



INVESTIGATION OF THE CHANGES ON HDL AND LDL CHOLESTEROL IN RESPONSE TO ISOLATED AND COMBINED RESISTANCE AND ENDURANCE TRAINING

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ABSTRACT :

The fortitude of the study was to find the effect of resistance, endurance and combined training on selected high and low density lipoprotein. To achieve this purpose of the study, sixty male students age ranged between 18 to 25 were randomly selected as subjects from the department of physical education, Annamalai University, Chidambaram, Tamil Nadu. They were divided into four equal groups, each group consisting of fifteen subjects in which group-I underwent resistance training, group-II underwent endurance training, group-III underwent combined resistance and endurance training and group-IV acted as control group who did not participate in any special training. The subjects were tested on selected criterion variables such as high density lipoprotein and low density lipoprotein prior to and immediately after the training period. The selected criterion variables such as high density lipoprotein and low density lipoprotein were measured by using the Boehringer Mannheim Kit method. The analysis of covariance (ANCOVA) was applied to find out significant difference if any between experimental and control group. In all cases .05 level of confidence was utilized to test the significance. After analysis of data, the results shows that the endurance training and combined training groups have reduced the level of low density lipoprotein and improved the level of high density lipoprotein significantly but the resistance training group did not reduced the level of low density lipoprotein and improved the level of high density lipoprotein. However there were no significant differences in improving the selected criterion variables among all the three experimental groups.



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KEYWORDS : Resistance Training, Endurance Training, Combined Training, High Density Lipoprotein and Low density Lipoprotein.

INTRODUCTION

Resistance training a form of strength training in which each effort is performed against a specific opposing force generated by resistance (i.e. resistance to being pushed, squeezed, stretched or bent). Exercises are isotonic if a body part is moving against the force. Exercises are isometric if a body part is holding still against the force (**Wikipedia.org**).

Endurance is a term widely used in sport and can mean many different things to many different people. In sports it refers to an athlete's ability to sustain prolonged exercise for minutes, hours, or even days. Endurance requires the circulatory and respiratory systems to supply energy to the working muscles in order to support sustained physical activity. When

most people talk about endurance they are referring to aerobic endurance, which is often equated with cardiovascular fitness. Aerobic means "with oxygen" and during aerobic exercise the body uses oxygen to help supply the energy needed for exercise. The objective of endurance training is to develop the energy production systems to meet the demands of activity for as long as they required (www.about.com).

Lipoprotein is the one of the bio-chemical parameter, which are combinations of lipids (fats) and proteins, are the form in which lipids are transported in the blood. Lipoprotein are transport vehicles in the circulation plasma that are composed of various lipids such as cholesterol, phospholipids, triglycerides and proteins known as apoproteins. The major classes of Lipoprotein are chylomicrons, very low-density lipoprotein cholesterol (VLDL-C), LDL-C, and HDL-C. Chylomicrons are the largest Lipoprotein, consisting of approximately 85% triglycerides. Triglycerides are the main types of lipids found in adipose tissue and in the diet. Once the triglycerides are removed from the chylomicron at receptor sites from the chylomicron at receptor sites in the body, the chylomicron remnant is returned to the liver for further metabolism. The principal lipid of VLDL-C is also triglycerides (60 - 70%). LDL-C is the primary transport carrier of cholesterol in the circulation. About 50-60% of cholesterol is delivered to the cells by LDL-C. Evidence suggests that LDL-C may directly contribute to the cellular alterations of the inner walls of arteries which may ultimately lead to the development of the atherosclerotic plaque. Thus, LDL-C is proposed to be more highly associated with CHD than total cholesterol.

METHODOLOGY

Purpose

Epidemiological research has decisively demonstrated that high levels of high-density lipoprotein and low concentrations of low-density lipoprotein are associated with a decrease in coronary heart disease. Hence, the purpose of the research was to find out which of the training, among resistance, endurance, and combined training, is better to alter the selected bio-chemical variables namely high-density lipoprotein and low density lipoprotein.

Variables

Resistance training is a systematic programme of exercises against some resistance for the development of the human muscular system and the endurance training is the deliberate act of exercising to increase stamina and endurance. The both training workout can burn calories and fat. Based on the above mentioned concept, the resistance, endurance and combined (resistance & endurance) training were selected as independent variables. For every training programme there would be a change in the various system in human body. So, the biochemical variables namely high-density lipoprotein and low density lipoprotein selected as criterion variables. Both the criterion variables were measured by Boehringer Mannheim kit test and the unit of measurement is mg/dl.

