CHAPTER IV

RESULTS AND DISCUSSION

4.1. OVERVIEW

The collected data is analysed and presented in this chapter. The purpose of the present study was to find out the effect of endurance, strength and concurrent training on selected physiological variables and lipid profile of college women players. To achieve the purpose of the study, 60 college women players who represented inter-collegiate and inter university level competitions irrespective of sports and games were selected randomly as subjects from Govindammal Aditanar College for Women, Tiruchendur. The age of the subjects ranged between 18 and 25 years. The selected subjects will be divided into three experimental groups and a control group with fifteen subjects (n=15) each.

The experimental design used for this study was pre and post test random group design involving sixty subjects, who were divided at random into four groups of fifteen each. This study consisted of three experimental groups and a control group. Group I (ETG) - Endurance Training Group, Group II (STG) - Strength Training Group, Group III (CTG) - Concurrent Training Group, and Group IV (CG) - Control Group. All the subjects were tested prior to and after the training on selected variables. The effect of the three independent variables namely ETG, STG and CTG on Fat Free Mass, body fat and basal metabolic rate (BMR) as physiological variables and HDL-C, LDL-C and Total Cholesterol as lipid profiles were investigated. The duration of the training period was three days per week for eight weeks. The subjects warmed up for 10 min before starting the main programme, and cooled down for 10 min after the main programme. All the training sessions were supervised by the researcher. However, control group was not exposed to any specific training but they participated in the regular scheduled work.

All the subjects were tested on selected dependent variables prior to and after the treatment. The data pertaining to the variables in this study were examined by using dependent t-test to find out significant changes and analysis of covariance (ANCOVA) for each variable separately in order to determine the differences if any among the adjusted post test means. Whenever 'F' ratio for the adjusted post-test was found to be significant, the Scheffe's test was used as post-hoc test to determine the six paired mean differences. The level of significance was fixed at 0.05 level of confidence in all the cases.

4.2. TEST OF SIGNIFICANCE

Statistical significance is used in hypothesis testing, whereby the null hypothesis (that there is no relationship between variables) is tested. A level of significance is selected (most commonly alpha = 0.05 or 0.01), which signifies the probability of incorrectly rejecting a true null hypothesis (**Polit and Beck, 2012**). If there is a significant difference between two groups at alpha = 0.05, it means there is only a 5% probability that the difference between the groups is due to chance; it gives no indication of the magnitude or clinical importance of the difference (**Haase, Ellis and Ladany, 1989**). When statistically significant results are achieved, they favour rejection of the null hypothesis, but they do not prove that the null hypothesis is false. Likewise, non-significant results do not prove that the null hypothesis is true; they also give no evidence of the truth or falsity of the hypothesis the researcher has generated (**Polit and Beck, 2012**). Statistical significance relates only to the likelihood that results obtained were not due to chance.

This is the vital portion of the thesis for achieving the conclusion by examining the hypothesis. The procedure of testing the hypothesis was either by accepting the hypothesis or rejecting the same in accordance with the results obtained in relation to the level of confidence.

The test was usually called the test of significance since one can test whether the difference between the three groups or within many groups the scores were significant or not. In this study, however, the obtained F value was greater than the table value, the hypothesis was accepted to the effect that there existed significant difference among the means of the groups compared and if obtained F value was lesser than the table value, then the hypothesis was rejected to the effect that there existed no significant difference among the means of the groups under study.

4.2.1. LEVEL OF SIGNIFICANCE

The purpose of this study was find out the effect of endurance, strength and concurrent training on selected physiological variables and lipid profile of college women players. The collected data pertaining to the dependent variables in this study were examined by using dependent t-test to find out significant improvement between pre and post tests and the analysis of covariance (ANCOVA) to find out the significant differences if any among the groups on selected criterion variables separately. In all the cases, 0.05 level of confidence was fixed to test of significance which was considered as appropriate for this study.

4.3. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON FAT FREE MASS

The analysis of dependent 't' test on the data obtained for **Fat Free Mass** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table VI.

TABLE VI
SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON FAT FREE MASS OF EXPERIMENTAL AND CONTROL GROUPS
(**Fat Free Mass** scores are expressed in Percentage)

		ETG	STG	CTG	CG
Pre test	Mean	25.71	25.73	25.75	25.76
	SD	0.28	0.32	0.32	0.48
Post test	Mean	26.48	26.90	27.75	25.85
	SD	0.41	0.39	0.60	0.37
't' test		6.55*	10.89*	11.36*	1.44

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.3.1. Results of Dependent 't' Test on Fat Free Mass

Table VI shows that the pre-test mean values of ETG, STG, CTG and CG on **Fat Free Mass** are 25.71, 25.73, 25.75 and 25.76 respectively and the post-test mean values on **Fat Free Mass** are 26.48, 26.90, 27.75 and 25.85 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **Fat Free Mass** are 6.55, 10.89, 11.36 and 1.44 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained 't' ratio values of experimental groups are greater than the table value, it is understood that ETG, STG and CTG had significantly increased the **Fat Free Mass**. However, the control group had not significantly improved the **Fat Free**

Mass. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **Fat Free Mass** of ETG, STG, CTG and CG were analysed and presented in Table VII.

TABLE VII
ANALYSIS OF COVARIANCE FOR THE DATA ON FAT FREE MASS AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	STG	CTG	CG					
26.492	26.906	27.748	25.845	Between	28.582	3	9.527	**51.046***
				Within	10.265	55	0.187	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.3.2. Results of Analysis of Covariance on Fat Free Mass

Table VII shows that the adjusted post-test means of ETG, STG, CTG and CG on **Fat Free Mass** are 26.492, 26.906, 27.748 and 25.845 respectively. The obtained F-ratio value is 51.046, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **Fat Free Mass**, the Scheffe's post-hoc test was applied and the results are presented in Table VIII.

TABLE VIII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF FAT FREE MASS

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
26.492	26.906			0.414	0.456
26.492		27.748		1.256*	
26.492			25.845	0.647*	
	26.906	27.748		0.842*	
	26.906		25.845	1.061*	
		27.748	25.845	1.903*	

*Significant at .05 level.

4.3.3. Results of Scheffe's Test on Fat Free Mass

The table VIII shows that the adjusted post test mean difference on **Fat Free Mass** between ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 1.256, 0.647, 0.842, 1.061 and 1.903 respectively which are higher than the confidence interval value of 0.456 and significant at .05 level of confidence. However, the adjusted post test mean difference on **Fat Free Mass** between ETG and STG is 0.414 which is less than the confidence interval value of 0.456 and insignificant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **Fat Free Mass** are graphically represented in figure 1.

The adjusted post test mean values of ETG, STG, CTG and CG on **Fat Free Mass** are graphically represented in figure 2.

