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Investigation of the Changes on High Density Lipoprotein Cholesterol in Response to Aerobic and Anaerobic Training among Type 2 Diabetic Patients

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Abstract

The rationale of the study is to investigate the changes on high-density lipoprotein cholesterol in response to aerobic and anaerobic training among type 2 diabetic patients. To achieve the purpose of the study 45 male type 2 diabetic patients from Ongole, in the southern part of Andhra Pradesh, India, were selected as subjects. The subjects were selected in the age group of 45 to 50 years and they were randomly assigned into three equal groups of 15 each. Experimental group-I performed aerobic training, experimental group-II performed anaerobic training and group III acted as control. The high-density lipoprotein cholesterol was selected as dependent variable. The data collected from the three groups prior to and post experimentation on selected dependent variable was statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test. In all the cases the level of confidence was fixed at 0.05 level for significance. The result of the study produced 7.81% percentage of improvement due to aerobic training and 5.20% of improvement due to anaerobic training in high density lipoprotein cholesterol of the diabetic patients.

Keywords: Aerobic training, Anaerobic training and High density lipoprotein cholesterol.

Introduction

Recent data suggest that both aerobic and anaerobic training may exert beneficial effects on cardiac risk factors in subjects with type 2 diabetes. However, it remains unclear if the extent of improvement and the mechanisms underlying the metabolic effects of these exercise protocols are similar. Recent comparison studies reported similar cardiac risk factors alterations after aerobic or anaerobic training. However, the extent of these changes in other studies using either type of exercise varied considerably, and therefore the results cannot be considered conclusive. No meta-analysis of the effects of aerobic and anaerobic training on coronary heart disease risk factors in people with diabetes has been published. In the general, predominantly nondiabetic population, the effects of exercise training on blood pressure (Albright et al., 2000) and lipids (Whelton et al., 2002) are relatively modest. Greater increases in HDL cholesterol and decreases in plasma triglycerides have been seen with exercise programs that are more rigorous in terms of both volume and intensity than those that have been evaluated in diabetic subjects (Leon et al., 2001). Potential mechanisms through which exercise could improve cardiovascular health were reviewed by Stewart (Kraus et al., 2002). These include decreased systemic inflammation, improved early diastolic filling (reduced diastolic dysfunction), improved endothelial vasodilator function, and decreased abdominal visceral fat accumulation. In particular, most of the benefit of regular exercise on cardiac risk factors in type 2 diabetes subjects is attributed to attenuation of insulin resistance. However, only a few studies have accurately assessed, the effects of aerobic training on insulin sensitivity in diabetic patients (Cuff et al., 2003; Yamanouchi et al., 1995; Tamura et al., 2005; Hey-Mogensen et al., 2010), and only one small study assessed the effects of anaerobic training. In contrast, little attention has been devoted to the potential effects of aerobic or anaerobic training on high density lipoprotein cholesterol in subjects with type 2 diabetes.

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Methodology

Subjects and Variables

The purpose of the study is to investigate the changes on high density lipoprotein cholesterol in response to aerobic and anaerobic training among type 2 diabetic patients. To achieve the purpose of the study 45 male type 2 diabetic patients from Ongole, in the southern state of Andhra Pradesh, India, were selected as subjects. The subjects were selected in the age group of 45 to 50 years and they were randomly assigned into

three equal groups of 15 each. Experimental group-I performed aerobic training, experimental group-II performed anaerobic training and group III acted as control. Control group was restricted to participate in any specific training. The high density lipoprotein cholesterol was selected as dependent variable. Venous blood specimens were withdrawn after overnight fasting (12-14 hours) from the subjects of experimental and control groups. High density lipoprotein cholesterol was estimated by Enzymatic chalorimatic method recommended by Bursten et al.

Training Protocol

The experimental group-I performed aerobic training alternatively three days in a week for twelve weeks. In this present investigation continuous running was given to the subjects as aerobic training. To fix the training load for the aerobic training group the subjects were examined for their exercise heart rate in response to different work bouts, by performing continuous running of two minutes duration for proposed repetitions and sets, alternating with active recovery based on work-rest ratio. The experimental group-II performed anaerobic training alternatively three days in a week for twelve weeks. The subjects were examined for their exercise heart rate in response to different anaerobic work bouts by the anaerobic exercise of 50 meters sprinting was performed for proposed repetitions and sets, alternating with rest time that enables complete recovery. The subject's training zone was computed using Karvonen formula (Karvonen, Kentala & Mustala, 1957) and it was fixed at 60%HRmax to 85%HRmax. The work rest ratio of 1:1 between repetition and 1:3 between sets was given. Heart rate monitors were used to standardize exercise intensity (Polar S810i; Polar Electro, Kempele, Finland). Before entering the study, all subjects were encouraged to follow a healthy diet, according to standard recommendations for diabetic subjects (American Diabetes Association Standards of medical care in diabetes, 2011). Thereafter, patients were instructed to maintain their baseline calorie intake by consuming self-selected foods.

