



Association of Physical Activity and Complications of Diabetes among Patients Having Type 2 Diabetes Miletus

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ABSTRACT

Objective: To assess the physical activities and complications of diabetes among patients having type 2 diabetes mellitus (T2DM).

Methods: We conducted a cross-sectional study inpatients having (T2DM) to measure the effect of physical activity and development of complication among the patients.

Results: Most of patients having (T2DM) were elderly female with the low standard level of living. Just one-quarter of them was performing exercises and they had poor Diabetes control evident by the high blood glucose level the increasing levels of HbA1c, increase levels of total cholesterol and High-Density Lipoprotein. The reported complications included: retinopathy (30 %), neuropathy (25 %), cardiovascular system diseases (13 %), blood vessel diseases (9%) and nephropathy (6 %) respectively.

Conclusions: Physical activity carries significant benefits offered to patients having (T2DM) and there is a need to address physical activity and prescribed it to the patients to prevent, control and postpone the appearance of the complication of the (T2DM).

Key Words: Complication of Diabetes, Physical Activity, Type 2 Diabetes Miletus

INTRODUCTION

Nowadays, Diabetes constitutes a widespread epidemic(1). World Health Organization (WHO) data revealed an increase in the number of people having Diabetes from 108 million in 1980 and reaching 422 million in 2014. And it is accounted as a major cause of heart attacks, stroke, blindness, kidney failure and lower limb amputation. The risk factors for Diabetes include insufficient physical activity, rising levels of obesity, and sedentary life(2,3). When Diabetes occurred, a lot of intervention can be undertaken like adequate treatment, regular physical exercises, regular screening and adequate treatment for complications(4). Exercise training carries a lot of benefits extending from improving glucose level, cardiorespiratory fitness, cardiovascular risk, body composition,

physical well-being and functioning in patients having (T2DM) or pre-Diabetes(5).

Exercises and Complications of Diabetes

Macrovascular and microvascular complications of Diabetes are prevalent in (T2DM)(6). The long term microvascular complications usually appear in poorly controlled patients. Vascular Disease: Diabetes carries a major risk factor that related to the development of cardiovascular disease. The risk of myocardial infarction (MI) is greater in patients having Diabetes and need to treat and consider seriously(7).

Peripheral Neuropathy: It is a special form of neuropathy that affects the extremities of the patients, more in the lower legs and feet(8,9) it affects patient and leads to loss of distal

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sensation and the patient will be prone to musculoskeletal injury and infections. Regarding the exercises, it's recommended that non-weight-bearing training should be applied by patients having peripheral neuropathy in order to relieve trauma and irritation to the lower extremities of the patient(10,11).

Nephropathy: High blood pressure is a well-known complication of Diabetes and it worse kidney functions of the patient(10), but, it needs to be proven whether exercise-induced high blood pressure can lead to the progression of nephropathy. physical activity may help to deal with some factors like blood glucose level and blood pressure, which may lead to the progression of nephropathy in patients having (T2DM)(12,13).

Retinopathy: Although exercise training carries risk of increasing systemic and retinal blood pressures, but some studies found that there were no clear associations between physical activity and the development or progression of proliferative retinopathy(14). Bernbaum and associates(15) revealed that there was an improvement in cardiovascular function(15%) in patients who performed a low-intensity training program and having diabetic proliferative retinopathy. It is recommended that the systolic blood pressure should be limited to 20–30 mm Hg above the baseline in each training session(16).

The Aim of this study was to assess the physical activities that are undertaken by patients having type II diabetes attending the Academy Charity Teaching Hospital (ACTH) in Khartoum State, Sudan 2015.

METHODS

This study is a cross-sectional hospital based study conducted during the period from 10th June to 10th July 2015 in (ACTH) Khartoum, Sudan. We included all patients having (T2DM) and whom were attending (ACTH) during the study period and whom were adult <20 years and having (T2DM) (fasting blood glucose 126 ml/dl, or if he/she on oral anti diabetic drugs). Total number of included subjects was 100 patients having (T2DM). We undertook direct interviews with the patients in the outpatient clinic using pre-coded questionnaire that included socio-demographic data, allocation of physical activities in time and frequency. Then we applied examination of the patients' Blood Pressure, reported the complications of diabetes and obtained the investigations (Fast Blood Sugar FBS, Haemoglobin A1c HbA1c, High Density Lipoprotein (HDL) levels and cholesterol) with routine and standard laboratory procedure.

