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ORIGINAL ARTICLE

INFLUENCE OF AEROBIC TREADMILL EXERCISE ON BLOOD GLUCOSE HOMEOSTASIS AND LIPID PROFILE IN OBESE TYPE-II DIABETICS MELLITUS

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Abstract:

The influence of aerobic treadmill exercise on blood glucose homeostasis and lipid profile in obese Type 2 diabetics over a period of six weeks was investigated. The experimental group consisted of 10 males with mean age (X=52±4) and a control group of 10 males with mean age (X=53±3), who were clinically and biochemical confirmed as obese diabetics. The results of both groups were compared after six weeks. The results were analyzed using an independent t- test. The experimental group showed a significant decrease in mean fasting blood sugar (FBS) of 39.4±8.315 and Post-prandial blood sugar (PPBS) of 44.4 ± 8.617 as compared to the control group with mean FBS of 27.4 SD±9.720 and PPBS of 32.2 SD± 6.972 with a significant inter group difference (P<0.005). The Lipid Profile also showed a significant difference between two groups. The mean decrease in cholesterol for the experimental group was 44.23±7.34; the control group was 14.34 ±5.782.

KEYWORDS:

Influence , Aerobic Treadmill Exercise , Blood Glucose , Lipid Profile .

INTRODUCTION:

Diabetes mellitus and obesity are metabolic disorders characterized by actual or relative insufficiency of insulin, an abnormal growth of adipose issue with an enlargement of fat cell size (hypertrophy) or an increase in fat cell number (hyperplasic) or a combination of both. Both environmental and genetic factors are involved in the pathogenesis of diabetes and obesity. The diabetes mellitus and obesity are inter- related - one is the risk factor for the other and affects approximately 2%-3% of the Indian population. These include excess calorie intake, decreased physical activity, and metabolic as well as endocrine abnormalities1.These factors lead to an inability to utilize glucose, hence elevated blood glucose levels called hyperglycemia,2 and an increase in cholesterol and triglycerides called hyperlipidemia3.The diagnosis is confirmed by following blood parameters fasting blood sugar (FBS), post-prandial blood sugar (PPBS), oral glucose tolerance test (OGTT) and urine examination, Lipid profile examination and clinical examination (Body Mass Index, Waist-Hip Ratio and skin fold measurement).

The complications associated with diabetes and obesity proves to be a major public health problem. The distribution of adipose tissue in different anatomic depots has substantial implications or morbid mortality in obese patients. Intra abdominal and abdominal subcutaneous fat are more substantive risk factors for diseases than subcutaneous fat in the buttocks and lower extremities. Based on the distribution of adipose tissue, obesity can be classified as android obesity and gynoid obesity4. In android obesity, there is storage of fat in the upper body-mainly in the abdomen giving the individual an “apple” shape and a waist hip ratio of more than one. It is seen predominantly in the male population. A waist hip

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ratio of more than one may be closely related to disease risk than Body Mass Index (BMI) alone.

METHOD

The study was conducted in Kasturba Hospital, Manipal, India (a University Teaching Hospital) after clearance obtained from the Ethical committee. Experimental group: Ten males between the ages of 45 and 60 years (X-52±4), who were clinically and biochemically confirmed cases of obese Type 2 diabetics were selected. Only those willing to participate in the experimental study were included. Control group: It consisted of 10 males between the ages of 45 and 60 (X-53±3) years, who were clinically and biochemically confirmed cases of obese Type 2 diabetics and who were not willing to participating in exercise were selected for the control group.A physician examined all participants. They were screened for cardiovascular problems such as ischemic heart disease and peripheral vascular disease, respiratory diseases such as chronic obstructive pulmonary diseases and musculoskeletal problems such as osteo-arthritis, cervical spondylosis and low backache, peri-arthritis and diabetic neuropathy before commencing the study. Both groups continued with standard diet and medication as prescribed.