Statistical Technique

The data collected from the experimental and control groups on high density lipoprotein cholesterol was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in selected dependent variable due to the impact of experimental treatment. The data collected from the three groups prior to and post experimentation on high density lipoprotein cholesterol was statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since three groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test. In all the cases the level of confidence was fixed at 0.05 level for significance.

Result

The descriptive analysis of the data showing mean and standard deviation, range, mean differences, 't' ratio and percentage of improvement on high density lipoprotein cholesterol of experimental and control groups are presented in table-I.

Table I. Descriptive Analysis of the Pre and Post Test Data and 'T' Ratio on High Density Lipoprotein Cholesterol of Experimental and Control Groups

Group	Test	Mean	Standard Deviation	Range	Mean Differences	't' ratio	Percentage of Changes
Aerobic Training	Pre test	39.31	3.42	11.13	3.07	12.64	7.81%
	Posttest	42.38	2.92	9.97			
Anaerobic Training	Pre test	38.08	3.26	10.25	1.98	7.17	5.20%
	Posttest	40.06	3.25	9.90			
Control Group	Pre test	37.17	2.57	9.62	0.71	2.28	1.91%
	Posttest	36.46	2.29	9.29			

Table t-ratio at 0.05 level of confidence for 14 (df) =2.15
**Significant*

Table-I shows that the mean, standard deviation, range and mean difference values of the pre and post test data collected from the experimental and control groups on high density lipoprotein cholesterol. Further, the collected data was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post data. The obtained 't' values of aerobic training and anaerobic training and control groups are 12.64, 7.17 and 2.28 respectively which was greater than the required table value of 2.15 for significance at 0.05 level for 14 degrees of freedom. It revealed that significant differences exist between the pre and post test means of experimental and control groups on high density lipoprotein cholesterol. The result of the study also produced 7.81% percentage of changes in high density lipoprotein cholesterol due to aerobic training, 5.20% of changes due to anaerobic training and 1.91% of changes in control group. The pre and post test

data collected from the experimental and control groups on high density lipoprotein cholesterol is statistically analyzed by using analysis of covariance and the results are presented in table–II.

Table II. Analysis of Covariance on High Density Lipoprotein Cholesterol of Experimental and Control Groups

	Aerobic training Group	**Anaerobic training Group**	**Control Group**	**S o V**	**Sum of Squares**	**Df**	**Mean squares**	**'F' ratio**
Pre test Mean SD	39.31	38.08	37.17	B	34.58	2	17.29	1.79
	3.42	3.26	2.57	W	405.51	42	9.66	
Post test Mean SD	42.38	40.06	36.46	B	267.48	2	133.74	16.48*
	2.92	3.25	2.29	W	340.78	42	8.11	
Adjusted Post test Mean	41.42	40.15	37.33	B	121.71	2	60.85	61.19*
				W	40.78	41	1.00	

Table F-ratio at 0.05 level of confidence for 2 and 42 (df) = 3.23, 2 and 41 (df) = 3.23
**Significant*

Table-II shows that the adjusted post-test means on high density lipoprotein cholesterol of aerobic training, anaerobic training and control groups are 41.42, 40.15 and 37.33 respectively. The obtained 'F' value of 61.19 on high density lipoprotein cholesterol was greater than the required table value of 3.23 of 2, 42 df at 0.05 level of confidence. Hence, it was concluded that significant differences exist between the adjusted post test means of aerobic training, anaerobic training and control groups on high density lipoprotein cholesterol. Since, the obtained 'F' value in the adjusted post test means was found to be significant, the Scheffe's test was applied as post hoc test to find out the paired mean difference, and it is presented in table-III.