Data analysis: Data was collected, checked for errors and analysed using statistical package of social sciences SPSS. Frequencies and cross tabulation and presentation of data

were performed accordingly.

Ethical consideration

Before interviewing of any patient, consent was obtained and the collected data were kept confidential. Also a declaration letter from the research committee of Community Department at University of Medical Sciences and Technology were obtained to undertake the study.

RESULTS

The majority of patients having (T2DM) were elderly female with the low standard level of living. Just one-quarter of them was performing exercises in their lives as shown in table 1. The data showed that the majority of the patients had poor Diabetes control as shown in table 2. Regarding the complications of Diabetes, the data showed that the majority of the patients developed diabetic complications in various pattern; the most obvious complications were Retinopathy followed by Neuropathy, cardiovascular system diseases (CVS), blood vessel diseases and Nephropathy as shown in table 3. We found that performing exercises had statistical significant associations with Blood Glucose Level ($p=0.006$), level of (HbA1c)($p=0.012$) and total Cholesterol levels ($p=0.014$) as shown in table 4, 5 and 6. We found that performing exercises had no statistical significant association with the (HDL) levels ($p=0.588$) as shown in table 7. The complications of diabetes among the patients not performing exercises regularly were increases more than the patients who performing exercises regularly as shown in figure 1.

DISCUSSION

In this study, we analysed the data of total number of 100 patients seen in the hospital along period of two months. According to these data, the control of the diabetes exerts a problem with the patients and this poor control was evident by the high blood glucose level and (HbA1c) along with the increased levels of total cholesterol and (HDL). Regarding the development of the complications of Diabetes, it seems to be expected when it compared with the poor control of glucose levels, and these results were corresponding to the previous one (17). The blood glucose, (HbA1c) and total Cholesterol levels of the patients who were performing exercises seem to be more controllable than the patients who didn't performing regular exercises, and these results match the pervious generated evident(18). On the other hand, (HDL) levels failed to exert a statistical significant association with performing physical exercises. And this may be due to the small portion of the patients performing the blood test for (HDL) levels at this study. These data obviously concentrates in presenting the effects of performing exercises and development of

complications of Diabetes in patients having (T2DM) and these data implies the increase numbers of complications of Diabetes in patients not performing exercises regularly in comparison with patients performing exercises. According to these findings, we assume that regular exercises can delay the onset of the occurrence of the complications of the diabetes in patients having (T2DM).

CONCLUSION

Physical activity carries significant benefits offered to patients having (T2DM). And there is a need to address physical activity and prescribed it to the patients because the physical activity exerts its beneficial effects in preventing, controlling and post pond the appearance of the complication of the (T2DM). Also, motivation of the patients and follow-up by the health care professionals is required.

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Conflicts of interest

The authors declare that there is no conflict of interests.