FIGURE 1

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON FAT FREE MASS

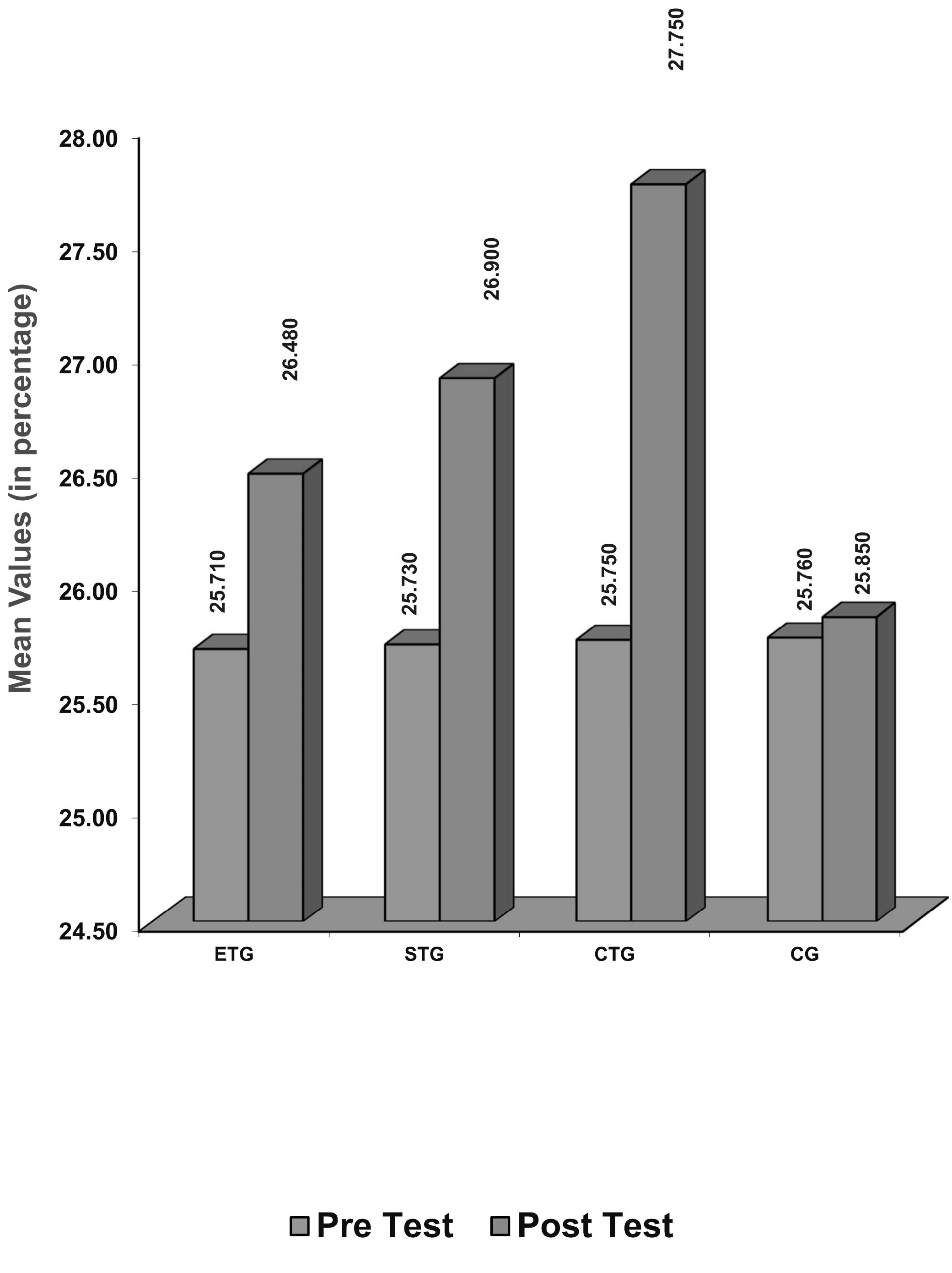
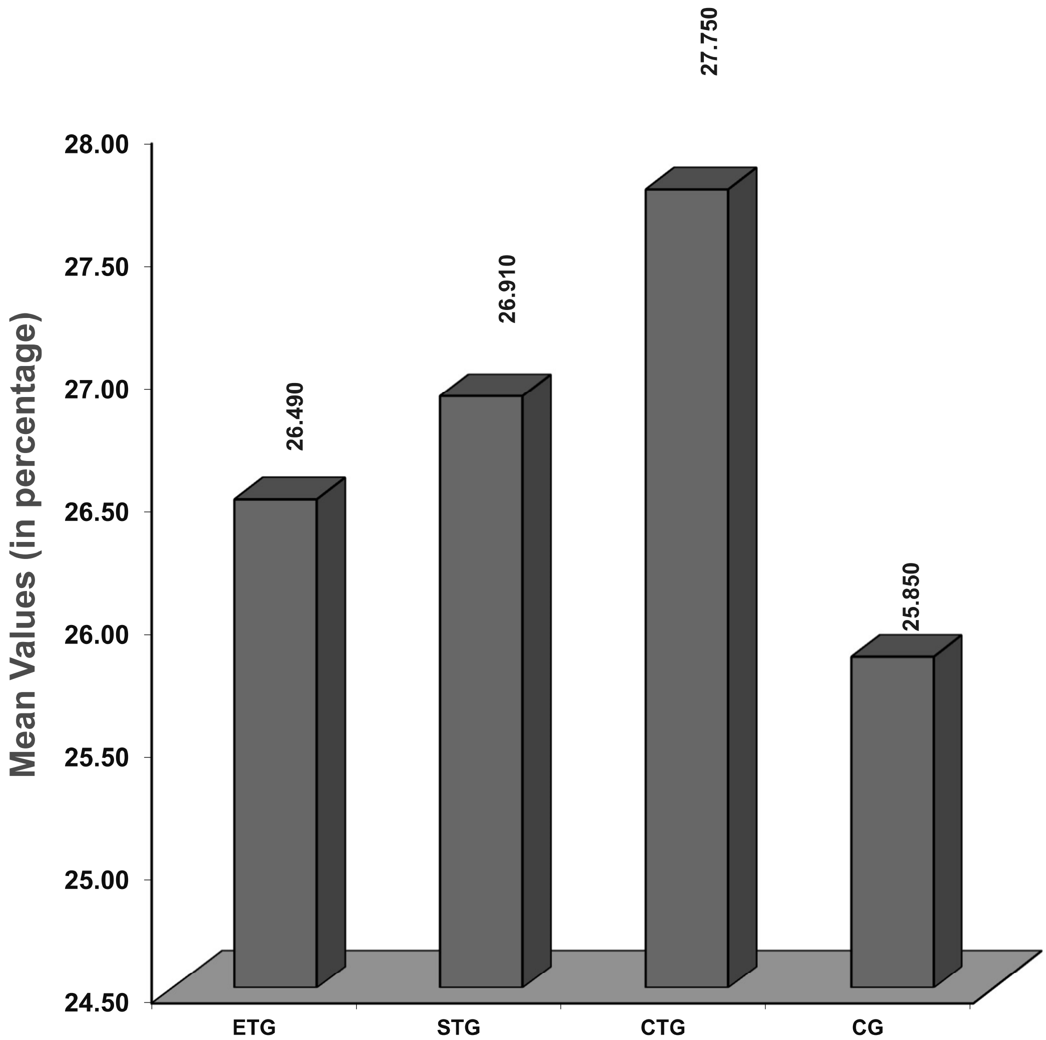


FIGURE 2

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON FAT FREE MASS



4.3.4. Discussion on Findings on Fat Free Mass

The result of the study indicates that all the experimental groups significantly differed when compared to the control group on increasing **Fat Free Mass**. However, it is further revealed that the experimental group CTG had increased **Fat Free Mass** better than the ETG and STG. At the same time there is no significant difference exists between ETG and STG.

Askari, et al., (2012) concluded that significant reduction in percent of subdermal fat was observed in experimental group in comparison with contol group after eight weeks of training in non athletic women. According to **Botero, et al., (2014)**, the high-intensity exercise training appears to have benefits on TG levels and to maintenance of FFM. **Binder, et al., (2005)** conducted three months of supervised progressive resistance training induced improvements in maximal voluntary thigh muscle strength and whole body FFM in frail, community-dwelling elderly women and men. **Davis, et al., (2008)** suggested that synergy rather than interference between concurrent strength and aerobic endurance training, support prescription of CE under defined conditions and document a highly effective athletic training protocol. The result of the findings the present study also incorporated with the findings of the present investigation and also with the findings of **Ali-Mohamadi, et al., (2014); and Manikowske, et al., (2012)**.

4.4. COMPUTATION OF DEPENDENT ‘t’ TEST, ANALYSIS OF COVARIANCE AND SCHEFFE’S POST HOC TEST ON BODY FAT

The analysis of dependent ‘t’ test on the data obtained for **Body Fat** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table IX.

TABLE IX
SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT ‘t’ TEST FOR THE PRE AND POST TESTS ON BODY FAT OF EXPERIMENTAL AND CONTROL GROUPS
(**Body Fat** scores are expressed in Percentage)

		ETG	STG	CTG	CG
Pre test	Mean	28.70	28.72	28.76	28.73
	SD	0.28	0.30	0.31	0.40
Post test	Mean	27.45	26.89	26.30	28.69
	SD	0.40	0.43	0.77	0.36
‘t’ test		10.81*	16.67*	14.09*	1.32

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.4.1. Results of Dependent ‘t’ Test on Body Fat

Table IX shows that the pre-test mean values of ETG, STG, CTG and CG on **Body Fat** are 28.70, 28.72, 28.76 and 28.73 respectively and the post-test mean values on **Body Fat** are 27.45, 26.89, 26.30 and 28.69 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **Body Fat** are 10.81, 16.67, 14.09 and 1.32 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained ‘t’ ratio values of experimental groups are greater than the table value, it is understood that ETG, STG and CTG had significantly reduced the **Body Fat**. However, the control group had not significantly reduced the **Body Fat**. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **Body Fat** of ETG, STG, CTG and CG were analysed and presented in Table X.

TABLE X
ANALYSIS OF COVARIANCE FOR THE DATA ON BODY FAT AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	STG	CTG	CG					
27.469	26.890	26.280	28.692	Between	47.512	3	15.837	**75.498***
				Within	11.538	55	0.210	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.4.2. Results of Analysis of Covariance on Body Fat

Table X shows that the adjusted post-test means of ETG, STG, CTG and CG on **Body Fat** are 27.469, 26.890, 26.280 and 28.692 respectively. The obtained F-ratio value is 75.498, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **Body Fat**, the Scheffe's post-hoc test was applied and the results are presented in Table XI.

TABLE XI

SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF BODY FAT

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
27.469	26.890			0.579*	0.483
27.469		26.280		1.189*	
27.469			28.692	1.223*	
	26.890	26.280		0.610*	
	26.890		28.692	1.802*	
		26.280	28.692	2.412*	

*Significant at .05 level.

4.4.3. Results of Scheffe's Test on Body Fat

The table XI shows that the adjusted post test mean difference on **Body Fat** between ETG and STG, ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 0.579, 1.189, 1.223, 0.610, 1.802 and 2.412 respectively which are higher than the confidence interval value of 0.483 and significant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **Body Fat** are graphically represented in figure 3.

The adjusted post test mean values of ETG, STG, CTG and CG on **Body Fat** are graphically represented in figure 4.

