RESEARCH ARTICLE

URINARY ALBUMIN EXERCTION RESPONSE TO AEROBIC EXERCISE IN TYPE 2 DIABETES MELLITEUS

*1Hala M, Ezzeldin, 2Samah M. Ismail, 3Ahmed M, Soliman and 4Eman M. Amin

1Dean & Professor of Faculty of Physical Therapy, Heliopolis University
2Assistant Professor of Physical Therapy for Cardiovascular/Respiratory Disorder and Geriatrics, Faculty of Physical Therapy, Cairo University
3Lecturer of Internal Medicine Cairo University
4- Physical therapist at 28th Family Center Ministry of Health

ABSTRACT

Background: Diabetic nephropathy is one of the major microvascular complications of diabetes which eventually manifests into end-stage renal disease. One-third of the diabetic population is prone to develop nephropathy and it represents the major cause of morbidity and mortality. **Objective:** The purpose of this study was to find out the effect aerobic training on urinary albumin excretion protein in type 2 diabetes mellitus. **Methods:** the study was conducted on twenty patients, their age ranged from 45 to 55 years. They participated inmoderate aerobic exercise (50-70%of MHR) for 30-40 minutes on electronic bicycle ergometer, 3 session per week for 12 weeks in addition to their medical treatment. Micro albumin urea, HBA1C, Fasting blood glucose, blood pressure *was measured before and after the study. Results: statistical analysis showed a* significant improvement (decrease) in HbA1C By 1.26%, Fasting blood glucose by 5.21%, Systolic & diastolic blood pressure by 4.78% &6.79% and albuminuria level by 9.68%. **Conclusion:** it is recommended for patients of diabetic nephropathy to practice aerobic exercise to avoid diabetic complication

INTRODUCTION

Diabetes mellitus (DM) is one of the most common endocrine disorders characterized by hyperglycemia due to defects in insulin secretion, insulin function, or both. Causing dysfunction in the body general metabolism, diabetes-induced chronic hyperglycemia leads to alterations in those endocrine glands involved in regulating the body metabolism (Elahi- *et al.*, 2013). Diabetes mellitus is a standout amongst the most widely recognized fundamental disease around the world. Presently DM influences 366 million individuals. it is By 2030, it is speculated number more than 550 million individuals will have DM. diabetes mellitus is related with various co-morbid conditions including contamination, diabetic kidney infection and diabetic neuropathy(Kobel and spencer, 2015). 33% or a greater of the DM patients creates diabetic nephropathy with dynamic weakening of renal capacity and structure in their life time. Diabetic nephropathy is characterized as urinary albumin excretion equivalents to or in excess of 300 mg/24hr and all the more regularly spoken to by steady albuminuria which is distinguished by different dipsticks Anurag *et al.*, 2011). An early manifestation of Diabetic nephropathy is the presence of microalbuminurea; which is defined as an elevation of urinary albumin excretion rate from 20 to 200 g per minute in an overnight urine sample (albumin-creatinine ratio of 30 to 300 mg/g in a random urine

specimen or - 200 mg/l), it is considered as the first stage of nephropathy in type-2 diabetes. Microalbuminurea or overt nephropathy occurs in 20 to 40 % of patients over a period of 15 years after the onset of diabetes. Microalbuminurea has been used for many years as a predictor of incipient diabetic nephropathy, reflecting the loss of glomerular selectivity, estimation of renal tubular function and integrity (Deepak *et al.*, 2012). Exercise is ordinarily one of the principal the board systems prompted for patient recently determined to have type 2 diabetes. Together with eating regimen and behavior modification, practice is a basic part of all diabetes anticipation and way of life mediation programs. Exercise training whether aerobic or resistance or a blend, encourages improved glucose guideline (Kirwan, 2017).