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REFERENCES

1. Facts F, Diabetes ON. National Diabetes Fact Sheet. Centers Dis Control Prev US Dep Heal Hum Serv. 2011;CS217080A(Division of Diabetes Translation):1–12.
2. Chen L, Magliano DJ, Balkau B, Colagiuri S, Zimmet PZ, Tonkin AM, et al. AUSDRISK: An Australian Type 2 Diabetes Risk Assessment Tool based on demographic, lifestyle and simple anthropometric measures. *Med J Aust.* 2010;
3. Venables MC, Jeukendrup AE. Physical inactivity and obesity: links with insulin resistance and type 2 diabetes mellitus. *Diabetes Metab Res Rev* [Internet]. 2009;25(S1):S18--S23. Available from: <http://dx.doi.org/10.1002/dmrr.983>
4. Balducci S, Iacobellis G, Parisi L, Di Biase N, Calandriello E, Leonetti F, et al. Exercise training can modify the natural history of diabetic peripheral neuropathy. *J Diabetes Complications.* 2006.
5. Snowling NJ, Hopkins WG. Effects of different modes of exercise training on glucose control and risk factors for complications in type 2 diabetic patients: A meta-analysis. *Diabetes Care.* 2006;29(11):2518–27.
6. Statement C. Role of Cardiovascular Risk. 1989;12(September):573–9. Available from: <http://care.diabetesjournals.org/content/diacare/12/8/573.full.pdf>
7. Haffner SM, Lehto S, Rönnemaa T, Pyörälä K, Laakso M. Mortality from Coronary Heart Disease in Subjects with Type 2 Diabetes and in Nondiabetic Subjects with and without Prior Myocardial Infarction. *N Engl J Med* [Internet]. 1998 Jul 23;339(4):229–34. Available from: <http://dx.doi.org/10.1056/NEJM199807233390404>
8. Albers JW, Brown MB, Sima AAF, Greene DA. Frequency of median mononeuropathy in patients with mild diabetic neuropathy in the Early Diabetes Intervention Trial (EDIT). *Muscle and Nerve.* 1996;19(2):140–6.
9. Fluckey JD, Hickey MS, Brambrink JK, Hart KK, Alexander K, Craig BW. Effects of resistance exercise on glucose tolerance in normal and glucose-intolerant subjects. *J Appl Physiol.* 1994;77(3):1087–92.
10. Graham C, Lasko-McCarthy P. Exercise options for persons with diabetic complications. *Diabetes Educ.* 1990;16(3):212–20.
11. Vinik AI, Erbas T. Recognizing and treating diabetic autonomic neuropathy. Vol. 68, *Cleveland Clinic Journal of Medicine.* 2001. p. 928–44.
12. Kang J, Robertson RJ, Hagberg JM, Kelley DE, Goss FL, DaSilva SG, et al. Effect of exercise intensity on glucose and insulin metabolism in obese individuals and obese NIDDM patients. *Diabetes Care.* 1996;19(4):341–9.
13. John L, Rao PS, Kanagasabapathy AS. Rate of progression of albuminuria in type II diabetes. Five-year prospective study from south India. *Diabetes Care* [Internet]. 1994;17(8):888–90. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/7956637>
14. Cruickshanks KJ, Moss SE, Klein R, Klein BEK. Physical Activity and the Risk of Progression of Retinopathy or the Development of Proliferative Retinopathy. *Ophthalmology* [Internet]. 2017 Feb 19;102(8):1177–82. Available from: [http://dx.doi.org/10.1016/S0161-6420\(95\)30893-7](http://dx.doi.org/10.1016/S0161-6420(95)30893-7).
15. Bernbaum M, Albert SG, Brusca SR, Drimmer A, Duckro PN, Cohen JD, et al. A model clinical program for patients with diabetes and vision impairment. *Diabetes Educ.* 1989;15(4):325–30.
16. Vitug A, Schneider SH, Ruderman NB. Exercise and type I diabetes mellitus. *Exerc Sport Sci Rev* [Internet]. 1988;16(4):285–304. Available from: <http://www.sciencedirect.com/science/article/B7RM4-4G7WH7M-9/2/4f16c4b28561cb3c82d0db402d3035aa>
17. Rosengård-Bärlund, Milla, Heikkilä, Outi, Lakka TA, Tikkanen, et al. Physical Activity and Diabetes Complications in Patients With Type 1. *Diabetes Care*; Feb. 2008;31(2).
18. Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, Rubin RR, et al. Exercise and type 2 diabetes: The American College of Sports Medicine and the American Diabetes Association: Joint position statement. *Diabetes Care.* 2010.

Table 1: Shows the demographic characteristics of the patients and their usage of exercises (N= 100).

Age	Gender	Socio Econom-ic Status	Perform Exercises
<40	6 Male	42 Lower standard of living	57 No 74
40-50	25 Female	58 Moderate standard of living	38 Yes 26
50-60	29 Total	100 High standard of living	5 Total 100
>60	40	Total	100
Total	100		

Table 2: Shows the investigation results of the patients having (T2DM) (N= 100).

Blood Glucose Level	HbA1c	Total Cholesterol	HDL
High	61	28	29
Normal	39	12	19
Total	100	40	48
Not done	0	60	52
			72

Table 3: Shows the distribution of complications of Diabetes mellitus (N= 100).

Complication	Frequencies
Retinopathy	30
Neuropathy	25
CVS diseases	13
Blood vessels	9
Nephropathy	6
No complication	17
Total	100

Table 4: Shows the association between performing exercises and the Blood Glucose Levels in patients having (T2DM) (N= 100).