FIGURE 3

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON BODY FAT

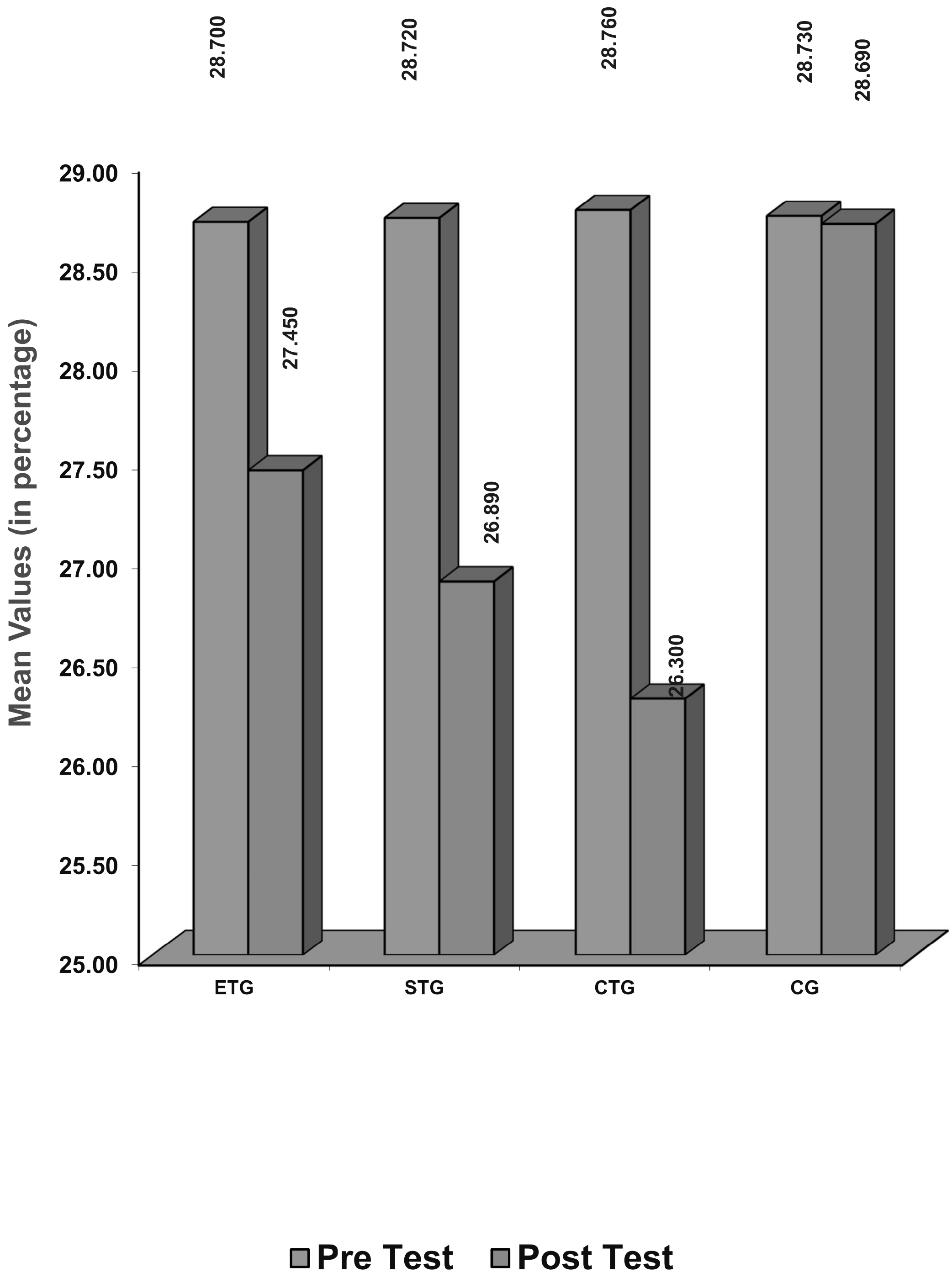
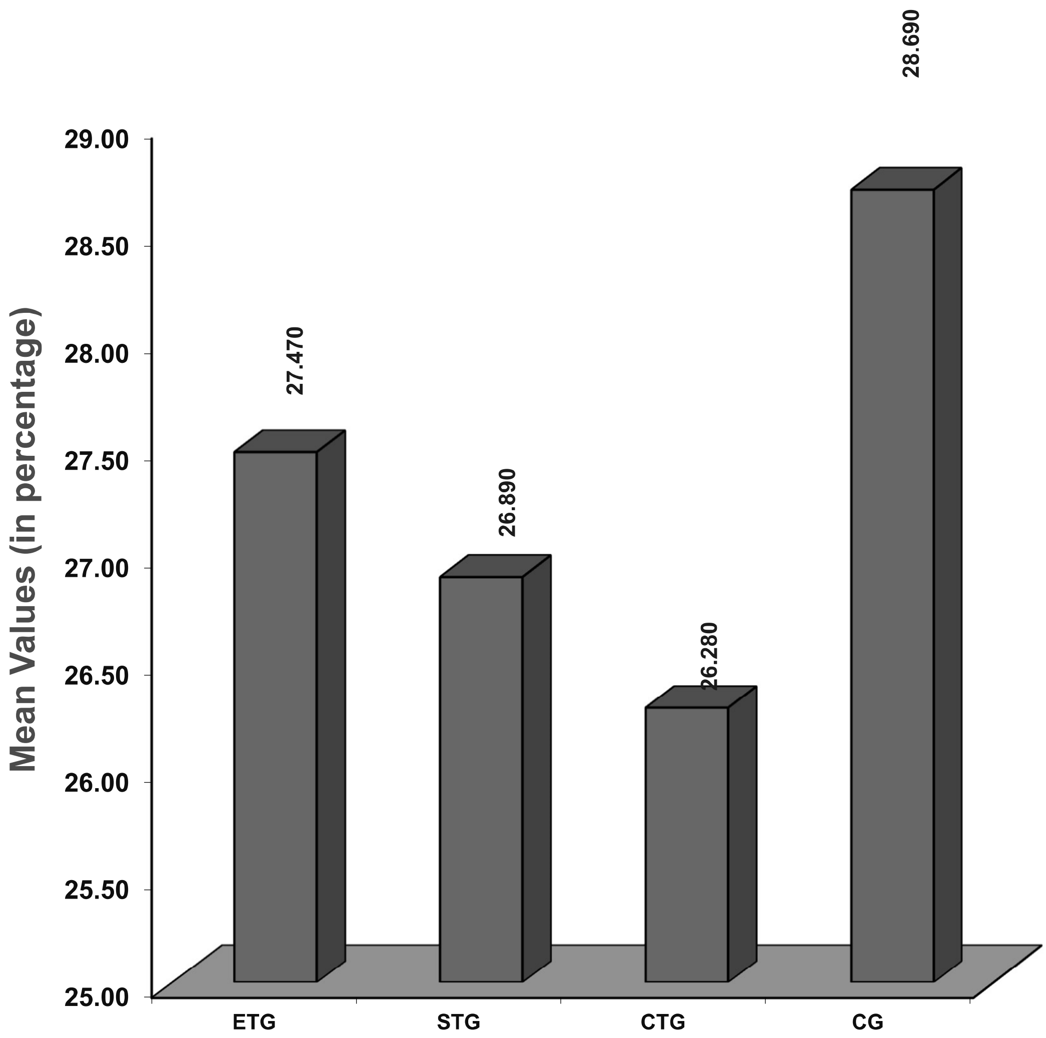


FIGURE 4

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON BODY FAT



4.4.4. Discussion on Findings on Body Fat

The result of the study reveals that all the experimental groups significantly differed when compared to the control group on **Body Fat**. However, it is further revealed that the experimental group CTG had reduced **Body Fat** better than the ETG and STG, and STG had reduced better than ETG.

Kostrzewa-Nowak, et al., (2015) concluded that twelve-week-long fitness training programme of two alternating styles (low and high impact) has a beneficial effect on overweight young women. **Orhan, et al., (2012)** found out that the decrease in fat percentage of male and female students was greater in the endurance exercise group than the sprint exercise group and on the whole female students outperformed male students in reducing both heart rate and body fat. The result of the findings the present study also against with the findings of the above investigations.

According to **Binder, et al., (2005)**, the supervised exercise program may not be sufficient to reduce whole-body or intra-abdominal fat area. The result of the findings the present study also against with the findings of the above study.

Daray, et al., (2011) investigated that combined endurance and resistance training may be an effective modality for reducing plasma CRP in young adult females independent of changes in aerobic capacity or body composition. **Ali-Mohamadi, et al., (2014)** investigated that strength endurance and endurance strength training groups significantly decreased in body fat. The result of the findings the present study also integrated with the findings of the above study and **Davis, et al., (2008); Eklund, et al., (2016); Stasiulis, et al., (2010); Sigal, et al., (2014); Ramírez-Campillo, et al., (2013);** and **Skrypnik, et al., (2015).**

4.5. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON BASEL METABOLIC RATE

The analysis of dependent 't' test on the data obtained for **Basal Metabolic Rate** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table XII.

TABLE XII
SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON BASAL METABOLIC RATE OF EXPERIMENTAL AND CONTROL GROUPS
(**Basel Metabolic Rate** scores are expressed in Calories)

		ETG	STG	CTG	CG
Pre test	Mean	1623.80	1626.33	1625.93	1623.53
	SD	9.50	12.76	15.23	15.34
Post test	Mean	1640.73	1655.87	1691.00	1626.80
	SD	9.42	12.36	19.01	12.02
't' test		9.05*	10.35*	13.77*	1.53

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.5.1. Results of Dependent 't' Test on Basel Metabolic Rate

Table XII shows that the pre-test mean values of ETG, STG, CTG and CG on **Basal Metabolic Rate** are 1623.80, 1226.33, 1625.93 and 1623.53 respectively and the post-test mean values on **Basal Metabolic Rate** are 1640.73, 1655.87, 1691.00 and 1626.80 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **Basal Metabolic Rate** are 9.05, 10.35, 13.77 and 1.53 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained 't' ratio values of experimental groups are greater than the table value, it is understood that STG, ETG and CTG had significantly increased the **Basal**

Metabolic Rate. However, the control group had not significantly increased the **Basal Metabolic Rate**. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **Basal Metabolic Rate** of ETG, STG, CTG and CG were analysed and presented in Table XIII.