Subjects

To achieve this purpose sixty male bachelor degree students studying during the year 2017-18 in the department of physical education, Annamalai University, Chidambaram, Tamil nadu were selected as subjects and they were divided into four equal groups of fifteen each as three experimental groups and one control (n = 15) at random. Their age ranged between 18 to 25 years. All the subjects were tested on criterion variables before and after commencement of the training programme.

Training Programme

Before constructing the training programme, a pilot study was conducted to find out the initial capacity of the subjects in order to fix the training intensity. The group-I performed resistance training, group -II performed endurance training, group-III performed combined resistance and endurance training and group-IV acted as control and did not participate any systematic training other than their regular routine work. The duration of the training programme was three alternate days in a week for twelve weeks. The resistance training programme comprised with eight exercises consisting of upper and lower body exercises for three sets. The initial training intensity for the resistance training group was 55% and it was progressively increased by 10% once in three weeks for twelve weeks. For

endurance training programme the running distance ranged between 900 meters to 1500 meters and the subjects were asked to perform the proposed repetitions with their maximum effort. The intensity of exercise was fixed based on subject’s maximal heart rate. The initial training intensity for the two experimental group was 60% and it was progressively increased by 10% once in three weeks for twelve weeks. The combined training group performed resistance training during every odd number of weeks and endurance training during every even number of weeks. The experimental groups performed their respective training programme under the strict supervision of the investigator. The subjects were tested again on the two criterion variables after the completion of training programme.

Statistical Analysis

For this study the random group design was used as experimental design. Analysis of covariance (ANCOVA) was used to find out the significant differences, if any, among the groups for criterion variables separately. No attempt made to equate the group in any manner. The Scheffe;s test was applied as post-hoc test, whenever the 'F' ratios of the adjusted post-test means were found to be significant at the .05 levels of confidence. All the data were analyzed using the statistical package (SPSS) in the computer.

RESULTS

High and low Density Lipoproteins

The data collected prior to and after the experimental period on high and low density lipoprotein of the resistance, endurance, combined training groups and control group were analysed and presented in Table-I.

Table -I
Analysis of Covariance on High and Low Density Lipoprotein of Resistance Training Endurance Training Combined Training and Control Groups

		Resistance Training Group	Endurance Training Group	Combined Training Group	Control group	SoV	Sum of squares	df	Mean square	'F' ratio
HIGH DENSITY LIPOPROTEIN	Pre-Test									
	Mean	51.30	51.33	5.19	50.10	B:	20.60	3	6.86	0.90
	SD	3.38	2.18	2.10	3.30	W:	435.60	56	7.78	
	Post-Test									
	Mean	52.20	53.10	53.06	49.21	B:	151.52	3	50.51	6.25*
	SD	2.81	3.41	1.90	3.10	W:	452.67	56	80.10	
Adjusted Post-Test										
Mean	51.80	52.62	53.44	49.70	B:	117.60	3	39.20	9.56*	
						W:	225.65	55	4.10	
LOW DENSITY LIPOPROTEIN	Pre-Test									
	Mean	112.25	110.00	112.48	111.36	B:	56.93	3	56.93	0.62
	SD	4.41	6.80	4.63	6.00	W:	1721.64	56	30.74	
	Post-Test									
	Mean	107.92	105.50	107.13	111.37	B:	271.53	3	90.51	2.33
	SD	3.60	7.73	5.50	7.27	W:	2177.48	56	38.90	
Adjusted Post-Test										
Mean	107.30	106.86	106.31	111.51	B:	254.68	3	84.90	5.04*	
						W:	926.68	55	16.85	

*Significant at 0.05 level of confidence.

df- degrees of freedom; SD-Standard Deviation; S.O.V.-Source of Variance. B-Between; W-Within
The table value required for significance at 0.05 level with df 3 & 56, and 3 & 55 is 2.78.

High Density Lipoprotein

Table-I shows that the adjusted post-test mean values on high density lipoprotein of resistance training group, endurance training group, the combined training group and the control group are 51.80, 52.62, 53.44 and 49.70 respectively. The obtained 'F' ratio value of 9.56 for the adjusted post-test scores of resistance, endurance, combined training and control groups were higher than the required table value of 2.78 for significance with df 3 and 55 at the .05 level of confidence.

Low Density Lipoprotein

Further the table-I indicates that, the adjusted post-test mean values of the resistance training group, the endurance training group, the combined training group and the control group are 107.30, 106.86, 106.31 and 111.51 respectively. The obtained 'F' ratio value of 5.04 for the adjusted post-test scores of resistance, endurance, combined training and control groups are higher than the required table value of 2.78 for significance with df 3 and 55 at the .05 level of confidence.