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.502 ^a	1	.006		
Continuity Correction ^b	6.277	1	.012		
Likelihood Ratio	7.380	1	.007		
Fisher's Exact Test				.010	.006*
Linear-by-Linear Association	7.427	1	.006		
N of Valid Cases	100				

(p values = 0.05).

Table 5: Shows the association between performing exercises and the HbA1c Levels in patients having (T2DM) (N= 100).

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.435 ^a	1	.006		
Continuity Correction	5.352	1	.021		
Likelihood Ratio	6.950	1	.008		
Fisher's Exact Test				.012	.012*
Linear-by-Linear Association	7.249	1	.007		
N of Valid Cases	40				

(p values = 0.05).

Table 6: Shows the association between performing exercises and the Total Cholesterol Levels in patients having (T2DM) (N= 100).

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.757 ^a	1	.009		
Continuity Correction ^b	4.934	1	.026		
Likelihood Ratio	6.764	1	.009		
Fisher's Exact Test				.020	.014*
Linear-by-Linear Association	6.616	1	.010		
N of Valid Cases	48				

(p values = 0.05).

Table 7: Shows the association between performing exercises and the HDL Levels in patients having (T2DM) (N= 100).

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.048 ^a	1	.827		
Continuity Correction ^b	.000	1	1.000		
Likelihood Ratio	.048	1	.827		
Fisher's Exact Test				1.000	.588*
Linear-by-Linear Association	.046	1	.830		
N of Valid Cases	28				

(p values = 0.05).

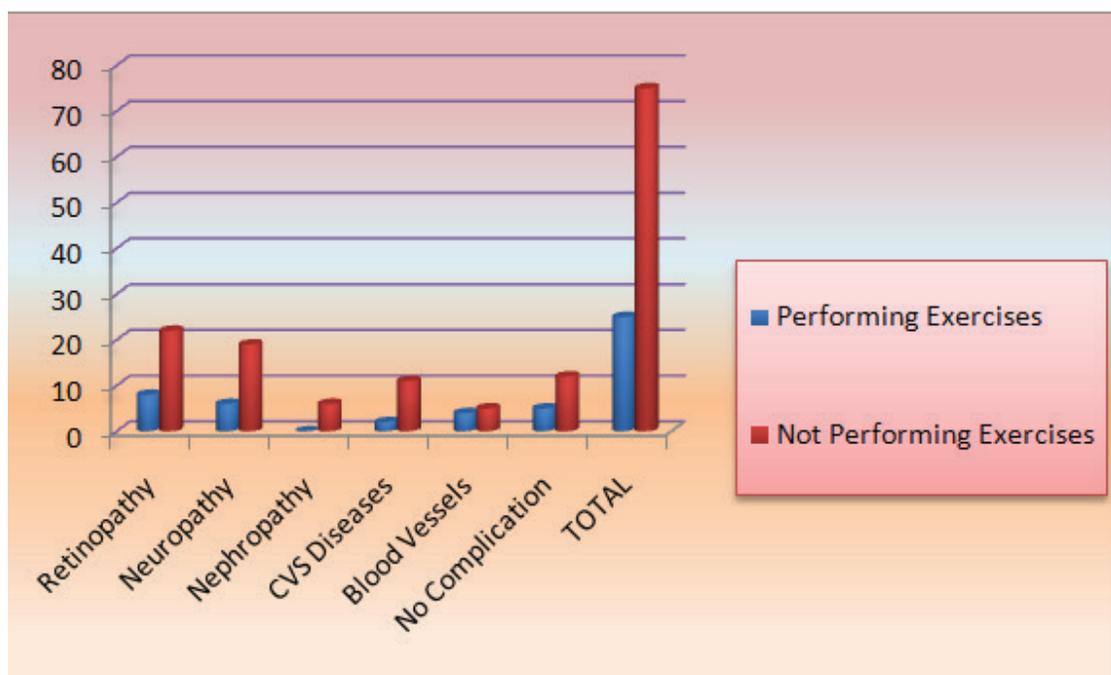


Figure 1: Shows the association between performing exercises and development of complications of Diabetes in patients having (T2DM) (N= 100).