TABLE XIII
ANALYSIS OF COVARIANCE FOR THE DATA ON BASAL METABOLIC RATE AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	STG	CTG	CG					
1641.413	1654.981	1690.362	1627.644	Between	32458.588	3	10819.529	**89.949***
				Within	6615.684	55	120.285	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.5.2. Results of Analysis of Covariance on Basal Metabolic Rate

Table XIII shows that the adjusted post-test means of ETG, STG, CTG and CG on **Basal Metabolic Rate** are 1641.413, 1654.981, 1690.362 and 1627.644 respectively. The obtained F-ratio value is 89.949, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **Basal Metabolic Rate**, the Scheffe's post-hoc test was applied and the results are presented in Table XIV.

TABLE XIV
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF BASAL METABOLIC RATE

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
1641.413	1654.981			13.568*	11.565
1641.413		1690.362		48.949*	
1641.413			1627.644	13.769*	
	1654.981	1690.362		35.380*	
	1654.981		1627.644	27.337*	
		1690.362	1627.644	62.717*	

*Significant at .05 level.

4.5.3. Results of Scheffe's Test on Basel Metabolic Rate

The table XIV shows that the adjusted post test mean difference on **Basal Metabolic Rate** between ETG and STG, ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 13.568, 48.949, 13.769, 35.380, 27.337 and 62.717 respectively which are higher than the confidence interval value of 0.483 and significant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **Basal Metabolic Rate** are graphically represented in figure 5.

The adjusted post test mean values of ETG, STG, CTG and CG on **Basal Metabolic Rate** are graphically represented in figure 6.

FIGURE 5

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON BASAL METABOLIC RATE

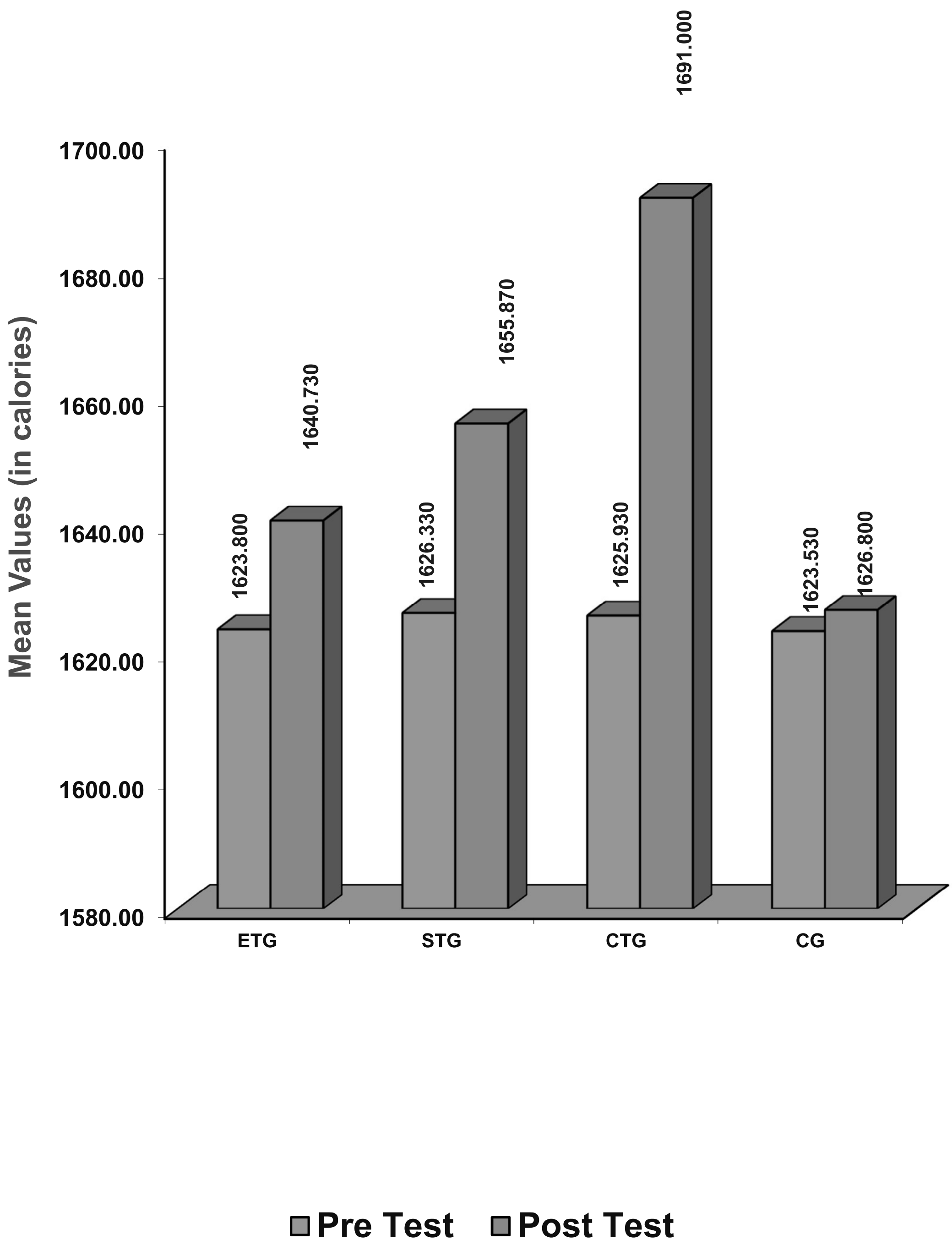
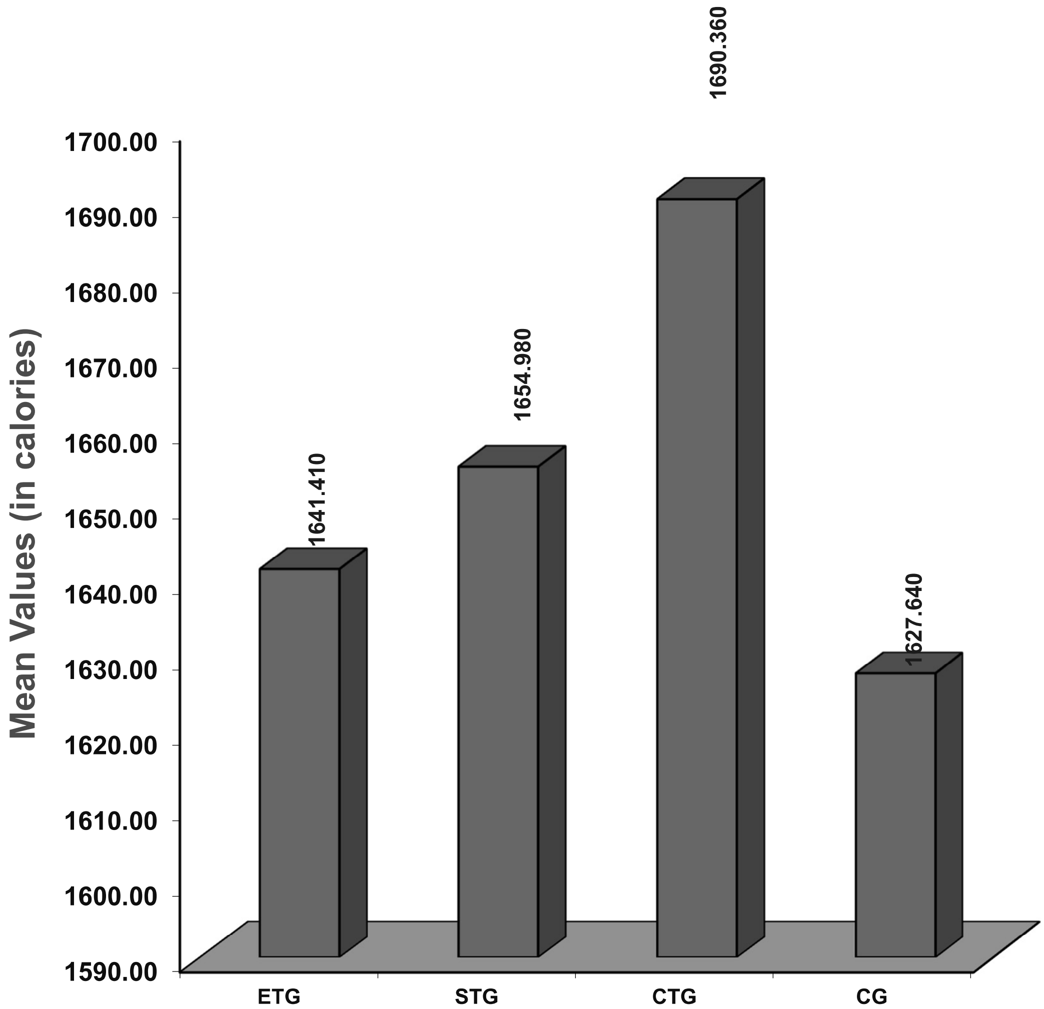


FIGURE 6

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON BASAL METABOLIC RATE



4.5.4. Discussion on Findings on Basal Metabolic Rate

The result of the study indicates that all the experimental groups significantly differed when compared to the control group on **Basal Metabolic Rate**. However, it is further revealed that the experimental group CTG had increased **Basal Metabolic Rate** better than the ETG and STG, and STG had increased better than ETG.

