Original Article

Association of Physical Activity with Blood Glucose Levels in Type 2 Diabetes Mellitus

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ABSTRACT

Objective: To study the association of physical activity with blood glucose levels (FPG) and (RPG) in type 2 diabetes mellitus.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Biochemistry Ayub Medical Complex, Abbottabad from June 2014 to Feb 2015.

Materials and Methods: For this purpose a cross-sectional study was designed and carried out at Ayub Medical Complex, Abbottabad to ascertain the association of physical activity with blood glucose levels in a subjects having type 2 diabetes. The study involved 200 known type-2 diabetics (20 to 80 years), both males and females were selected randomly. Physical activities levels (self-reported) were measured on the basis of present public health standards. The fasting and random blood glucose profile was determined.

Results: Statistical analysis was done using SPSS version 20. Mean ±SD, CV% were determined for age; height, weight, BMI, fasting plasma glucose, random plasma glucose, and physical activity. Association between physical activity level and both fasting and random blood glucose levels were determined by Pearson's correlation coefficient (r). Negative relationship was seen for physical activity ($p>0.005$). Poor glycemic levels were observed in case of our study subjects for FPG (139.3mg/dl) and RPG (207.6mg/dl).

Conclusion: In our study, we have established importance of associations of glycemic levels both fasting and random with physical activity.

Key Words: Diabetes mellitus, physical activity, fasting plasma glucose, random plasma glucose.

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INTRODUCTION

Diabetes Mellitus is a chronic disease that is linked to increased glycemic levels in blood this results either from decreased synthesis of insulin or failure of the body to utilize its own insulin[1].In type 1 diabetes (IDDM) pancreatic β-cells are destroyed by an autoimmune process[2]. Type 2 diabetes is the most common and predominant type. In this condition, the levels of insulin are inconstant and the resistance is also not persistent, initially high circulating insulin but the relationship between β-cell injury and resistance to the insulin is not clear[3]. Many patients of type 2 diabetes display beta cell dysfunction with the passage of time and eventually need insulin for glycemic control[4].

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The diagnosis of diabetes mellitus is based on the characteristic clinical features of hyperglycemia[5]. These are thirst, excessive urination, blurring of vision and laboratory report of post-prandial glucose concentration of 200 mg/dl (11.1mmol/L) or higher and is performed on different occasions. In type 2 diabetes, genetic association has a key role in impaired secretion and resistance to insulin but can also be affected by behavioral and environmental factors both in positive and negative way[6]. Diabetics are at increased risk of having macro-vascular complications including ischemic heart disease, cerebrovascular disease and peripheral vascular disease, and also micro-vascular complications such as retinopathy, nephropathy, and neuropathy, these may cause tissue or organ damage[7]. Following factors help to prevent type-II diabetes: diet, physical activity, weight reduction, smoking cessation and drug therapy[8]. Diabetes can be prevented by effective lifestyle intervention[9]. Physical activity (exercise) in patients with diabetes mellitus reduces cardiovascular risk and mortality and weight management[10]. The protective effect of physical activity on the development of diabetes is primarily linked to improved insulin sensitivity and glucose metabolism[11]. Modern physical activity standards mention practical, consistent and moderate to rigorous

programs for activity, this criteria recommends that minimum five sessions in a week with physical activity of moderate nature without any particular heart rate targets is effective[12]. There are different types of physical activities, and they have positive and varied effects on human subjects, aerobic exercise decreases high levels of blood glucose and also decreases LDL cholesterol by five percent[13]. Exercise may be useful apart from its impact on weight reduction by specially targeting abdominal fat, at least in women[14]. Exercise is recommended as a minimum standard of 30 minutes per day of moderate-intensity such as brisk walking [15]. Increasing the activity beyond that improves the healthy effect[16].

MATERIALS AND METHODS

A cross-sectional study was done in Ayub Medical Complex, Abbottabad. Convenient technique was used to sample two hundred, already diagnosed diabetes patients fulfilling the American Diabetes Association standards for diabetes (American Diabetes Association, 2013) were selected for the study. Previously registered two hundred known type 2 diabetic patients (20 to 80 years) of both sex admitted in medical wards and those visiting the outpatient department were selected. Informed consent was obtained from each study subject. Subjects excluded were individuals with age less than 20 years, mental disorder, other hormonal disorders, Pregnant and lactating diabetic women.

A questionnaire method was used and useful data was collected by using well designed questionnaire, especially for bio-data in which valid questions related to demographic information including name, gender, age, height, weight, BMI and physical activity levels were added. Self-reported physical activity levels were designed and found out using public health standards. The subjects were divided into three categories, Sedentary (subjects who did less than 30 minutes brisk walk (minimum 5sessions/week), moderately active level(30 minutes brisk walking with 5sessions/week) and Active level (more than 5sessions in a week or exercise of any nature). Information regarding family history of diabetes (Yes/No), past history, medical history(Oral/Insulin/Nil), medication use, and symptoms of diabetes mellitus were mentioned in the same very questionnaire. Fasting plasma glucose and random plasma glucose levels were also recorded in the same form. Blood samples were collected after an overnight fast of about 8-10 hours. Then, the patients were directed to have breakfast and come for sample collection after 2hrs, postprandial blood glucose estimation was done as well.

