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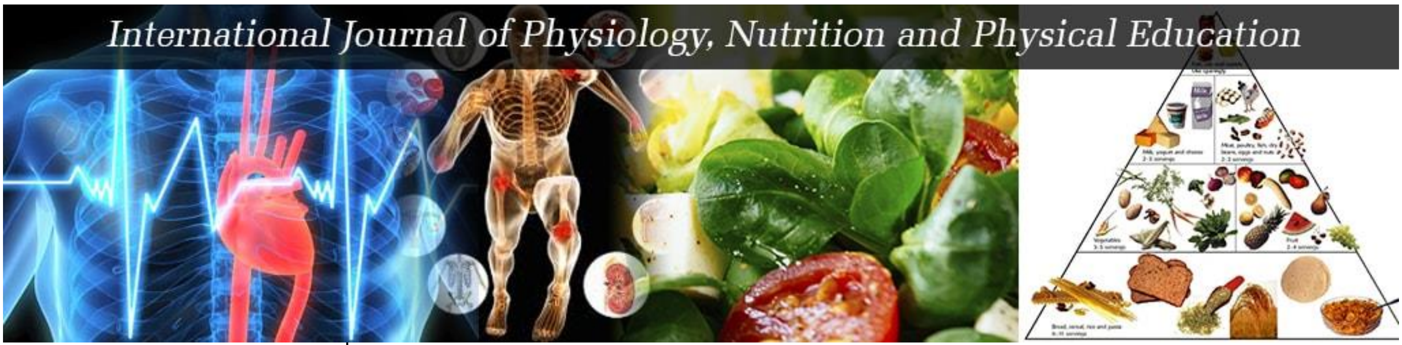

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Investigation of the changes on mean arterial pressure in response to aerobic and anaerobic training among type 2 diabetic patients

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Abstract
The rationale of the study is to investigate the changes on mean arterial pressure 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. The mean arterial pressure 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 reveals that due to the effect of aerobic and anaerobic training the mean arterial pressure of the diabetic patients is significantly reduced. It is also concluded that no significant differences existed between aerobic and anaerobic training groups in altering mean arterial pressure.

Keywords: Aerobic training, Anaerobic training, Mean Arterial Pressure.

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 non diabetic population, the effects of exercise training on blood pressure (Albright *et al*., 2000) [1] and lipids (Whelton *et al*., 2002) [15] 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) [9]. Potential mechanisms through which exercise could improve cardiovascular health were reviewed by Stewart (Kraus *et al*., 2002) [17]. These include decreased systemic inflammation, improved early diastolic filling (reduced diastolic dysfunction), improved endothelial vasodilator function, and decreased abdominal visceral fat accumulation.

Fitness is a key to enjoy life. Exercise is an important of a total fitness programme. Modern living has taken all the exercise out of our lives and so in order to get fit and have to put it back again, regular exercise is necessary to develop and maintain an optional level of health, performance and appearance. It makes feel good, both physically and mentally. It gives psychological lift and strengthens a sense of accomplishment. Looking young is a reflection of good health. Regular physical exercise enhance the function of the joints, increase the sense of physical well-being and promotes a sense of feeling good, increases physical working capacity by increasing cardio respiratory fitness, muscle strength and endurance and decreases the risk of serious diseases that could lead to early disability and death. Ukoho (1988) express that exercise have shown to improve health prospects in various ways. It helps to reduce body fat and overall weight and reduce blood pressure.

Methodology

Subjects and Variables

The purpose of the study is to investigate the changes on mean arterial pressure 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 mean arterial pressure was selected as dependent variable After ensuring that the subjects were relaxed mentally and physically, they were asked to sit in a chair and the blood pressure monitor was placed at the wrist, by winding up the wristlet cuff of the digital blood pressure monitor - wrist measuring model CH607 from Citizen Systems, Japan, around the left wrist, by placing the body of the blood pressure monitor on the inside of the wrist. The measurement was taken while at sitting position and with the left hand on a table held a level with the heart and by keeping the body relaxed during measurement.