The above statistical analysis indicates that there were a significant increase in high density lipoprotein and decrease in the low density lipoprotein after training periods. Further to determine which of the paired means has a significant decrease, the Scheffe S test was applied. The result of the follow-up test is presented in Table-II.

Table-II
Scheffe's Test for the Difference between the Adjusted Post-Test Mean of High Density Lipoprotein and Low Density Lipoprotein

	Adjusted Post-Test Means				Means Differences	Confidence Interval
	Resistance Training Group	Endurance Training Group	Combined Training Group	Control group		
HIGH DENSITY LIPOPROTEIN	51.80			49.70	2.10	2.14
		52.62		49.70	2.92*	2.14
			53.44	49.70	3.74*	2.14
	51.80	52.62			0.82	2.14
	51.80		53.44		1.64	2.14
		52.62	53.44		0.82	2.14
LOW DENSITY LIPOPROTEIN	107.30			111.51	4.21	4.33
		106.86		111.51	4.63*	4.33
			106.31	111.51	5.20*	4.33
	107.30	106.86			0.44	4.33
	107.30		106.31		0.99	4.33
		106.86	106.31		0.55	4.33

* Significant at 0.05 level.

High Density Lipoprotein

Table-II shows that the adjusted post-test mean difference of 2.92 and 3.74 between endurance training group and the control group and combined training group and control group which are higher than the confidence interval value of 2.14 at 0.05 level of significance. It shows that, there was a significant difference between the groups. It may be concluded from the results that the endurance training group and combined training group have significantly increased high density lipoprotein when compared with the control group.

Further, table-II shows that the adjusted post-test mean difference between resistance training group and the control group 2.10 is lower than the confidence interval value of 2.14 at 0.05 level of significance. It is inferred that the resistance training group increased high density lipoprotein but not significantly. The mean difference between resistance training group and endurance training group and resistance training group and combined training group are 0.82, 1.64 and 0.82 which are lower than the confidence interval value of 2.14 at 0.05 level of significance. The results indicates that, there were no significant differences among the three experimental groups.

Low Density Lipoprotein

Table-II shows that, the adjusted post-test mean difference of 4.63 and 5.20 between endurance training group and the control group and combined training group and control group which are higher than the confidence interval value of 4.33 at 0.05 level of significance. It shows that, there was a significant difference between the groups. It may be concluded from the results that the endurance training group and the combined training group have significantly reduced low density lipoprotein when compared with the control group.

Table-II further shows that, the adjusted post-test mean difference between resistance training group and the control group 4.21 is lower than the confidence interval value of 4.33 at 0.05 level of significance. It is inferred that the resistance training group reduced low density lipoprotein but not significantly. The mean difference between resistance training group and endurance training group and resistance training group and combined training group are 0.44, 0.99 and 0.55 which are lower than the confidence interval value of 4.33 at 0.05 level of significance. The results indicates that, there were no significant differences in low density lipoprotein among the three experimental groups.

The details of adjusted post-test mean values of high density lipoprotein and low density lipoprotein for three experimental groups and control group are graphically illustrated in figure- I and II.

Figure-I
The Adjusted Post-Test Mean Values of High Density Lipoprotein for Three Experimental Groups With Control Group