Shinkai, Watanabe and Watanabe (1993) found that suggested that physical exercise and an active daily life are important for decelerating the decrease in BMR for the elderly through maintaining active tissue mass and its basal metabolism. **Nesic, Seper and Cvetko (2014)** concluded that the strength training, even in relatively restricted time period, influences the changes in person's physique, as well as the changes in resting energy expenditure and they suggested that the overall changes in one's physique and energy expenditure indicate that the strength training needs to be one of the crucial factors in physical activity, aimed at the improvement of person's health. **Dolezal and Potteiger (1998)** investigated that BMR increased significantly from pre to post training for resistance training program of 10 weeks and RT alone would increase BMR. **Manikowske, et al., (2012)** concluded that FFM and RMR significantly increased among women after 12 weeks in a RT exercise program. The result of the findings the present study also incorporated with the findings of above studies.

4.6. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON HDL-C

The analysis of dependent 't' test on the data obtained for **HDL-C** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table XV.

TABLE XV

SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON HDL-C OF EXPERIMENTAL AND CONTROL GROUPS

(**HDL-C** scores are expressed in mg/dl)

		ETG	STG	CTG	CG
Pre test	Mean	51.04	50.93	51.02	51.10
	SD	0.55	0.57	0.60	0.65
Post test	Mean	52.39	52.30	54.37	51.11
	SD	0.41	0.62	0.88	0.65
't' test		7.55*	8.78*	9.90*	1.61

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.6.1. Results of Dependent 't' Test on HDL-C

Table XV shows that the pre-test mean values of ETG, STG, CTG and CG on **HDL-C** are 51.04, 50.93, 51.02 and 51.10 respectively and the post-test mean values on **HDL-C** are 52.39, 52.30, 54.37 and 51.11 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **HDL-C** are 7.55, 8.78, 9.90 and 1.61 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained 't' ratio values of experimental groups are greater than the table value, it is understood that STG, ETG and CTG had significantly improved the **HDL-C**. However, the control group had not significantly improved the **HDL-C**. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **HDL-C** of ETG, STG, CTG and CG were analysed and presented in Table XVI.

TABLE XVI
ANALYSIS OF COVARIANCE FOR THE DATA ON HDL-C AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	STG	CTG	CG					
52.383	52.319	54.376	51.091	Between	82.992	3	27.664	**64.868***
				Within	23.456	55	0.426	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.6.2. Results of Analysis of Covariance on HDL-C

Table XVI shows that the adjusted post-test means of ETG, STG, CTG and CG on **HDL-C** are 52.383, 52.319, 54.376 and 51.091 respectively. The obtained F-ratio value is 64.868, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **HDL-C**, the Scheffe's post-hoc test was applied and the results are presented in Table XVII.

TABLE XVII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF HDL-C

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
52.383	52.319			0.064	0.689
52.383		54.376		1.993*	
52.383			51.091	1.291*	
	52.319	54.376		2.056*	
	52.319		51.091	1.228*	
		54.376	51.091	3.284*	

*Significant at .05 level.

4.6.3. Results of Scheffe's Test on HDL-C

The table XVII shows that the adjusted post test mean difference on **HDL-C** between ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 1.993, 1.291, 2.056, 1.228 and 3.284 respectively which are higher than the confidence interval value of 0.689 and significant at .05 level of confidence. However, the adjusted post test mean difference on **HDL-C** between ETG and STG is 0.064 which is less than the confidence interval value of 0.689 and insignificant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **HDL-C** are graphically represented in figure 7.

The adjusted post test mean values of ETG, STG, CTG and CG on **HDL-C** are graphically represented in figure 8.

FIGURE 7

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON HDL-C

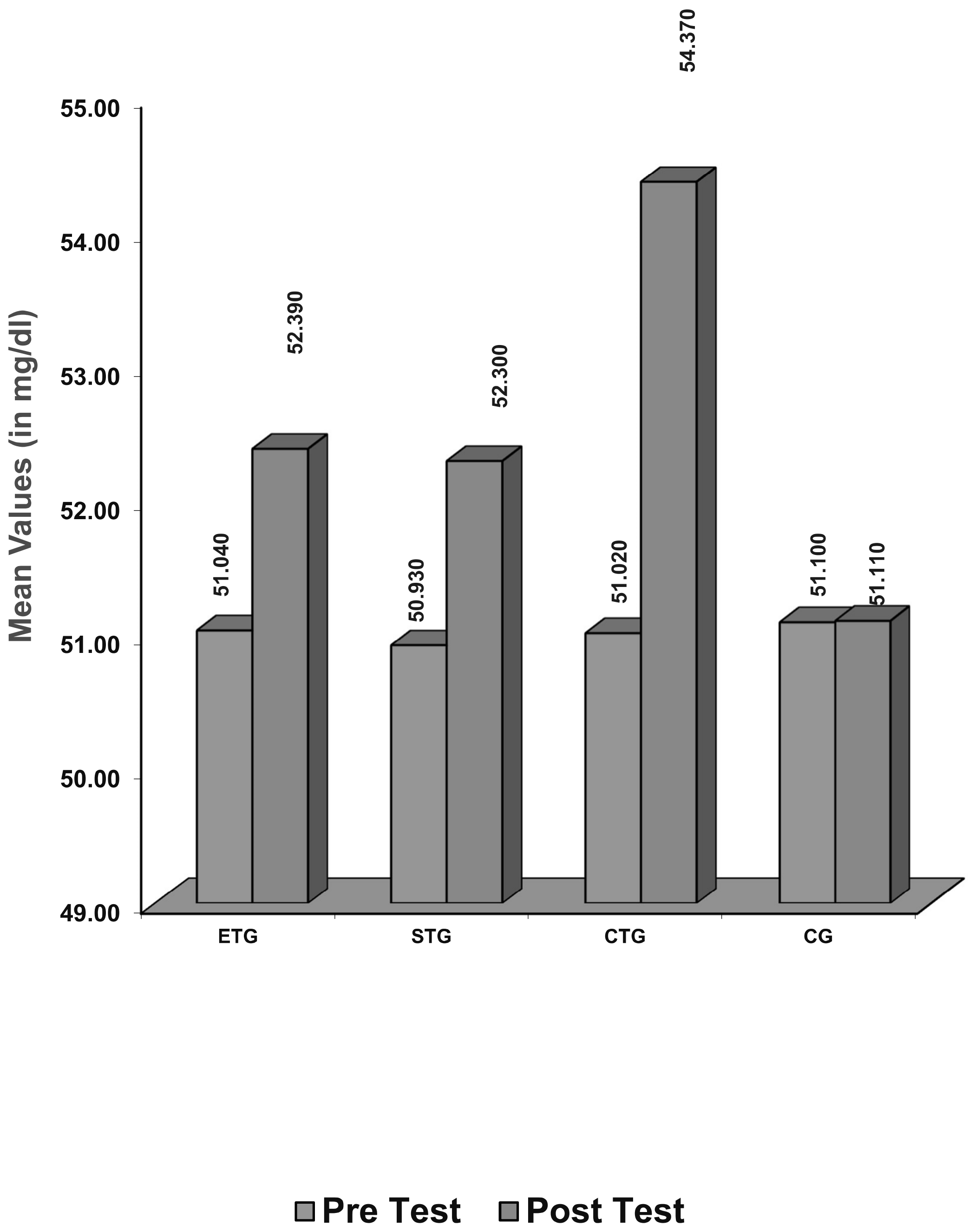
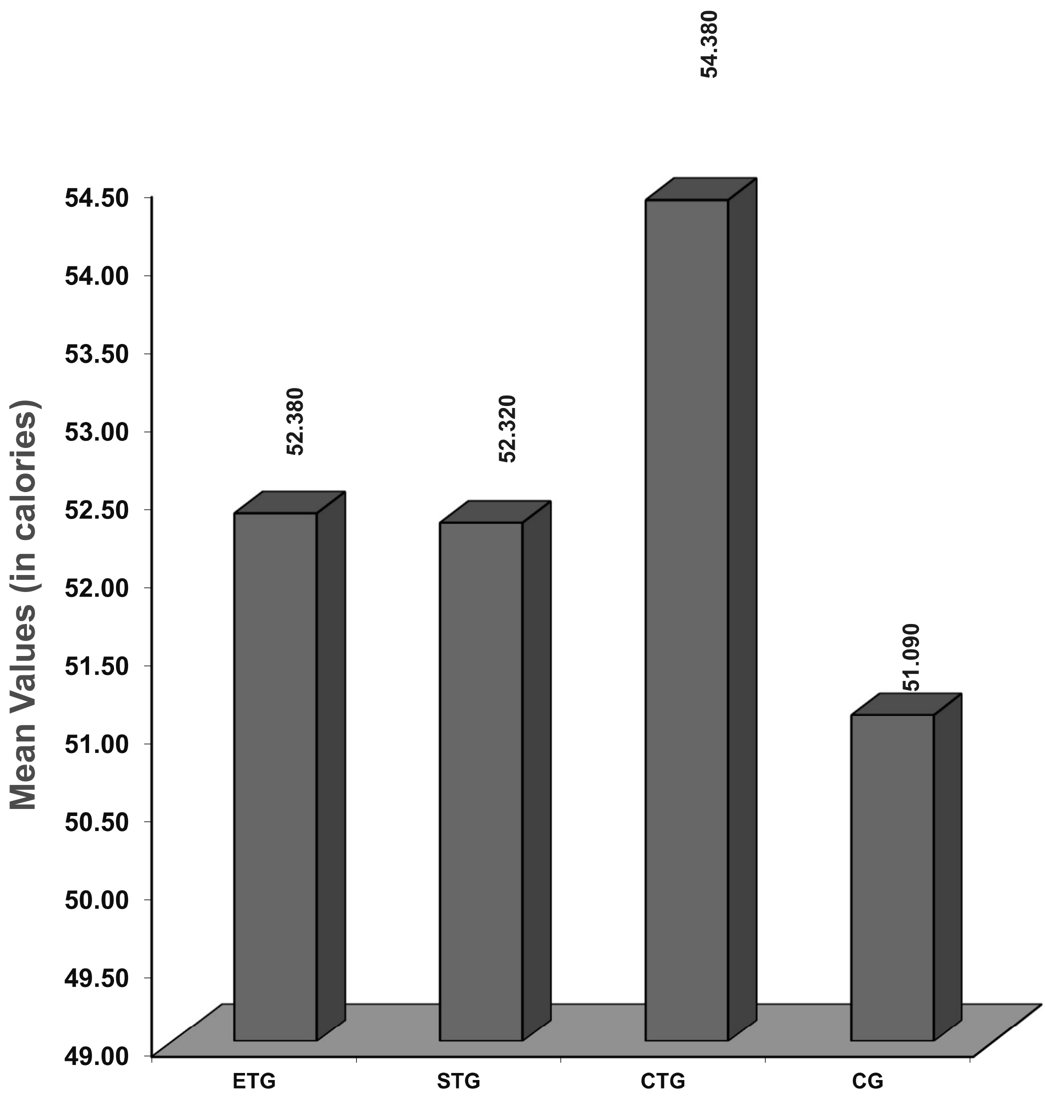


