



Effect of aerobic exercises, specially walking on BMI and different parameters of Diabetic control

KEYWORDS

Physical activity (PA), Type 2 Diabetes Mellitus (T2DM), Aerobic Exercise, Walking.

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ABSTRACT

Background: Physical activity, including appropriate endurance and resistance training, is a major therapeutic modality for type 2 diabetes. Unfortunately, too often physical activity is an underutilized therapy. Favorable changes in glucose tolerance and insulin sensitivity usually deteriorate within 72 h of the last exercise session; consequently, regular physical activity is imperative to sustain glucose-lowering effects and improved insulin sensitivity. Although physical activity (PA) is a key element in the prevention and management of type 2 diabetes, many with this chronic disease do not become or remain regularly active. High-quality studies establishing the importance of exercise and fitness in diabetes were lacking until recently, but it is now well established that participation in regular PA improves blood glucose control and can prevent or delay type 2 Diabetes. **Objective:** To determine the effect of aerobic exercises (i.e. walking) on BMI & different parameters of diabetic control. **Materials and Methods:** 100 people were divided in 2 groups selected from MOPD of KPC Medical College & Hospital, Jadavpur, of these 50 diabetic people with 40-60 yrs. of age were included in a group who were doing aerobic exercises for 3 months considered as study group and rest 50 patients with diabetes received no exercise instructions, considered as control. **Results:** The group of diabetic patients who were participated in walking program, after 1 ½ months of walking changes in BMI were not statistically significant, though after 3 months of doing exercise, changes in BMI were statistically significant as compare to the other group. Similarly, the group of diabetic patients who participated in walking program for 3 months shows statistically significant change in plasma fasting and postprandial glucose with improved glycemic control. **Conclusions:** Physical activity specially walking affords significant benefit for those with type 2 diabetes which is clearly emerges from this study.

Introduction:

Type 2 Diabetes Mellitus (T2DM) is an epidemic affecting millions of people worldwide constituting nearly 90% of the diabetic population in any country [1]. India, the world's second populous country, now has more people with T2DM (more than 50 million) than any other nation [2]. The primary driver of the epidemic is rapid epidemiological transition associated with change in dietary patterns and decreased physical activity as evident from a higher prevalence of diabetes in the urban population [3]. T2DM is preventable by lifestyle changes and to a lesser extent, medications [4]. Aerobic training has been promoted as the most effective mode of exercise for treating T2DM with improvements in lipid profiles and insulin sensitivity [5]. Older adults with T2DM are advised to undertake exercises that maintain or improve balance as a means of increasing joint range of motion and reducing risk of injury [6]. A well planned program will optimize the likelihood of a safe and effective response by addressing what types of exercise can be performed and how much exercise is recommended [7]. Walking appears to be the preferred activity among sedentary individuals taking up physical activity [8]. Tools to assist in the monitoring of physical activity and enhanced motivation may play an important role in changing exercise behaviors [9]. Dunn et al., 1999 [10] found both lifestyle and structured interventions produced significant and comparable beneficial changes in physical activity, cardiorespiratory fitness, blood pressure and percentage of body fat. With continued increase in the growth of numbers of T2DM individuals, importance of physical activity has caught importance for the management of this disease. Studies have shown the effectiveness of physical activity protocols, like 30-40 minutes of moderate intensity walking in T2DM [11]. Therefore, the purpose of present study was to evaluate the effectiveness of walking on BMI and different parameters of diabetic control.

The diagnosis and classification of diabetes have been revised by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus [12]. The new classification system emphasizes etiology and pathogenesis rather than modalities of treatment.

Diabetes is divided into four major categories depending on etiology: type 1, type 2, gestational, and other specific types. In type 1 diabetes, the final common pathway is beta cell destruction by autoimmune processes, which leads to insulin deficiency. Type 2 diabetes is characterized by varying degrees of insulin resistance and relative insulin deficiency. Gestational diabetes is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The final category includes diabetes due to specific genetic defects, medications, and other diseases [12].

Guidelines for diagnosing diabetes have also been revised and are much simpler than the previous scheme. The new diagnostic criteria reflect more closely the prevalence of microvascular complications specific for diabetes. One of three criteria must be met for the diagnosis of diabetes:

- 1) A fasting plasma glucose = 126 mg/dl;
- 2) Symptoms of diabetes such as polyuria, polydipsia and unexplained weight loss plus a casual plasma glucose of 200 mg/dl or more; and
- 3) 2-h plasma glucose = 200 mg/dl during an oral glucose tolerance test using 75 g of glucose. If there is no acute metabolic decompensation, these criteria should be confirmed on a different day [12].