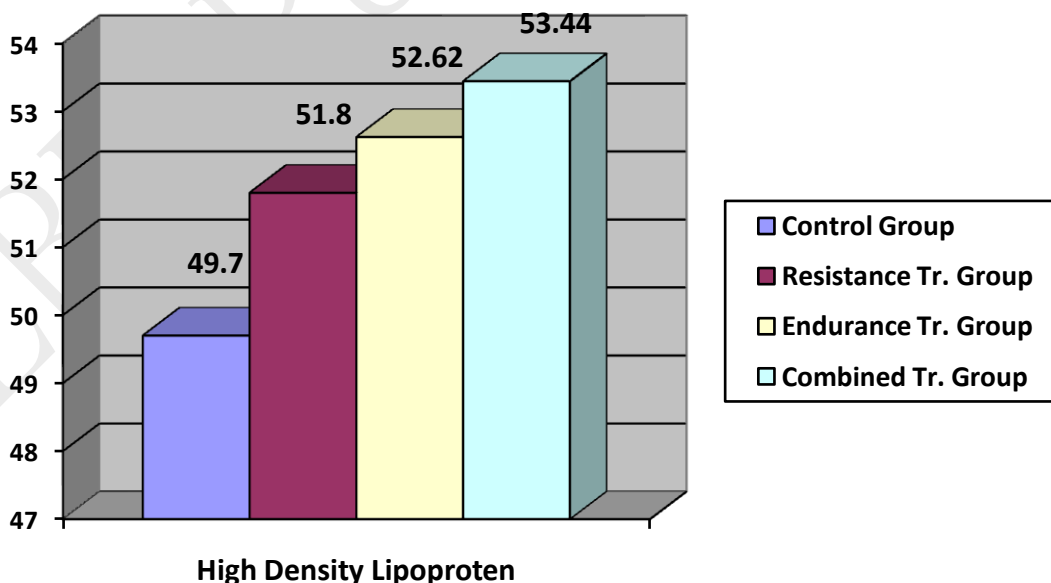
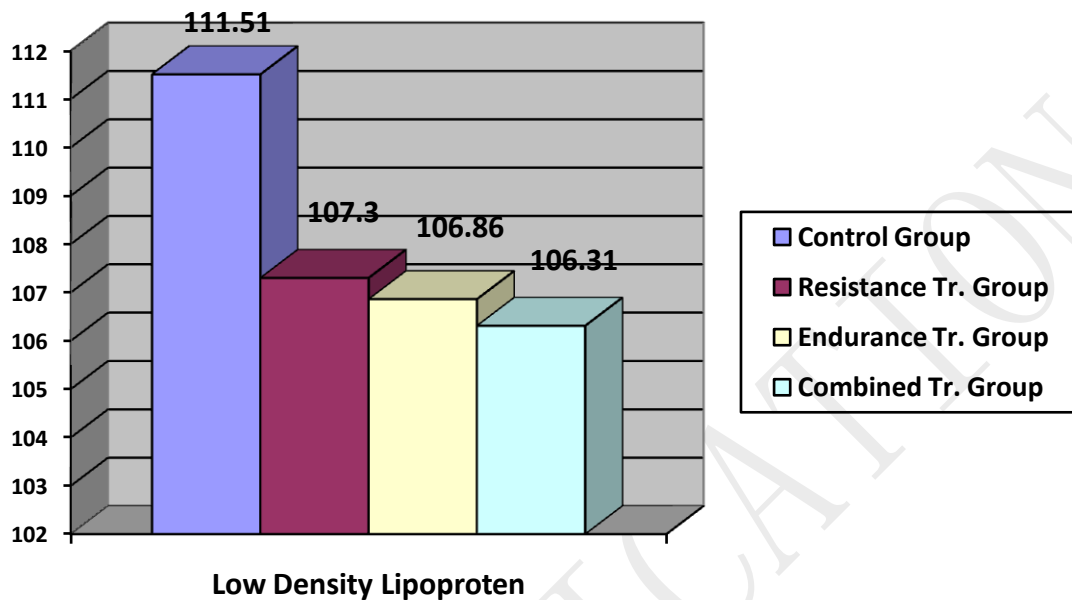


Figure-II
The Adjusted Post-Test Mean Values of Low Density Lipoprotein for Three Experimental Groups With Control Group



DISCUSSION

Regularly doing resistance training can result in a lowered heart rate and lowered blood pressure, especially after exercise. The risk of heart diseases is reduced to a considerable extent. Resistance training builds muscle to prevent or reduce muscle loss and help improve metabolism a key to maintaining our body weight. Regular endurance exercise lowers the risk of many chronic, disabling diseases. It can also help people with those diseases improve their health. The most significant health benefits occur when someone who is sedentary becomes moderately active. The result of the study also shows that, there was a significant increase in high density lipoprotein and decrease in low density lipoprotein only after the endurance training and the combined training when compared with the control group. *Charles Couillard (2001)*, also found that there was a significant increase in high density lipoprotein and decrease in low density lipoprotein in response to endurance and combined training. But the resistance training group did not significantly increase and reduce the high and low density lipoprotein. *Tambalis et al., (2009)* stated that, the aerobic exercise training programme to be effective in improving the lipid profiles. *Perez-Gomez et al., (2013)* resulted that, the ten weeks of endurance and resistance training also increased high density Lipoprotein and decreased low Density Lipoprotein. The following authors studies are supported this research *Banz, (April 2003)*, *Fahlman (February 2002)*, *Kelley (2009,)* *Kumar(2010)*, *Lee (1990)* and *Lemura,(2000)*.

CONCLUSIONS

It was concluded that the endurance training group and combined training group have significantly increased high density lipoprotein and decreased low density lipoprotein. Further, the study conclude that, there were no significant changes in high and low density lipoprotein in resistance training group. In altering the selected bio- chemical variables no significant differences were found among the three experimental groups.

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