SUBJECTS AND METHODOLOGY

Subjects: Twenty type 2 diabetic women, their ages ranged from 45 to 55 years they were referred from IbnSainai Hospital in 10th of Ramadan city, Egypt. The study was conducted in Physical Therapy out Patients Clinic at center 28 of family health in 10th of Ramadan city, Egypt, for 12weeks. All patients have received a through explanation of the objectives and procedures of the study and a written informed consent was signed by each patient before participation in the study. Before starting the program, a complete history and physical examination were taken for all patients with particular attention paid to identify any long-term complications of

*Corresponding author: **Hala M, Ezzeldin,**
Dean & Professor of Faculty of Physical Therapy, Heliopolis University

Table 1. Analytic statistics for FBG, HbA1c,Micro albumin urea and blood pressure

	Pre treatment	Post treatment	MD	% of change	p- value
	Mean± SD	Mean± SD			
FBS	153.3±6.98	145.3 ±8.11	8	5.21	0.0001*
HbA1c	7.16±0.24	7.07 ±0.24	0.09	1.26	0.022*
Micro albumin urea	200.3±41.37	180.55 ±43.26	19.75	9.68	0.0001*
Systolic blood pressure	148.45±4.582	141.35 ±4.04	7.1	4.78	0.0001*
Diastolic blood pressure	92.1±1.65	85.85 ±3.69	6.25	6.79	0.0001*

*Significant level is set at alpha level <0.05   SD: standard deviation
MD: Mean difference   p-value: probability value

diabetes. This study was reviewed and was approved by the Ethics Committee of Faculty of Physical therapy.

Inclusion criteria: Type 2 diabetic women Their age ranged from 45 to 55 years old, BMI between 30-34.9 kg/ m2(class I obesity), Glycosylated hemoglobin A1C (HbA1c) $\geq$ 6.5%, urinary albumin excretion equals to or more than 30-300mg/24hr, Elevated fasting blood sugar >140mg/ dl , and Their blood pressure from 140/90 to 159/99.

Exclusion criteria: Patients with one of the following criteria were excluded from the study; those with any chronic respiratory disorders , musculoskeletal disorders that interfere with practicing exercise ,Cardiovascular problems , metabolic disorders, Those with BMI more than 35or less than30, type 1 diabetic patientsor haemodynamically unstable patients.

Instrumentation

A-Evaluation tools and equipment: Weight and high scale was used for measuring the weight and height of each patient to calculate the BMI for everyone to exclude subjects with BMI less than 30 or more than 34.9 kg/m2, Urinary analysis to measure urinary albumin excretion Pulsometer (Model 2998 made in china) to measure HR. and blood sample to measure fasting blood glucose and HBA1C.

B-Training equipment: Electronic bicycle ergometer (model c12 made in china) was used for exercise training.

Procedure

A.**Evaluation procedure:** Weight and height of each patient was measured using weight and height scale and then BMI for each patient was calculated using the following formula:BMI= weight (kg)/height (m2) (Jae *et al*., 2008). Urine sample were obtained to measure the urinary albumin level**.** Blood sample also obtained to measure HBA1C percentage and level of fasting blood glucose. HRmax was measured using pulsometer that connected to the electrical bicycle ergometer, through two calibers connected to ring finger of both hands of the patient gives us a continuous reading of pulse throughout the session on the bicycle screen.

B.**Training procedure:** All patients were individually instructed at first training session about signs and symptoms that when occurred must stop exercise or decrease the intensity of it: (chest pain, dizziness, headache, confusion, sever fatigue) and how working on bicycle ergometer and how to stop it. Exercise conducted through the use of bicycle ergometer patients Perform aerobic activity at continuous heart rate for entire duration of the activity. Subjects exercised on bicycle ergometer at low intensity of between 50-70%of their HR max reserve.

The starting workload to obtain a HR max reserve of 50%. This was increased to reach the level up to 60%HRmax reserve throughout the first two weeks of training and increase gradually to 70% HR max reserve for 12 weeks. (,30-40min , session plus 5min warming up and 5 min cooling down 3times/week pescatello *et al*., 2007).

C.Karvonen formula as target heart rate = (maxHR-restingHR)X %Intensity) +resting HR (Tanaka *et al*., 2001).

Statistical analysis: The data obtained were statistically analyzed to compare the difference before and after the treatment. The statistical package of social studies using SPSS for windows, version 20 (SPSS, Inc., Chicago, IL).The p-values <0.05as level of significance.