Both genetic and environmental factors have been implicated in the etiology of type 2 diabetes. There is a strong genetic predisposition for this type of diabetes although the exact genetic defects are not currently well defined [12]. Among the risk markers for the disease are older age, obesity, minority ethnicity, family history, and lower socioeconomic status [13]. Along with overall obesity, fat distribution (specifically, intra-abdominal fat distribution) predicts type 2 diabetes. Lifestyle factors that are implicated in the development of type 2 diabetes are physical inactivity and more inconsistently, diet, and parity [14]. Type 2 Diabetes is a dynamic disease in which individuals often become more insulin deficient with time.

The goal of treatment in type 2 diabetes is to achieve and maintain near-normal blood glucose levels and optimal lipid levels, in order to prevent or delay the microvascular, macrovascular, and neural complications [15]. Because exercise improves insulin sensitivity (diminishes resistance), it is a logical treatment modality. Exercise also modifies lipid abnormalities and hypertension. Additionally, physical activity is an underutilized mode of therapy for type 2 Diabetes, often due to lack of understanding. This position stand provides a breadth and depth of information that should facilitate understanding and use of exercise in the management of type 2 diabetes.

Acute Effects of Exercise/Physical Activity

Physical activity is one of the principal therapies to acutely lower blood glucose in type 2 diabetes due to its synergistic action with insulin in insulin-sensitive tissues. Abnormal insulin secretion and peripheral insulin resistance [16] are primary factors that influence the acute effects of physical activity on metabolic responses in those with type 2 diabetes. In addition, oxygen delivery to peripheral tissues in type 2 diabetic individuals may be impaired during acute bouts of graded exercise, [17, 18] as the rate of oxygen consumption during submaximal and maximal workloads is significantly lower than age- and activity-matched persons without diabetes [19]. Hence, functional capacity of those with type 2 diabetes is frequently lower than age-matched nondiabetic counterparts [18]. Acute bouts of physical activity can favourably change abnormal blood glucose and insulin resistance.

Blood glucose reduction during physical activity is attributed to an attenuation of hepatic glucose production, whereas muscle glucose utilization increases normally [20, 18]. Reduced hepatic glucose production may include a negative feedback mechanism associated with sustained insulin levels during exercise and elevated glucose levels before activity.

In our study we tried to show PA definitely improves Fasting, Post prandial, random blood glucose level. It also affect in change of BMI to better side.

MATERIALS & METHODS:

This study was carried out in the Medicine OPD of KPC Medical College & Hospital, Jadavpur.

100 people were divided in 2 groups selected from MOPD of KPC Medical College & Hospital, Jadavpur, of these 50 diabetic people with 40-60 yrs of age were included in a group who were doing aerobic exercises for 3 months considered as study group.

Rest 50 patients with diabetes received no exercise instructions, considered as control.

The inclusion criteria were as follows:

- (i) \geq 1 year diagnosis of type 2 diabetes
- (ii) Not taking insulin
- (iii) No physical activity limitation
- (iv) Were not enrolled in any other physical activity program previously or simultaneously.

Exclusion criteria were disease or condition e.g. any evidence of coronary artery disease, uncontrolled hypertension, diabetic complications and moderate-severe orthopedic/ cardiovascular/respiratory condition that would interfere with physical activity.

As per ADA guidelines the people in study group should perform a minimum of 150 minutes of moderate aerobic exercise each week, spread over at least 3 days of the week, with no more than 2 consecutive days without exercise.

Measurements of Fasting, Post prandial, random blood glucose level of subjects of both groups were measured at beginning, after one and half months, after three months.

Anthropometric measurements of subjects were done, i.e. Weight in kg, height in meter and body composition (BMI-Kg/m²) done in accordance with standardized anthropometric protocol.

Results & Analysis

In the present study, majority of subjects aged 40 – 60 years reported having diabetes for more than 5 years.

Table 1 shows comparison of change in BMI (Body mass index) in patients who are doing exercises regularly according to ADA protocol. It is observed from this table 1 that P value is 0.02423 i.e. significant $p \leq 0.05$ after doing Paired t test performed after 3 months of exercise in test group.

Table 2 shows comparison of change in BMI (Body mass index) in patients who are not doing exercises regularly according to ADA protocol. It is observed from this table 2 that P value is 0.006744 i.e. significant $p \leq 0.05$ after doing Paired t test performed after 3 months in control group. So BMI After 3 months is increased in control group in contrast to Test group.

Whereas, Table 3 shows variation of fasting plasma glucose in patients who are doing exercises as per study schedule. Subsequently, Paired t test is performed after 3 months and p value is ≤ 0.00001 , which is significant in this study.

Similarly, Table 4 shows variation of fasting plasma glucose in patients who are not doing exercises as per study schedule. Subsequently, Paired t test is performed after 3 months and p value is 0.000132, which is significant.

Again, Table 5 shows comparison of change in PPG in patients who are doing exercises regularly according to ADA protocol. It is observed from this table 5 that P value is ≤ 0.00001 , i.e. significant $p \leq 0.05$ after doing Paired t test performed after 3 months of exercise in test group.