FIGURE 8

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON HDL-C



4.6.4. Discussion on Findings on HDL-C

The result of the study indicates that all the experimental groups significantly differed when compared to the control group on **HDL-C**. However, it is further revealed that the experimental group CTG had increased **HDL-C** better than the ETG and STG. Also there is no significant difference exists between ETG and STG.

Askari, et al., (2012) found out that due to the effect of eight week aerobic training the increase of HDL-C was observed in experimental group in non athletic women. **Stasiulis, et al., (2010)** found that in improvement in high-density lipoprotein cholesterol after eight week of aerobic cyclying. **Leon and Sanchez (2001)** reviewed the effects of aerobic exercise training improves **LeMura, et al., (2000)** suggested that aerobic-type exercise improves lipoprotein-lipid profiles, cardio respiratory fitness and body composition in healthy, young women, while resistance training significantly improved upper and lower body strength only. According to **Joseph, et al., (1999**) resistance exercise would properly increase HDL-C concentration. **Ossanloo, Zafari and Najar (2012)** showed that levels of HDL-C significantly modified after 12 weeks of concurrent training. The results of the findings the present study also supported with the findings of the above researches.

4.7. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON LDL-C

The analysis of dependent 't' test on the data obtained for **LDL-C** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table XVIII.

TABLE XVIII
SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON LDL-C OF EXPERIMENTAL AND CONTROL GROUPS
(**LDL-C** scores are expressed in mg/dl)

		ETG	STG	CTG	CG
Pre test	Mean	51.71	51.78	51.83	51.79
	SD	0.27	0.28	0.39	0.52
Post test	Mean	50.30	50.39	49.14	51.69
	SD	0.62	0.41	0.65	0.36
't' test		8.61*	9.79*	15.72*	1.64

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.7.1. Results of Dependent 't' Test on LDL-C

Table XVIII shows that the pre-test 1 values of ETG, STG, CTG and CG on **LDL-C** are. 51.71, 51.78, 51.83 and 51.79 respectively and the post-test mean values on **LDL-C** are 50.30, 50.39, 49.14 and 51.69 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **LDL-C** are 8.61, 9.79, 15.72 and 1.64 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained 't' ratio values of experimental groups are greater than the table value, it is understood that STG, ETG and CTG had significantly reduced the **LDL-C**. However, the control group had not significantly reduced the **LDL-C**. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **LDL-C** of ETG, STG, CTG and CG were analysed and presented in Table XIX.

TABLE XIX
ANALYSIS OF COVARIANCE FOR THE DATA ON LDL-C AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	**STG**	**CTG**	**CG**					
50.331	50.386	49.117	51.686	Between	49.475	3	16.492	**64.642***
				Within	14.0317576	55	0.255	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.7.2. Results of Analysis of Covariance on LDL-C

Table XIX shows that the adjusted post-test means of ETG, STG, CTG and CG on **LDL-C** are 50.331, 50.386, 49.117 and 51.686 respectively. The obtained F-ratio value is 64.642, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **LDL-C**, the Scheffe's post-hoc test was applied and the results are presented in Table XX.

TABLE XX
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF LDL-C

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
50.331	50.386			0.055	0.533
50.331		49.117		1.214*	
50.331			51.686	1.355*	
	50.386	49.117		1.269*	
	50.386		51.686	1.300*	
		49.117	51.686	2.569*	

*Significant at .05 level.

4.7.3. Results of Scheffe's Test on LDL-C

The table XX shows that the adjusted post test mean difference on **LDL-C** between ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 1.214, 1.355, 1.269, 1.300 and 2.569 respectively which are higher than the confidence interval value of 0.533 and significant at .05 level of confidence. However, the adjusted post test mean difference on **LDL-C** between ETG and STG is 0.055 which is less than the confidence interval value of 0.533 and insignificant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **LDL-C** are graphically represented in figure 9.

The adjusted post test mean values of ETG, STG, CTG and CG on **LDL-C** are graphically represented in figure 10.

FIGURE 9

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON LDL-C

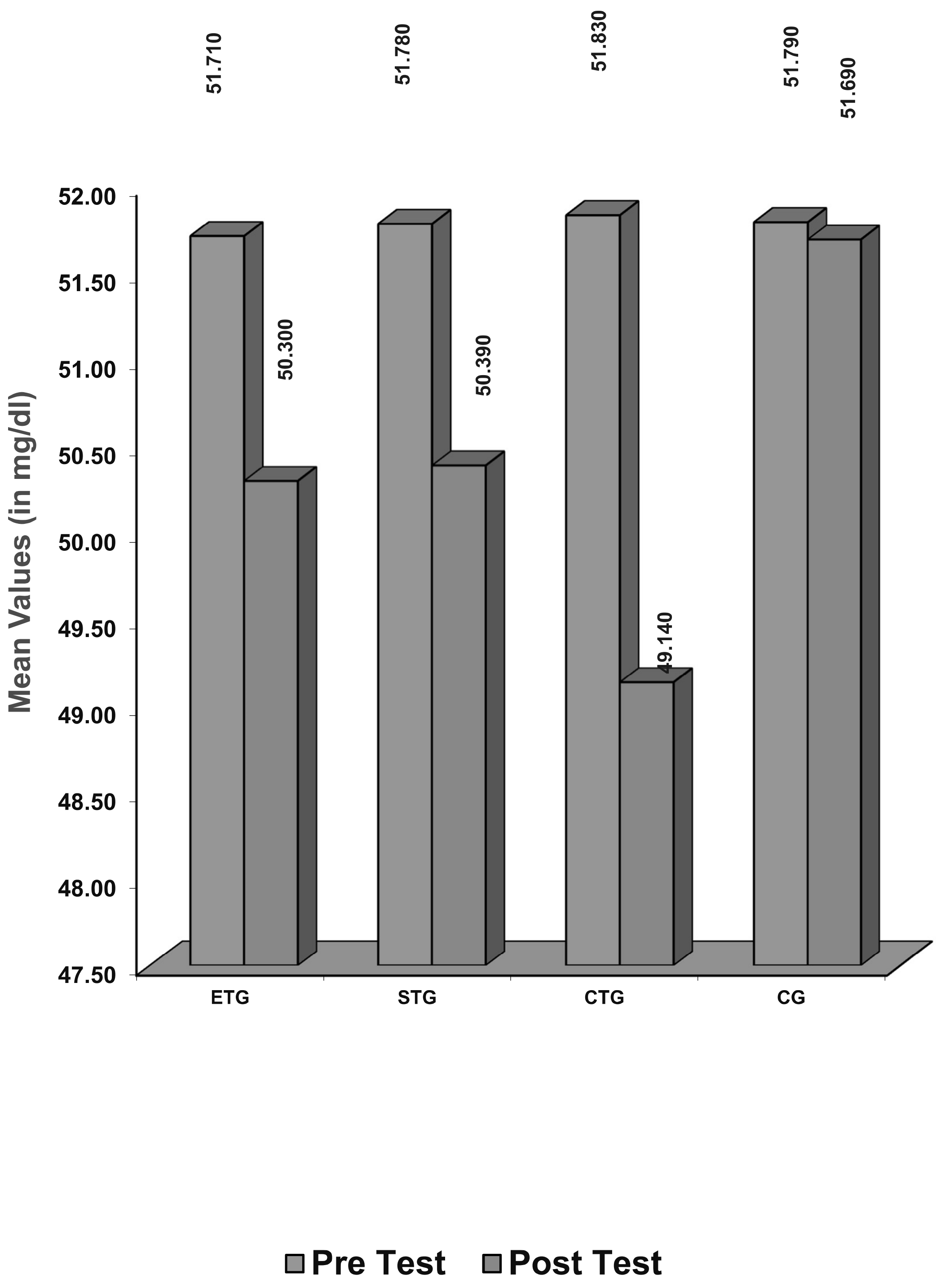
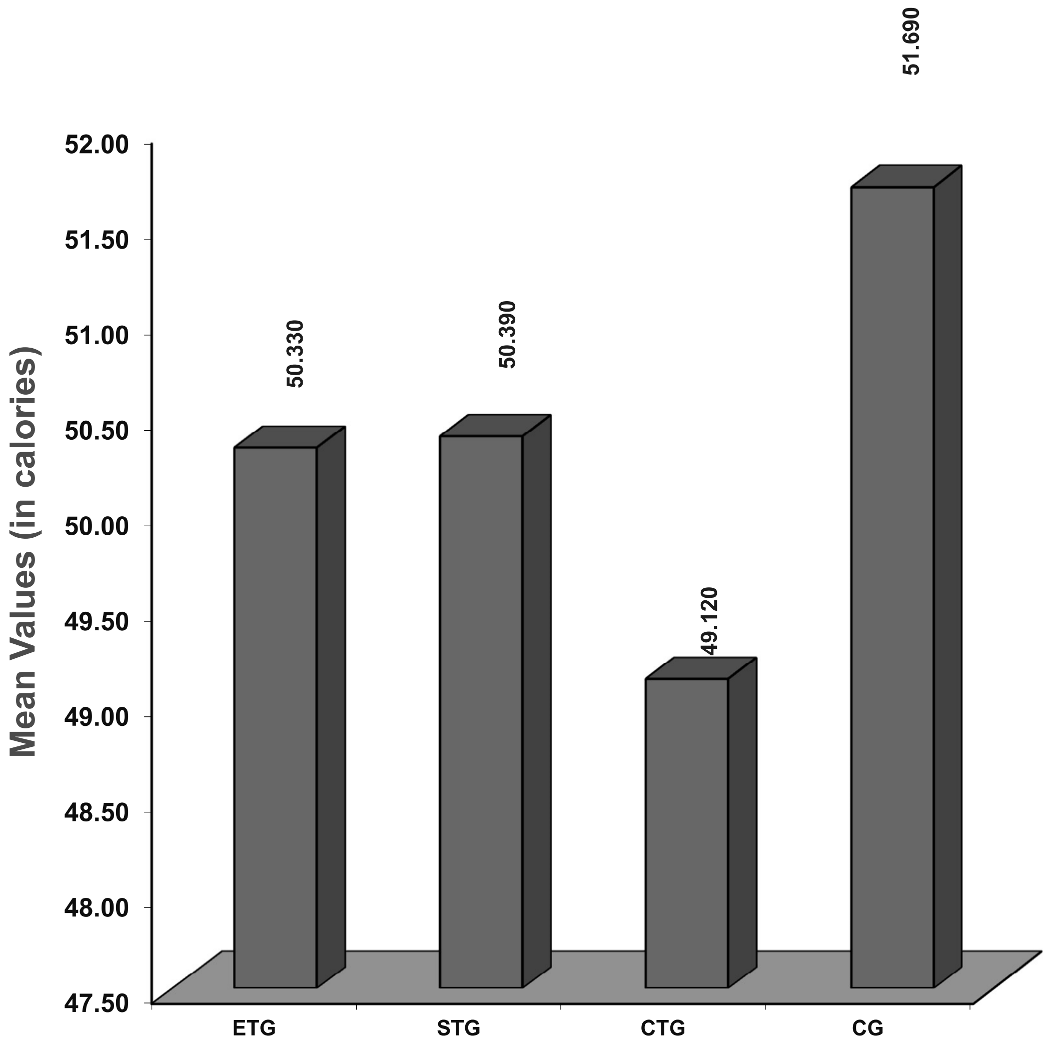