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) [18] 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 mean arterial pressure 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 mean arterial pressure 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 mean arterial pressure of experimental and control groups are presented in table-1

Table 1: Descriptive Analysis of the Pre and Post-test Data and 'T' Ratio on Mean Arterial Pressure of Experimental and Control Groups

Group	Test	Mean	Standard Deviation	Range	Mean Differences	't' ratio	Percentage of Changes
Aerobic Training	Pre test	104.12	3.05	11.20	6.16	9.27	5.91%
	Posttest	97.96	3.50	9.10			
Anaerobic Training	Pre test	103.81	2.77	9.34	4.37	8.10	4.21%
	Posttest	99.44	3.31	10.67			
Control Group	Pre test	102.99	2.99	9.67	0.70	2.17	0.68%
	Posttest	103.69	3.38	9.49			

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

Table- 1 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 mean arterial pressure. 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 groups are 9.27 and 8.10 respectively which are 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 groups however, no significant differences exists between the pre and post-test means of control group on mean arterial pressure.

The result of the study also produced 5.91% percentage of changes in mean arterial pressure due to aerobic training, 4.21% of changes due to anaerobic training and 0.68% of changes in control group.

The pre and post-test data collected from the experimental and control groups on mean arterial pressure is statistically analyzed by using analysis of covariance and the results are presented in table–2.

Table 2: Analysis of Covariance on Mean Arterial Pressure of Experimental and Control Groups

	Aerobic training Group	Anaerobic training Group	Control Group	So V	Sum of Squares	Df	Mean squares	'F' ratio
Pre-test Mean	104.12	103.81	102.99	B	10.14	2	5.07	0.59
SD	3.05	2.77	2.99	W	362.70	42	8.64	
Post-test Mean	97.96	99.44	103.69	B	265.31	2	132.66	11.47*
SD	3.50	3.31	3.38	W	485.61	42	11.56	
Adjusted Post-test Mean	97.52	99.28	104.29	B	360,18	2	180.09	42.52*
				W	173.62	41	4.24	

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

Table-2 shows that the pre-test means and standard deviation on mean arterial pressure of aerobic training, anaerobic training and control groups are 104.12 ± 3.05, 103.81 ± 2.77 and 102.99 ± 2.99 respectively. The obtained 'F' value 0.59 of mean arterial pressure is lesser than the required table value of 3.23 for the degrees of freedom 2 and 42 at 0.05 level of confidence, which proved that the random assignment of the subjects were successful and their scores on mean arterial pressure before the training were equal and there was no significant differences. The post-test means and standard deviation on mean arterial pressure of aerobic training, anaerobic training and control groups are 97.96 ± 3.50, 99.44 ± 3.31 and 103.69 ± 3.38 respectively. The obtained 'F' value of 11.47 on mean arterial pressure was greater than the required table value of 3.23 at 2, 42 df at 0.05 level of confidence. It implied that significant differences exist between the three groups during the post-test on mean arterial pressure. The adjusted post-test means on mean arterial pressure of aerobic training, anaerobic training and control groups are 97.52, 99.28 and 104.29 respectively. The obtained 'F' value of 42.52 on mean arterial pressure 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 mean arterial pressure. 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-3.

Table 3: Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Mean Arterial Pressure

Aerobic Training	Anaerobic Training	Control Group	Mean Difference	Confidence Interval
97.52	99.28		1.76	1.91
97.52		104.29	6.77*	1.91
	99.28	104.29	5.01*	1.91

**Significant at 0. 05 level*

As shown in table-3 the Scheffe's post hoc analysis proved that significant mean differences existed between aerobic training and control groups, anaerobic training and control groups on mean arterial pressure. Since, the mean differences 6.77 and 5.01 are higher than the confident interval value of 1.91 at 0.05 level of significance. However, no significant mean differences existed between aerobic training and anaerobic training groups, since, the mean differences 1.76 is lesser than the confident interval value of 1.91 at 0.05 level of significance.