RESULTS

The main purpose of this study was to find out the effect of moderate aerobic exercise on microalbuminurea in diabetic nephropathy patients. Fasting blood glucose, HbA1C, Micro albumin urea level and blood pressure was measured before and after the study (i.e. 12 weeks). Results revealed statistical significant improvement (decrease)in, Micro albumin urea, fasting blood glucose, HBA1Csystolic and diastolic blood pressure which were represented in Table (1).

DISCUSSION

Diabetic nephropathy is one of the major microvascular complications of diabetes which eventually manifests into end-stage renal disease 33% of the diabetic populace is inclined to create nephropathy it represents the major cause of morbidity and mortality. Diabetic nephropathy is traditionally characterized by albuminuria and impaired renal function such as abnormal serum creatinine, creatinine clearance and glomerular filtration rate. This is predominantly seen in African Americans, Asians, and Native Americans (Matheson *et al*., 2010). The purpose of this study was to find out the impact of moderate aerobic training on urinary albumin excretion among type 2 diabetic women.
The current study was conducted on twenty women with Type-2 diabetes. Performed Continuous moderate aerobic exercise training 50%-70%HRmaxon electronic bicycle ergometer, 3times/week ,30-40min/ session plus 5min warming up and 5 min cooling down. The results of this study revealed significant improvement (decrease)in HbA1C , Fasting blood glucose , Systolic & diastolic blood pressure and albuminurea level by 1.26% , 5.21% , 4.78% &6.79% , 9.68% respectively. This comes in agreement with other previous studies such as (Khashaba, 2016) who find out the Effect of continuousaerobic exercise on VO2max values and glycosylated hemoglobin intype 2 diabetic patients. It was reported that aerobic exercise

training is a necessary adjunct to the treatments of type 2 diabetes to improve glycemic control and personal satisfaction in type 2 diabetic patients. This also supported by (Jagtap *et al.*, 2013) who studied the effect of exercise on HbA1C in Type 2 Diabetes Mellitus. It was reported that exercise is shown to have significant impact on HbA1C in T2DM patients. It was also supported by (Shakil *et al.*, 2017) who investigate the Effects of aerobic exercise trainingprogram on plasma insulin level, glycemic control, fasting blood glucose level and insulin resistance in type 2 diabetic patients. It was reported that a 25 weeks program along with traditional medical management is more benificial treatment in the management of glycemic control, plasma insulin level, fasting blood glucose level, and insulin resistance as compared with traditional medical management and dietary plan in the management of T2DM. This also can be supported by (Smith *et al.*, 2007) who studied the impact of weight reduction intervention and continuous aerobic exercise on 133 inactive-hypertensive (SBP: 130-180mmHg; DBP: 85-110mmHg)of both sex. Patients were assembled into aerobic with weight reduction group and control group. Participants engaged in 24 weeks' treatment period. They reported a significant decrease in both systolic and diastolic blood pressure in the treatment group compared to the control group. It was also reported that a six-month aerobic exercise, without any change in the medication, tended to decrease microalbuminuria without changing enzymuria (Lazarevic *et al.*, 2007). The finding of current study can be supported by (Patrick *et al.*,20015). Who found that mechanism for the benefit of aerobic exercise on albuminuria is obscure yet might be because of impacts on the vascular endothelium, potentially mediated by nitric oxide. Damage to the renal vascular endothelium is related with increased urinary albumin excretion. Nitric oxide is a vasorelaxant, and nitric oxide syntheses inhibition in rats causes albuminuria In patients with coronary artery disease, exercise training improves endothelium-dependent vasodilation in coronary vessels. Aerobic exercise training could have almost the samebeneficial effects on the renal vascular endothelium, decreasing albuminuria (Robinson *et al.*, 2010). Kurdak *et al.*, 2010 suggest that regular submaximal aerobic exercise has a preventive effect on development of microalbuminuria and thus may retard nephropathy in diabetic rats. It also can supported by Calle *et al.*, 2010 who found that Prevalence of normo-albuminuric patients remained significatively higher in the patient with the greater physical activity level when adjusted to systolic blood pressure, diastolic blood pressure, evolution time and HbA1c value. It was concluded that regular non-strenuous physical activity may have a protective effect on the appearance of microalbuminuria in Type 2 diabetic patients.

