assessed by a number of studies. Today, the beneficial role of exercise has been fully documented and exercise should be incorporated systematically in the prevention and treatment of patients with diabetes mellitus.

## Keywords

Diabetes Mellitus, Physical exercise, *Madhumeha*, *Vyayama*

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## INTRODUCTION

In recent years, the decrease in physical exercise associated with automation and computerization has combined with western-style eating habits to lead to insufficient physical activity and overeating (high fat diet). This in turn has brought about an increase in the prevalence of the pathological conditions known as "syndrome of insulin resistance," "visceral fat syndrome," or "metabolic syndrome" as represented by diabetes mellitus, obesity, hypertension, and hyperlipidemia. The Ministry of Health and Welfare introduced the concept of "lifestyle-related diseases" to describe these conditions [1]. Amongst the many dreadful conditions arising because of modern day living, Diabetes Mellitus (DM) is a giant disease considered as one of the archenemies of the humankind caused by improper diet and lifestyle. It is often referred to as a "silent killer." Diabetes and its complications pose a major threat to public health resources throughout the world. Looking at its gravity, the World Health Organization (WHO)[2] has taken up a close vigilance and survey about this problem the world over[3].

*Madhumeha* is described as one of the 20 varieties of *Prameha*. *Prameha* is defined as *'Prabhutamutrata'*(excessive urination) and *'Avilmutrata'* (turbid urination)[4]. If *Prameha* is not treated properly in time; it can be converted into *Madhumeha* [5]. The word "*Madhu*" shows its similarity in respect of colour, taste, etc. like *Madhu* [6] .In *Madhumeha*, the patient passes large quantity of *Kashaya* (astringent), *Madhura* (Sweet), *Pandu*(greyish & white) urine similar to the characters of *Madhu*(honey) and body too attains sweetness[7]. The word diabetes has been derived from two words, diabetes (Greek) which means 'siphon through' and mellitus (Latin) which means 'sweetened with honey' [8]. Therefore, *Madhumeha* is comparable to disease like Diabetes mellitus because of great resemblance of *Madhumeha*with Type 2 Diabetes mellitus (T2DM) which is characterized by hyperglycaemia (increased concentration of blood glucose) and disturbance of glucose metabolism, as a result of reduced secretion or insulin resistance or both[9,10]. This review seeks to briefly summarize the ancients as well as contemporary scientific literatures related role of *Vyayama*(physical exercise) in the

prevention and management of diabetesmellitus.

**PREVALENCE**

India has been projected by W.H.O. as the country with the fastest growing population of diabetic patients. It is estimated that between 1995 to 2025 diabetic patients in India will increase by 195%. Type II diabetes mellitus is a global health problem and one of the major causes of morbidity and mortality. The incidence of the disease is high worldwide and varies between populations because of differences in genetic susceptibility and other modifiable risk factors[9,10]. In the literature it is cited that there are approximately 145 million patients with type II diabetes mellitus worldwide and this number is expected to rise to 300 million by 2025[11].

**CLASSIFICATION**

Diabetes is classified into two types. Type I DM also known as Insulin dependent diabetes mellitus (IDDM) results when body is not able to produce enough insulin. Its cause in not known. It is also referred to as juvenile diabetes. Another is type 2 DM also known as non insulin-dependent diabetes mellitus (NIDDM) is a condition in which cells do not respond to insulin. It is also known as adult-onset diabetes. The main cause is excess body weight and sedentary life style. Type-II diabetes constitutes 95% of diabetic population[12].

**SIGNIFICANCE OF *VYAYAMA* (PHYSICAL EXERCISE) IN DM**

The management of Diabetes mellitus needs multi strategies involving integrative approach of *Ayurvedic* management viz. *Aushadha* (Drugs), *Ahara* (Diet) and *Vihara*(Lifestyle modification including exercise) which are the basis for the management of DM. Similarly western researches have highlighted the use of modern medicines, herbal medicines and exercise as a therapy in the management of Type2 DM. The entire management regimen proves to have a positive impact on the disease. Nevertheless, the adverse effects of modern medicines are also challenging, and it cannot be ignored[13,14].

Hence, worldwide interest is increasingtowards safe and effective approach which *Ayurveda* can provide for the prevention and management of DM. *Ayurveda* promotes holistic health through prevention and curing diseases through recommended lifestyle changes.To prevent and manage the “Life Style Disorders” such as DM, adaptation of *Ayurvedic* life style including *Vyayama* (physical exercise) is

necessary. Therefore, *Vyayama* (physical exercise) is considered as the most important strategy for T2DM.