FIGURE 10

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON LDL-C



4.7.4. Discussion on Findings on LDL-C

The result of the study reveals that all the experimental groups significantly differed when compared to the control group on **LDL-C**. However, it is further revealed that the experimental group CTG had reduced **LDL-C** better than the ETG and STG. Also there is no significant difference exists between ETG and STG.

Gullu, et al., (2013) concluded that there were decreases in step-aerobics group of body weight, BMI, total cholesterol, LDL-K, and triglyceride and suggested that maintaining a healthy life would be more appropriate in step-aerobics exercises due to have high tempos and rhythms than the run-walk exercises. According to **Joseph, et al., (1999**) resistance exercise would properly reduce LDL-C concentration. **Ossanloo, Zafari and Najar (2012)** concluded that moderate intensity combined training included aerobic dance, step exercises and resistance training have positive effect on some cardio vascular disease risk factors in sedentary females. The result of the findings the present study also integrated with the findings of **Halverstadt, et al., (2008); Askari, et al., (2012); Heitkamp, et al., (2008); Tolfrey, Jones and Campbell (2000); Seyed et al., (2016); Lemor, et al., (2000);** and **Durstine, et al., (2002)**.

4.8. COMPUTATION OF DEPENDENT 't' TEST, ANALYSIS OF COVARIANCE AND SCHEFFE'S POST HOC TEST ON TOTAL CHOLESTEROL

The analysis of dependent 't' test on the data obtained for **Total Cholesterol** of the pre-test and post-test means of ETG, STG, CTG and CG has been analysed and presented in Table XXI.

TABLE XXI
SUMMARY OF MEAN, STANDARD DEVIATION AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON TOTAL CHOLESTEROL OF EXPERIMENTAL AND CONTROL GROUPS
(**Total Cholesterol** scores are expressed in mg/dl)

		ETG	STG	CTG	CG
Pre test	Mean	104.78	104.80	104.77	104.79
	SD	0.44	0.41	0.31	0.42
Post test	Mean	102.55	102.64	101.56	104.69
	SD	0.62	0.41	0.74	0.36
't' test		11.66*	12.12*	16.95*	1.73

*Significant at .05 level. The table value required for .05 level of significance with df 14 is 1.761.

4.8.1. Results of Dependent 't' Test on TOTAL CHOLESTEROL

Table XXI shows that the pre-test 1 values of ETG, STG, CTG and CG on **Total Cholesterol** are. 104.78, 104.80, 104.77 and 104.79 respectively and the post-test mean values on **Total Cholesterol** are 102.55, 102.64, 101.56 and 104.69 respectively. The obtained dependent t-ratio values between the pre and post test means of ETG, STG, CTG and CG on **Total Cholesterol** are 11.66, 12.12, 16.95 and 1.73 respectively. The table value required for significant difference with df 14 at .05 level is 1.761. Since, the obtained 't' ratio values of experimental groups are greater than the table value, it is understood that STG, ETG and CTG had significantly reduced the **Total Cholesterol**. However, the control group had not significantly reduced the **Total Cholesterol**. The obtained 't' value for the control group is less than the table value since they were not subjected to any specific training.

The analysis of covariance on **Total Cholesterol** of ETG, STG, CTG and CG were analysed and presented in Table XXII.

TABLE XXII
ANALYSIS OF COVARIANCE FOR THE DATA ON TOTAL CHOLESTEROL AMONG EXPERIMENTAL AND CONTROL GROUPS

Adjusted Post Test Means				Sources of Variance	Sum of Squares	df	Mean Squares	F-Ratio
ETG	STG	CTG	CG					
102.552	102.634	101.563	104.694	Between	77.844	3	25.948	**85.345***
				Within	16.722	55	0.304	

* Significant at 0.05 level of confidence.
The table value for significance at 0.05 with df 3 and 55 is 2.78.

4.8.2. Results of Analysis of Covariance on Total Cholesterol

Table XXII shows that the adjusted post-test means of ETG, STG, CTG and CG on **Total Cholesterol** are 102.552, 102.634, 101.563 and 104.694 respectively. The obtained F-ratio value is 85.345, which is higher than the table value 2.78 with df 3 and 55 required for significance at .05 level. Since the value of F-ratio is higher than the table value, it indicates that there exist significant differences among the adjusted post-test means of ETG, STG, CTG and CG. To find out which of the paired means had a significant difference on **Total Cholesterol**, the Scheffe's post-hoc test was applied and the results are presented in Table XXIII.

TABLE XXIII
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS OF TOTAL CHOLESTEROL

Adjusted Post Means				Mean Difference	Confidential Interval
ETG	STG	CTG	CG		
102.552	102.634			0.082	0.581
102.552		101.563		0.988*	
102.552			104.694	2.142*	
	102.634	101.563		1.070*	
	102.634		104.694	2.060*	
		101.563	104.694	3.131*	

*Significant at .05 level.

4.8.3. Results of Scheffe's Test on Total Cholesterol

The table XXIII shows that the adjusted post test mean difference on **Total Cholesterol** between ETG and CTG, ETG and CG, STG and CTG, STG and CG, and between CTG and CG are 0.988, 2.142, 1.070, 2.060 and 3.131 respectively which are higher than the confidence interval value of 0.581 and significant at .05 level of confidence. However, the adjusted post test mean difference on **Total Cholesterol** between ETG and STG is 0.082 which is less than the confidence interval value of 0.533 and insignificant at .05 level of confidence.

The pre and post test mean values of ETG, STG, CTG and CG on **Total Cholesterol** are graphically represented in figure 11.

The adjusted post test mean values of ETG, STG, CTG and CG on **Total Cholesterol** are graphically represented in figure 12.