Conclusion

The results of the study showed significant reduction of micro albumin urea, fasting blood glucose, HbA1 and blood pressure after 12 weeks of continuous aerobic training which may avoid diabetic complications.

REFERENCES

Anurag S. and Simon C. 2011. Microalbuminuria: causes and implications *PediatrNephrol* 26:1957–1965

CallelAL; Martin PJ; Reyes C; and Calle JR(2010): .Regular physical activity and reduced occurrence of microalbuminuria in type 2 diabetic patients. *J Sports Sci Med.* 1;9(2):294-9

Deepak N. and Amit A. 2012. Diabetic Nephropathy: Progression and Pathophysiology ijmsph..1.59-7.

ElhaiZ.; BehnamM.; Mahdavi N.; Hajinejad R. and Khajouee E. 2013. Comparative study on the effect of type 1 and type2 diabetes on structural changes and hormonal output of the adrenal cortex in male wistar rats. J Diabetes Metab Disord.;28;12(1):9.

Jae M.; Luscher T. and Cosentioo F. 2008. Obesity. The Lancet, 306(9492): 119- 127.

Jagtap W.; Rohankar H .; Kale A.2013. Exercise Reduces HBA1C and Mostly Brings Good Control in Type 2 diabetes Mellitus. (IJSR) ISSN (Online): 2319-7064

Khashaba A.; 2016. Effect of aerobic exercise on glycosylated hemoglobin and VO2max values in patients with type 2 diabetes INTER 2016; 5 (5):72-77

KirwanP.; Sacks J.; and Nieuwoudt S.2017. the essential role of exercise in the management of type 2 diabetes. *Cleve Clin J Med*/; 84(7suppl 1):s15-s21

Korbel L and Spencer JD. 2015. diabetes mellitus and infection: an evaluation of hospital utilization and management costs in the united states. *J Diabetes Complication.* 29(2); 1963672-5.

Kurdak H .; Sandikci S .; Ergen N .; Dogan A and Kurdak S. 2010. The Effects of Regular Aerobic Exercise on Renal Functions in Streptozotocin Induced Diabetic Rats, *Am J Epidemiol.* 1; 171(5): 515–521 doi: 10.1093/aje/kwp442

Lazarevic G, Antic S, Vlahovic P, *et al.* 2007. Effects of aerobic exercise on microalbuminuria and enzymuria in type 2 diabetic patients. *Ren Fail.;*29(2):199-205.

Matheson A.; Willcox M.; Flanagan J. and Walsh B. 2010. Urinary Biomarkers Involved inType 2 Diabetes: aRview, Diabetes Metab Res. Rev. 26: 150-171.

Patrick T.; Aaron S and Vincent D. 2015. High Intensity Interval Training Favourably Affects Angiotensinogen mRNA Expression and Markers of Cardiorenal Health in a Rat Model of Early-Stage Chronic Kidney Disease. Biomed Res Int. 2015; 2015: 156584.

Pescatello L.; Franklin B. and Fagard R. 2007. American college of sports medicine position stand. Exercise and hypertension. *Med sciexerc*, 36:533-53.

Robinson ES; Fisher ND; Forman JP; CurbanGC. 2010. Physical activity and albuminurea, *Am J Epidemiol,* 1;171(5)515-21.

Shakil U R.; Rehman S .; Karimi H and Gillani S A 2017. Effects of supervised structured aerobic exercise training program on fasting blood glucose level, plasma insulin level, glycemic control, and insulin resistance in type 2 diabetes mellitus. *Pak J Med Sci.* ;33(3):576-580. doi: 10.12669/pjms.333.12023.

Smith PJ; Blumenthal JA; Babyak MA; Georgiades A; Hinderliter A and Sherwood A. 2007. Effect of exercise and weight loss on depressive symptoms among men and women with hypertensive. J Psychosome Res, 63:463-9.

Tanaka H.; Monahan D.;and Seals R.. 2001. Age-predicted maximal heart rate revisited. *J Am CollCardiol.* ;37(1):153-6.

****