Table 6 shows comparison of change in PPG in patients who are not doing exercises regularly according to ADA protocol. It is observed from this table 6 that P value is ≤ 0.00001 , i.e. significant $p \leq 0.0$ after doing Paired t test performed after 3 months of exercise in test group.

DISCUSSION

Diabetes has emerged as a major healthcare problem in India and it is only next to China which leads world in number of diabetics [28]. In the Diabcare Asia Study (1998), it was observed that, of all the patients with diabetes who were taking treatment from specialized centers, more than 50% of patients were on diet therapy, 59.9% were receiving oral antidiabetic agents, 22% of patients were taking insulin and 19% were on both insulin and oral drugs [29].

Diabetes mellitus is reaching potentially epidemic proportions in India. The level of morbidity and mortality is growing day by day for this disease.

Walking appears to be the preferred physical activity among sedentary individuals with diabetes. It improves glucose utilization in people with T2DM. The focus on physical activity for control of diabetes and its complications is lacking in India.

The aim of this present study was to determine the effectiveness of aerobic exercise specially walking in the relation of T2DM.

As Table 1 shows that the group of diabetic patients who participated in walking program, after 1 ½ months of walking changes in BMI are not statistically significant, though after 3 months of doing exercise changes in BMI are statistically significant.

In contrast, Table 2 shows that, the patient who was not doing exercises, eventually BMI was increased which was statistically significant. So exercise changes BMI in significant level.

It is observed from Table 3 that the group of diabetic patients who participated in walking program for 3 months shows statistically significant change in fasting plasma glucose with improved glycemic control.

On the other hand, Table 4 shows that diabetic people not participated in walking program at all for 3 months shows statistically significant increase levels of fasting plasma glucose with poor glycemic control.

Similarly, Table 5 shows diabetic patients who participated in walking program for 3 months have statistically significant change in post prandial plasma glucose level with improved glycemic control.

In contrast, Table 6 shows that diabetic patients who were not participated in walking program shows statistically significant increase in post prandial plasma glucose level with poor glycemic control.

Conclusion

Physical activity specially walking affords significant benefit for those with type 2 diabetes which is clearly emerges from this study. It is obvious that treatment of diabetes always includes a combination of exercise, proper diet, life style modification and of course with medication. Aerobic training specially walking promoted as the most effective mode of exercise for treating T2DM.

Till date, The American College of Sports Medicine and the American Diabetes Association have recommended exercise for improvement of glycemic control. Unfortunately, physical activity is underutilized in the management of type 2 diabetes. This may be due to lack of understanding and/or motivation on the part of the person with diabetes and lack of clear ideas, encouragement, and follow-up by health care professionals. Several factors including muscle fiber composition, low capillary density, obesity, and older age require that physical activity be initiated at lower intensity/duration and be increased gradually to reduce risks and contribute to maintenance of physical activity by those with type 2 diabetes. Attention to the patient's stage of readiness and factors that will encourage adoption and maintenance of regular physical activity are extremely important for successful use of physical activity as a therapeutic intervention. Health care professionals must address physical activity more seriously in this patient population because most people with type 2 diabetes have the potential to derive benefits from regular, moderate levels of physical activity.

The findings of this study would help clinical practitioners, diabetologists and physical therapist to have a better idea, how physical activity is affecting type 2 diabetes individuals in improving different aspects of treatment satisfaction.

Tables

Table 1: Showing comparison of change in BMI (Body mass index) in patients who are doing exercises

Mean value of BMI before start of exercise	Mean value of BMI after 1 ½ months of exercise	Mean value of BMI after 3 months of exercise
24.62Kg/m ² 24.47 Kg/m ² 24.34 Kg/m ²		

Table 2 Showing comparison of change in BMI (Body mass index) in patients who are not doing exercises

Mean value of BMI before start of exercise	Mean value of BMI after 1 ½ months	Mean value of BMI after 3 months
24.8Kg/m ² 24.9 Kg/m ² 25.07 Kg/m ²		

Table 3 Showing variation of fasting plasma glucose in patients who are doing exercises

Mean value before start of exercise	Mean value after 1 ½ month	Mean value after 3 months
164.7mg/dl 136.7 mg/dl 112.4 mg/dl		

Table 4 Showing variation of fasting plasma glucose in patients who are not doing exercises

Mean value before start of exercise	Mean value after 1 ½ month	Mean value after 3 months
147.1mg/dl 158.9 mg/dl 173.8 mg/dl		

Table 5 Showing comparison of change in PPG in patients who are doing exercises regularly

Mean value before start of exercise	Mean value after 1 ½ month	Mean value after 3 months
240.4mg/dl 196.5 mg/dl 165.8 mg/dl		

Table 6 Showing comparison of change in PPG in patients who are not doing exercises

Mean value before start of exercise	Mean value after 1 ½ month	Mean value after 3 months
187mg/dl 202 mg/dl 225.5 mg/dl		

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