**CONCEPT OF *VYAYAMA* INAYURVEDA:**

The basic meaning of *Vyayama* according to Sir Williams is to pull or drag different ways or draw. Some other important meanings of *Vyayama* are struggle, exertion; make great efforts, gymnastic exercise, exercise or training [15] . It has been defined by *AcharyaVagbhatta* [16] that any activity that when indulged in, produces *Ayasa*(exhaustion/tiredness) to an individual is termed as *Vyayama*. This is a very primary definition of *Vyayama*. Similarly, taber'scyclopedic medical dictionary has defined the term physical activity and exercise as "a general term for any sort of muscular effort but especially the kinds intended to train condition or increase flexibility of the muscular and skeletal systems of the body[17]. This clearly states that *Vyayama* may not necessarily be in any specific form. It may be a brisk walk, a workout at the gym, a jog, practice of some martial art, practice of a dance form, aerobics and so on.

In *Ayurveda*, great importance has been given to *Vyayama* (physical exercise). Moreover, it has been mentioned in ancient classics that, lack of exercise (*Asyasukham*) and excessive sleep during day and night time (*Swapnasukhama*) play important role in etiology of DM[18]. These factors are the major cause of obesity, which leads to insulin resistance. So, exercise is very much important in the management of diabetes mellitus because of its effect on blood glucose and free fatty acids.

**ROLE OF *VYAYAMA* (PHYSICAL EXERCISE) IN DM FROM *AYURVEDIC* PERSPECTIVE:**

In Ayurveda, *Vyayama* (physical exercise) is included as a daily regimen for the maintenance of good health. Practice of physical exercise renders *Laghava*(lightness in body), *Karma Samarthya* (efficient in activities), *Deeptagni*(improves digestion), *MedaKshaya*(Causing combustion of excessive fat), renders *VibhaktaGatra* (finely chiselled contours)), *Ghana Gatra*(consistent body)[19].

**Preventive aspect of*Vyayama*(physical exercise) in DM:**

A disease can be prevented by intervention in its cycle of pathogenesis as early as possible beginning from the avoidance of predisposing/risk factors of the disease. *Ayurveda* has great potential in preventing

life style disorders such as DM. *Madhumeha*(Type2DM) can be prevented as primordial, primary, secondary and tertiary level. *Vyayama* can be incorporated in primordial and primary prevention. Both are achieved through individual and mass education of regular *Vyayama* till the appearance of features of *BalardhVyayama*(exercise up to half strength) as a part of *Dinacharya*(daily routine).

*AcharyaCharaka* has nicely elaborated the role of different types of*Vyayama* in the prevention of DM [20] . One quotation mentioned by*AcharyaVagbhatta* [21] is veryclassical for preventing *Madhumeha*. He stated that one should withdraw from luxury to create happiness. A person can prevent DM if he/she will get rid of sedentary life style and involve in full of activity in daily routine. For this *MaharshiSushruta* and *Vagbhatta* advised to walk 100 *Yojana* (1 Yojanapprox 4 km)[22] to avoid sedentary lifestyle.

Recently several research studies have also proved the role of exercise in the prevention of DM.

According to the finding in D. P. P. study (Diabetes Prevention Programme[23] and Da-Qing study[24]) a daily brisk walk of 7.5 km (brisk is walking with speed of at least 5 km/hr) for 100 days (3 months) can reverse GTT to normal.

Data show that moderate exercise such as brisk walking reduces risk of type 2 diabetes [25 -29] and all studies support the current recommendation of 2.5 h/week of a moderate aerobic activity or typically 30 min/day for 5 days/week for prevention. A meta-analysis of 10 cohort studies [26] that assessed the preventive effects of moderate-intensity physical activity found that risk reduction for type 2 diabetes was 0.70 (0.58–0.84) for walking on a regular basis (typically briskly for ≥2.5 h/week). Further, if completely sedentary and underactive individuals participate in moderate physical activity 30 minutes a day, they would obtain at least a 30% reduction in risk not only for type II diabetes but also for other chronic diseases such as coronary artery disease, stroke and colon cancer[27].

***Curative aspect of Vyayama*(physical exercise*)* inDM*:***

All the ancient scholars have described various types of *Vyayama* (physical exercise) in the management of DM.