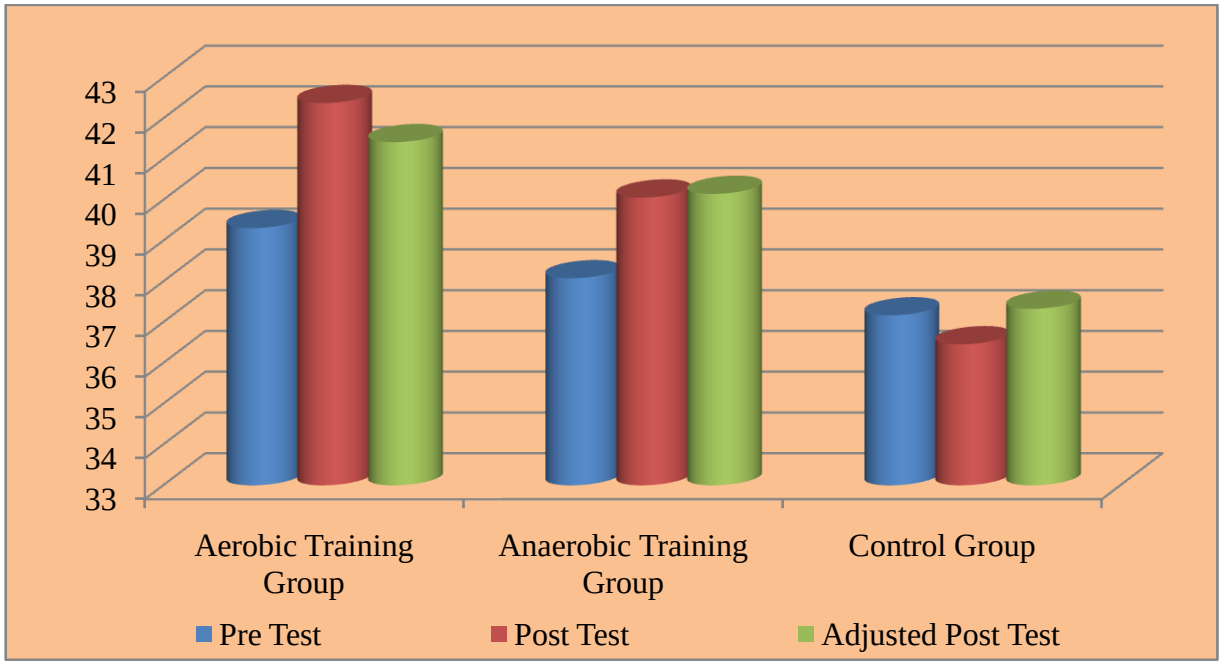
Table III. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on High Density Lipoprotein Cholesterol

Aerobic Training	**Anaerobic Training**	**Control Group**	**Mean Difference**	**Confidence Interval**
41.42	40.15		1.278	0.93
41.42		37.33	4.09*	0.93
	40.15	37.33	2.82*	0.93

**Significant at 0 .05 level*

As shown in table-III the Scheffe's post hoc analysis proved that significant mean differences existed between aerobic training and anaerobic training groups, aerobic training and control groups, anaerobic training and control groups on high density lipoprotein cholesterol. Since, the mean differences 1.27, 4.09 and 2.82 are higher than the confident interval value of 0.93 at 0.05 level of significance. Hence, it is concluded that due to the effect of aerobic training and anaerobic training the high density lipoprotein cholesterol of the subjects was significantly improved. It is also concluded that aerobic training is better than anaerobic training in improving high density lipoprotein cholesterol. The pre, post and adjusted post test mean values of experimental and control groups on high density lipoprotein cholesterol is graphically represented in figure-I.

Figure I. Bar Diagram Showing the Mean Values on High Density Lipoprotein Cholesterol of Experimental and Control Groups



Discussion

Use of physical activity in the form of aerobic and anaerobic exercise is widespread, with a general consensus about its beneficial effects in patients with type 2 diabetes. The therapeutic benefits include regulation of body weight, reduction of insulin resistance, enhancement of insulin sensitivity, and glycemic control. The result of the present study is in conformity with the findings of the previous research studies. Many previous studies have shown that long term low intensity aerobic exercise is beneficial and increases the HDL level (Hata & Nakajima 2000; Halverstadt et al., 2007; Ring-Dimitriou et al., 2007; Marti B et al., 1990; Marti et al., 1990 and Dragusha et al., 2010). The above finding can also be substantiated by observations made by the following authors. Tikkanen, Hamalainen and Harkonen (1999) concluded 12 month home-based exercise training significantly increases HDL-C level in healthy men. Kelley, Kelly and Tran (2004) observed an increase of 3% for HDL-C.

Leon and Sanchez (2001) concluded that aerobic exercises appeared to decrease the TC and LDL increases the HDL in men and women. Buyukyazi (2005) compared the lipid profiles of master athletes, recreational athletes and sedentary workers and concluded that habitual physical training favorably altered the serum lipid and lipoprotein profiles. Similarly, Lippi et al., (2006), while debating the levels of exercise required to produce beneficial/deleterious alterations in lipid profiles, conclude and recommend regular aerobic exercise as a means of favorably altering lipid profile and reducing risks for cardiovascular disease. In conclusion, although 12-week aerobic and anaerobic exercise program in addition to conventional cares of patients with type-2 diabetes mellitus produce significant improvement on coronary heart disease risk factors and health related physical fitness components over those receiving conventional cares only, its inclusion will be beneficial on longer duration. The outcomes of this study suggest inclusion of an aerobic and anaerobic exercise program into the routine management of patients with type 2 diabetes could be beneficial.

Conclusion

It is concluded that due to the effect of aerobic training and anaerobic training the high density lipoprotein cholesterol of the diabetic patients was significantly improved. It is also concluded that aerobic training is better than anaerobic training in improving high density lipoprotein cholesterol. The result of the study produced 7.81% percentage of changes due to aerobic training and 5.20% of changes due to anaerobic training in high density lipoprotein cholesterol of the diabetic patients.

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