RESULTS

Maximum 200 subjects were included in the study. All the patients were diagnosed (known) cases of type 2 diabetics. 41.89 ± 14.87 was the mean age of study subjects. Frequency with maximum 75 and minimum was 20. The variability co-efficient of was 35.49%. The mean weight of diabetics was 69.05 ± 9.02. The variability CV % was 13.06%. The frequency was 92 at highest while the lowest frequency was 45. The mean height was 2.69± 0.34. The highest to lowest frequency range was 3.53 to 1.61. The coefficient of variability, CV% was 12.6%. The mean physical activity was 1.71 ± 0.79. The variability coefficient CV% was 46.7 as shown in Table 1 and Figure 1.

Table No. 1: Frequency distribution of Physical Activity

	Frequency	Percent	Valid Percent	Cumulative Percent
Sedentary	101	50.5	50.5	50.5
Mod. Active	56	28	28	78.5
Active	43	21.5	21.5	100
Total	200	100	100	

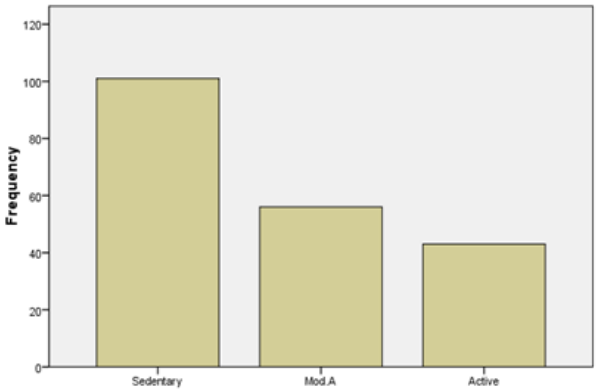

Figure No. 1: Frequency Distribution of Physical Activity Among Study Subjects.

Table No. 2: Pearson Correlation Co-efficient of FPG with BMI and Physical Activity

S.No	Variables	Pearson Correlation Co-efficient	P-Values
1	BMI(kg/m²)	0.199	0.002
2	Physical Activity	-0.369	0.000

Table 3: Pearson correlation coefficients of RPG with BMI and physical activity

S.No	Variables	Pearson Correlation Co-efficient	P-Values
1	BMI(kg/m²)	0.055	0.003
2	Physical Activity	-0.239	0.001

The Pearson's coefficients for fasting and Random glucose levels were (r = -.369 and r =-.239) respectively as shown in Table 2 and Table 3 respectively. Inverse associations were found significant $p < 0.005$ for both the variables.

DISCUSSION

Diabetes mellitus is becoming a widespread and epidemic problem throughout the globe mainly because of the increasing prevalence and incidence of type 2 diabetes[17]. Type 2 diabetes has touched epidemic extents worldwide and in Pakistan[18]. It brings with it an increased mortality risk, multiple co-morbidities, decreased quality of life and a significant economic burden.[19] In the development of type II diabetes, two factors play an important role i.e i.e. genetics along with environmental factors[20]. Positive effects of physical activity are very vital and important for the patient suffering with type 2 diabetes[21], because recent studies reinforce on the significance of persistent and long term physical activity programs for the prevention and treatment of this metabolic disorder and its complications[22]. Recently a study suggests that vigorous exercise is crucial in improving insulin sensitivity[23].

Our study has shown significant inverse association ($r = -0.369$, $p < 0.005$) of FPG (139.3±23.9) with physical activity and an inverse association ($r=-0.55$, $p < 0.005$) of physical activity for RPG (207.6 ± 28.5). In our study subjects were mostly sedentary. This was in accordance to a study which found that physical activity was inversely associated ($r = -0.26$, $p = 0.037$) with RPG for males and ($r = -0.22$, $p = 0.016$) for females but not with fasting plasma glucose ($p = 0.323$)[24]. Also clinical trial observed no significant response in case of FPG ($p>0.005$) following exercise training while poor HbA1c (7.5%) was observed in those with no intensive activity[25]. Studies revealed that physical activity of moderate level (both male and female) was not related to the fasting plasma glucose ($p>0.005$) levels but was related to the random blood glucose level ($p < 0.005$)[26]. The usefulness of physical activity in prevention of diabetes has been confirmed and verified in many studies. Regular moderate physical activity (brisk walking) compared with being sedentary (RR 0.69, 95% CI 0.58-0.83) is related to a lower risk of developing diabetes was reported in a meta-analysis of ten prospective cohort studies of diabetes type 2 and physical activity[27]. Nurse's Health study carried out research on females who were very active as per their report, and were clinically diagnosed cases of diabetes showed two-third less new cases as compared to women who were less active. Some studies which are are multifactorial, targeting several activities including physical activity, but include many behavioral changes that also involve alterations in diet and weight loss emphasis or management.[28]

CONCLUSION

Our study, we have established an important role of associations of physical activity with glycemic levels both fasting and random. Our study population consisted of mostly young males, who reported themselves as sedentary, as a result our study population showed uncontrolled diabetes mellitus predisposing themselves to various complications.

Recommendation:

Based upon these conclusions, it is recommended that So, a healthy, active and responsible lifestyle is essential for the effective diabetes control.

Author's Contribution:

Concept & Design of Study:	Sofia Shoukat
Drafting:	Madeeha Jaddon, Uzma Faryal
Data Analysis:	Javeria Saqib
Revisiting Critically:	Sofia Shoukat, Madeeha Jaddon
Final Approval of version:	Sofia Shoukat

Conflict of Interest: The study has no conflict of interest to declare by any author.

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