The experimental group was given graded Treadmill exercise for period of six weeks. Both groups were clinically assessed for weight, height, body mass index (BMI), waist-hip ratio and skin fold measurement. Muscular flexibility and strength in lower limbs were assessed and, in case of tightness or weakness, an appropriate physical therapy program was instituted before the study. At the beginning of the study, blood glucose levels were investigated for PPBS and FBS. A Lipid Profile for cholesterol and Triglycerides were ascertained on both groups. A motor-driven treadmill was used for the study. It provided computerized programming parameters for distance traveled (Kilometers), calories used (Kilocalories) and speed (RPM). Treadmill calibrationwas done before starting treatment. A clear explanation involving treadmill protocol was given to each patient.Each experimental session lasted for 40 minutes including 5 minutes of warm-up, 30 minutes of aerobic treadmill walking and 5 minutes of cool-down. The vital parameters for HR, BP, and RR were recorded before, during and after treatment. Intensity of exercise was regulated by maintaining constant speed of 3.4 km/hr, fixed inclination of 4.2 angle and Borg's score of 13-14 for rate of perceived exertion. All 10 patients completed five sessions per week, for six weeks, uneventfully.

RESULT ANALYSIS

All patients in the experimental group completed the planned six weeks of treadmill endurance exercise program without any complications. The BMI of the experimental group was 25-29; the control group was 27- 31. Blood glucose levels were analyzed to determine the inter-groups decrease in FBS and PPBS. The mean decrease in FBS was 39.4±8.315 for the experimental group and 27.4±9.720 for the control group; the intergroup decrease in FBS was significant with p value <0.005. The decrease in PPBS was 44.4± 8.617 for the experimental group and 32.2± 6.972 for the controls; the inter-group decrease in PPBS was significant with $p<0.005$

The Lipid Profile was analyzed to determine the intergroup decrease in cholesterol and triglycerides. The mean decrease in cholesterol was 44.23±27.34 for the experimental group; the control group was 14.34±5.782 and was highly significant at $p<0.0001$. The mean decrease in triglycerides for the experimental group was 27.12 ±7.34; the control group was 16.45±4.3; it was significant at $p<0.005$. (Table II & Figures 3 & 4). The mean body mass index (BMI) of the experimental group was 25.67±1.150. The mean body mass index (BMI) of the control group was 29.56±2.007.

DISCUSSION

The deficiency of insulin and the failure of glucose uptake lead to a backup of glucose in the blood resulting in hyperglycemia. The treatment of diabetes consists of education, exercise, diet, oral hypoglycemic drugs and subcutaneous insulin therapy11. The triad of drugs, diet and exercise has been the basis for treatment of diabetes for the past 60 years12. Each done individually or in combination has a place in treatment regimen. An exercise program in conjunction with diet and oral medication can create glycemic control, weight reduction, and reduction in cardiovascular risk factors as well as improvement in the mental well being of the patient.It was reported that exercise in poorly controlled diabetes cases, leads to increased blood glucose and ketoacids. Hermansen and co-workers16 reported that after six weeks of treadmill walking, insulin binding to monocyte receptor sites increased and allowed greater insulin mediated glucose uptake within promoted oxidation of glucose and its glycolytic products. There is increased glycogen utilization and storage during and after physical activity influencing glucose

metabolism, so that there is enhanced glucose uptake associated with endurance exercise. A sedentary lifestyle is considered a risk factor for the development of coronary artery disease,whereas regular exercise is associated with reduced Coronary Artery Disease mortality26. Increased HDL-C levels observed with regular exercise might be partially responsible for this protection. Regular exercise, along with other lifestyle changes (smoking cessation, fat weight reduction, and a low fat diet) are now recommended as an adjunct to medical therapy in an effort to combat Coronary Artery Disease.

As endurance exercises begin, muscle glycogen is available for a short period. As exercise is prolonged, glycogenolysis becomes the source of increased glucose availability.After 15 minutes of exercise, hepatic gluconeogenesis begins. When exercise is prolonged over 30 minutes,
free fatty acid is generated by adipocyte lipolysis. In a diabetic, conversion from resting to working metabolism occurs more rapidly due to higher basal circulating levels of free fatty acid and circulating gluconeogenic substrates. Exercise facilitates blood lipid profile favorably, i.e., increases HDL-C and decreases total cholesterol, triglycerides as evidenced by our study.

CONCLUSION

The Graded Aerobic Treadmill Exercise is a substantive tool in addition to drugs and diet in glycemic and Lipid Profile Control. Moderate exercise has an additional advantage in cardio respiratory conditioning.

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