**1) Various types of exercises according to the financial condition and according to their community:**[28,29]

**1. Exercise for poor diabetics:**It has been said that poor patients who cannot purchase medicines if walk about 100 *Yojana* (appox. 400 km), bare footed, not staying more than one night in the settle place or dig a reservoir of water by himself or wander along with a herd of cows sub sting on the dung, urine etc. of the cows. He should eat only the things available by begging and keeping restraint on his sense organs (adopt the life style of Sage), then there diabetes can be managed.

**2. Exercise for rich diabetics**: Patients of diabetes who are rich and hate consuming medicines or who are who lead a life of comfort and luxury should made to drink *Asava*(fermented infusion) prepared from *Patha*(*Cissampelosparieta Linn.),Abhaya*(*Terminaliachebula*), *Chitraka* (*Plumbagozeylanica Linn.*). Moreover patient should consume r*uksha* (free from fat) foods prepared of *Maricha*(*Piper nigrum*),*Shyamaka*(*Setariaitalica*), *Kodrava*(*Paspalumscrobiculatum Linn*.) processed with honey and should eat fruits like*Amalaki*(*Emblicaofficinalis*),*Kapittha*(*Limoniaacidissima Linn.),Ashmantaka (Bauhinia variegata)*. Powder of dung of camel, mule or ass may be consumed along with *Yusha*(soup) added with *Hingu*(Ferula asafoetida), S*aindhav*(Rock salt) and *Sarsapa*(*Brassica nigra*) and residue with the cattle (domestic animals). They may stay with the cows and eat the above with the urine and faeces of the cow.

Above diet articles are having certain antidiabetic property or low glycemic index. These foods contain high dietary fiber, complex carbohydrate, amino acids and minerals in comparisons to rice or wheat, which encourages in control of high blood sugar and low cholesterol level and thus beneficial in Diabetes mellitus.

Some of the hard and productive exercises prescribed by *AcharyaSushruta*in the greatly increased diabetic conditions are as under:-

1) *Vyayama* (exercises)
2) *Niyuddha* (wrestling/fighting)
3) *Kreeda* (sports/games)
4) *Gajacharya* (to ride on an elephant)
5) *Turangacharya* (to ride on horse)
6) *Rathacharya* (cart riding)
7) *Padaaticharya* (brisk walking) etc.

From the above, it will be seen that the exercises prescribed by the *Acharyas* are very hard and aerobic. This is meant for proper utilization of the fat and consumes the glucose in the body.

In short for diabetics, exercise serves the purposes of (1) Utilizing the fat and (2) Metabolizing sugar fat and carbohydrates, and also proteins. The methods and types of exercise can be changed in the present times according to the strength, age, habitat and complications. As it is mentioned that *Vyayama* (exercise) should be performed after considering age, physique, place, time and diet otherwise one is afflicted with severe disorder[30].

The patient who is *Brahmin* community should adopt the profession of sculptor and carve a chariot of god; others cast should indulge constantly in ploughing fields and digging wells[31].

In the present day civilization, when these types of exercise are not possible, one should regularly play some out- door games, do some productive workshould incorporate some exercise into their daily life, e.g. getting off the bus at a stop before the destination and walking the rest of the way. The use of a pedometer is useful for motivating patients and for determining how much exercise has been performed. The recorded figures should be checked during regular inpatient rounds or in the outpatient clinic, with the goal set at 10,000 steps (or at least 7,500 steps) per day.[1]

## CONSEQUENCES OF OVERINDULGENCE OF *VYAYAMA* (PHYSICAL EXERCISE)

*AcharyaSushruta* [32] has mentioned that a person seeking his/her own well should take physical exercise everyday only to the half extent of his capacity otherwise it may prove fatal. Physical exercise in surplus causes consumption, exertion, exhaustion and thirst, bleeding from different parts of the body, aversion to food, dizziness, cough, fever and vomiting[33-39].

According to several studies, high-intensity exercise is contraindicated in poorly controlled DM. The reason is it may aggravate abnormal carbohydrate metabolism through increased secretion of insulin-counter regulatory hormones such as glucagon and catecholamine. In condition of poorly controlled DM, secretion of these counter regulatory hormones is further increased. Even when diabetes is favorably controlled, low-intensity exercise is recommended[1].

Modern researchers have proved that the risk of sudden cardiac death has been suggested among diabetes patients who have coronary heart disease. Therefore, it is recommended that prior screening for myocardial ischemia is necessary before any

exercise prescription for patients with diabetes [34] . Diabetic adults with complications such as retinopathy, nephropathy and neuropathy may respond with lesser acceptability to exercises compared to diabetic patients without any additional complications[35].