Hence, it is concluded that due to the effect of aerobic training and anaerobic training the mean arterial pressure of the subjects was significantly changed. It is also concluded that no significant differences existed between aerobic training and anaerobic training groups in altering mean arterial pressure. The pre, post and adjusted post-test mean values of experimental and control groups on mean arterial pressure is graphically represented in figure-1.

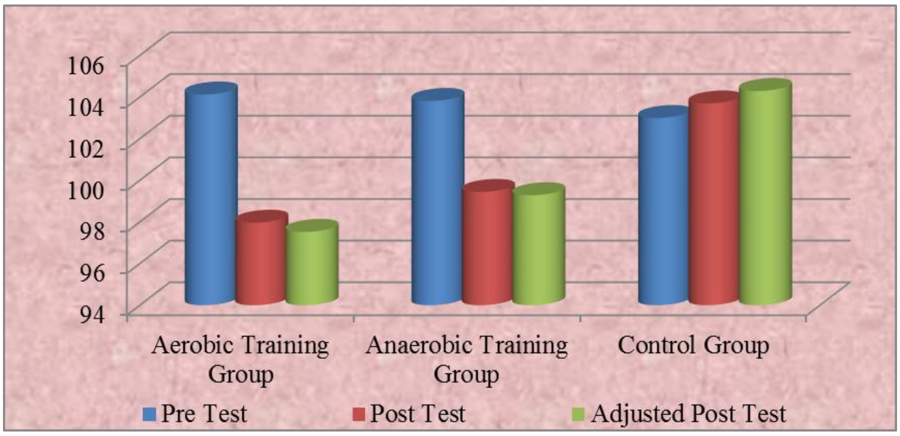

Fig 1: Bar Diagram Showing the Mean Values on Mean Arterial Pressure of Experimental and Control Groups

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. It has been found that in previously sedentary individuals regularly performed aerobic and anaerobic training results in significant improvements in exercise capacity. The development of peak exercise performance is dependent upon several months to years of aerobic training. The physiological adaptations associated with these improvements in both maximal exercise performance, as reflected by increases in maximal oxygen uptake, and submaximal exercise endurance include increases in both cardiovascular function and skeletal muscle oxidative capacity. Short-term daily conditioning protocol of aerobic exercise program induces significant improvements in both aerobic capabilities and anaerobic performance (Sartorio *et al*., 2003) [21]. The intermittent aerobic exercise produced an acute interference effect on leg strength endurance. Maximum strength was not affected by the aerobic exercise mode (DeSouza *et al*., 2007) [19]. The specific mechanisms underlying this response have not been established. The acute changes in blood pressure after an episode of exercise may be an important aspect of the role of physical activity in helping control blood pressure in physically untrained people. Several studies (Simao, Polito & Lemos, 2003; MacDougall *et al*., 1992; Stone *et al*., 1991; Fleck, 1988) confirm the findings of this study. Hence, it is suggested that more dynamic forms of training are associated with reductions in blood pressure.

The result of the present study shows decreases in blood pressure in the experimental groups; and this phenomenon was also described by Gordon *et al*., (2008) [24], who showed a significant reduction in systolic blood pressure after resistance training in patients with type 2 diabetes mellitus. However, another study did not find any blood pressure reductions after exercise training (Dunstan *et al.,* 2002) [23].

Conclusion

It is also concluded that due to the effect of aerobic training and anaerobic training the mean arterial pressure of the diabetic patients was significantly changed. It is also concluded that no significant differences existed between aerobic training and anaerobic training groups in altering mean arterial pressure. The result of the study produced 5.91% percentage of changes due to aerobic training, 4.21% of changes due to anaerobic training in mean arterial pressure of the diabetic patients.

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