**CONTRAINDICATION**[36-44]

There are some conditions mentioned in *Ayurveda* in which exercise is contra indicated which are as mentioned below.

Exercise is forbidden after meal and the fatigue of sexual intercourse. Person having *Vata-Pitta* diseases, either child or elderly should not perform exercise. Further, individual who is excessive weak, are suffering from indigestion, cachexia, bleeding disorders, dyspnoea and cough also should not practice exercise.

Modern science also documented that brisk walking is contraindicated in patients with diabetic neuropathy, while in people with diabetic retinopathy strength exercise is not allowed. In addition, if the patient has fever, exercise is forbidden. So, before undertaking programs of physical exercise, various medical examinations are needed to determine that patients have good diabetic control and are without progressive complications.[1]

**ROLE OF *VYAYAMA* (PHYSICAL EXERCISE) IN DM FROM MODERN PERSPECTIVE**

Exercise training programs have emerged as a useful therapeutic regimen for the management of type 2 diabetes mellitus (T2DM). Majority of the Western studies highlighted the effective role of exercise in T2DM. It is well established that physical activity produces general and specific health benefits for diabetic patients [37] . Several studies [38 -50],[31] have fully documented the beneficial role of exercise and have been incorporated systematically in the treatment of patients with diabetes.

Fourteen randomized controlled trials comparing exercise against no exercise in Type 2 DM were identified, involving 377 participants. Trial durations ranged from eight weeks to 12 months. Compared with the control, the exercise intervention significantly improved glycemic control as indicated by a decrease in A1C levels of 0.6 percent (−0.6; 95% confidence interval [CI], −0.9 to −0.3; $P < .05$). This result is statistically and clinically significant.[51]Another study revealed that a combination of aerobic and resistance exercise training may be more effective in

improving blood glucose control than either alone.[52]

More in detail, exercise has a significant role in the regulation of blood glucose, improves insulin action, metabolism of proteins and fats, prevents complications of diabetes, improves muscle flexibility and strength, has beneficial effects on the cardiovascular system and increases life expectancy of the patients. In addition, physical activity is beneficial for the mental state of the individual, because it increases the energy of the human body, improves self-esteem and decreases depression[46-50].

**BASIC PRINCIPLES OF EXERCISE**[1]

The basic principles of an effective exercise program are the intensity, duration and frequency of exercise in an appropriate environment. Usually, low-intensity and long-duration exercise programs are considered the most suitable for diabetic patients.

**TYPE AND INTENSITY OF EXERCISE**[1]

Recommended types of exercise are aerobic exercises that use muscles throughout the body, such as walking, jogging, radio gymnastic exercises, stationary bicycle exercise and swimming are more useful in improving the in vivo insulin sensitivity than anaerobic exercise (resistance exercise) like weightlifting. However, mild resistance exercise, if carried out in an aerobic manner, is also useful for improving insulin sensitivity in patients with type-2 diabetes and in the elderly. If resistance exercise/anaerobic is adopted, the level of the load should be low.

The effect of exercise that manifests in improved insulin sensitivity decreases within 3 days after exercise, and is no longer apparent after 1 week. Regular moderate or lower intensity exercise is preferable.

**PRECAUTIONS IN IMPLEMENTING PHYSICAL EXERCISE**[1]

1. If diet therapy is not followed, good control of blood glucose will not be achieved. Dietary restrictions should be instructed.
2. Usually, exercise should be performed after meals.
3. If exercise extends over a prolonged period of time, dietary supplementation is necessary before, during, and after exercise.
4. If hypoglycemia occurs during exercise, glucose dissolved in lukewarm water should be taken. Cookies, cheese and milk are suitable before and after exercise to prevent hypoglycemia.

5. In patients on insulin therapy, the insulin dose should be reduced prior to exercise.

6. General precautions including the use of sports shoes and incorporation of warm-up and cool-down exercises should be given.

## CONCLUSION

As it is mentioned in *Ayurveda* and also modern researchers have also provided enoughevidence, that *Vyayama* (physical exercise) plays a crucial role in the prevention and management of DM-type 2. Physical exercise in conjunction with therapeutic management is one of the key components in ensuring adequate control of blood sugar in diabetic patients. Thus, ensures a comprehensive strategy for appropriate prevention as well as management of DM-type 2. It is the matter of encouragement to adopt increase of physical activity in conjunction with healthy dietary choices and avoid sedentary behavior is a successful public health approach for type II diabetes mellitus prevention and management.

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