FIGURE 11

PRE TEST AND POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON TOTAL CHOLESTEROL

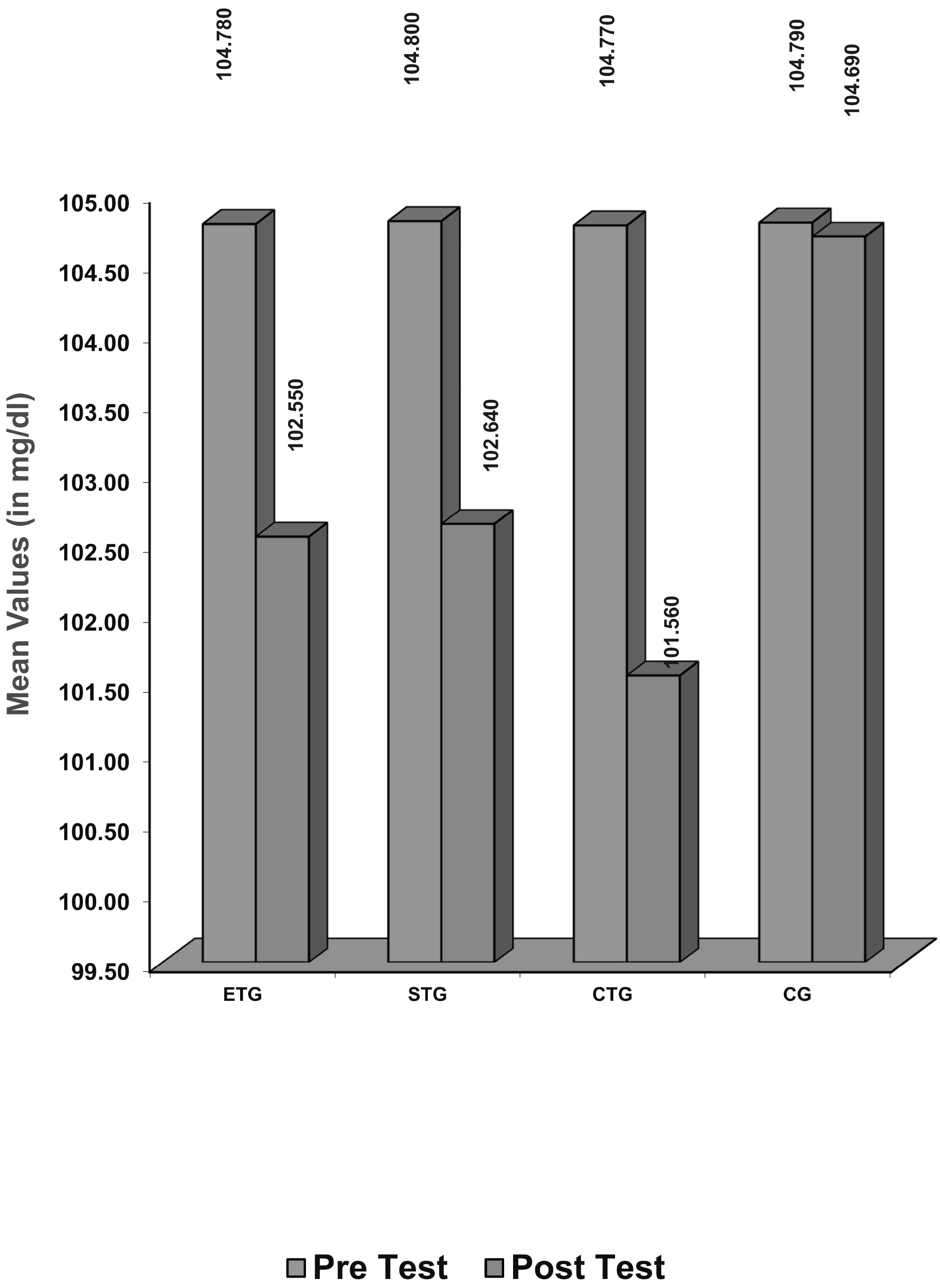
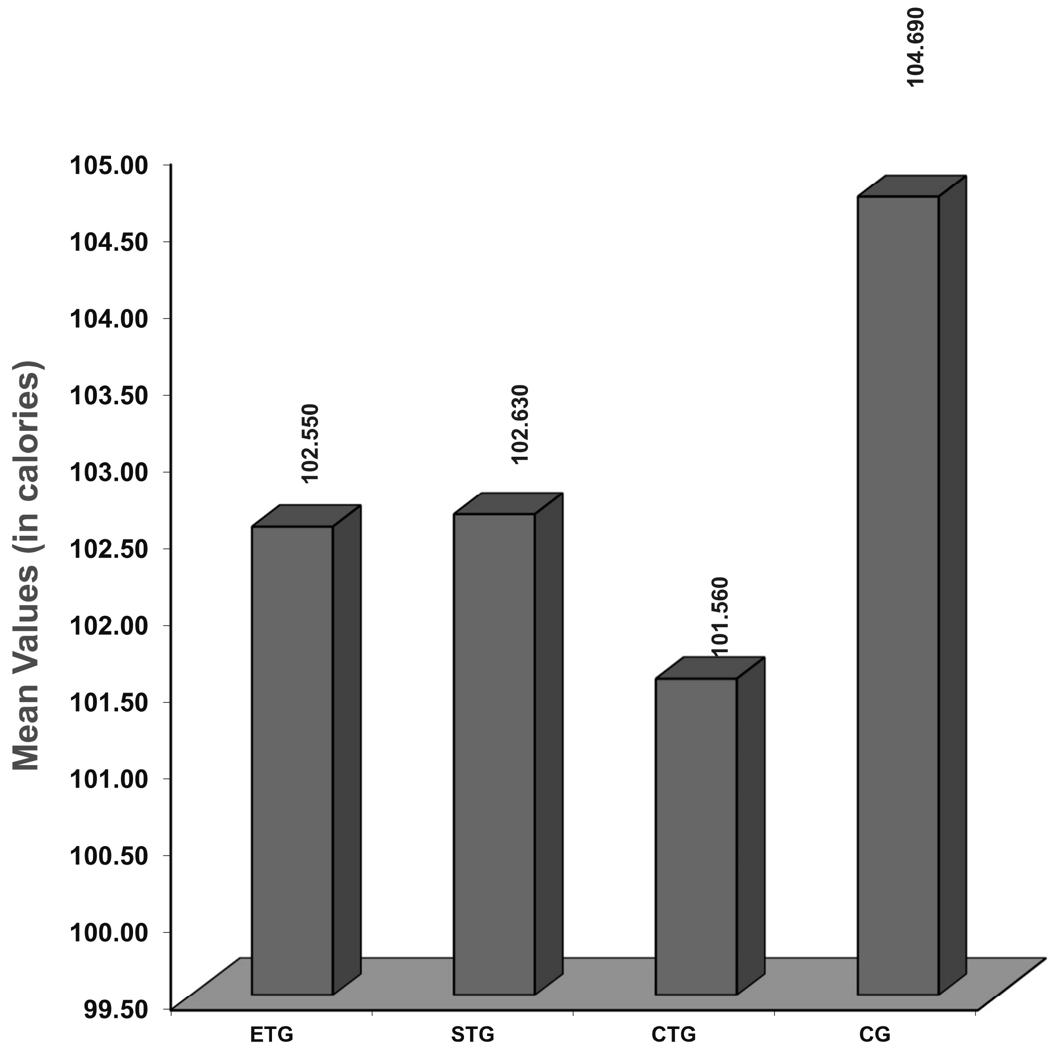


FIGURE 12

ADJUSTED POST TEST MEAN VALUES OF ETG, STG, CTG AND CG ON TOTAL CHOLESTEROL



4.8.4. Discussion on Findings on Total Cholesterol

The result of the study reveals that all the experimental groups significantly differed when compared to the control group on **Total Cholesterol**. However, it is further revealed that the experimental group CTG had reduced **Total Cholesterol** better than the ETG and STG. Also there is no significant difference exists between ETG and STG.

Askari, et al., (2012) found that **s**ignificant reduction of TC and subdermal fat were observed in experimental group in comparison with contols after aerobic training. The result of the findings the present study also integrated with the findings of **Ossanloo, Zafari and Najar (2012); Gullu, et al., (2013)**. **Ali-Mohamadi, et al., (2014)** suggested that strength endurance and endurance strength significantly improved lipid profile (significantly reduces in TC). The result of the findings the present study also integrated with the findings of **Askari, et al., (2012); Ossanloo, Zafari and Najar (2012); Gullu, et al., (2013)**; **Ramirez, et al., (2013); and Durstine, et al., (2002)**.

4.9. DISCUSSION ON HYPOTHESES

1. It was mentioned in the first hypothesis that there would be a significant improvement on selected physiological variables due to the effect of endurance, strength and concurrent training among college women players. The result of the present study showed that significant improvement on selected physiological variables such as fat free mass, body fat and BMR due to the influence of endurance, strength and concurrent training among college women players. Hence, the first hypothesis was accepted at 0.05 level of confidence.

2. It was mentioned in the second hypothesis that there would be a significant improvement on selected lipid profiles due to the effect of endurance, strength and concurrent training among college women players. The result of the present study showed that significant improvement on selected lipid profiles such as HDL-C, LDL-C and total cholesterol due to the influence of endurance, strength and concurrent training among college women players. Hence, the second hypothesis was accepted at 0.05 level of confidence.
3. In the third hypothesis, it was mentioned that there would be a significant improvement difference among the endurance, strength and concurrent training on selected criterion variables among college women players. The result of the present investigation showed that the college women players who underwent concurrent training had improved significantly on selected criterion variables than that of other two groups such as ETG and STG. Also STG had improved significantly on selected criterion variables such as body fat and BMR than that of ETG and for other variables such as fat free mass, HDL-C, LDL-C and total cholesterol there was not significant difference exists between ETG and STG. Hence, the third hypothesis was partially accepted at 0.05 level of confidence.

4.10. SUMMARY OF FINDINGS

The results of the study confirmed by the following experts: an aerobic endurance training in particular leads to numerous health benefits, and there is great evidence for its favorable influence on weight (**Donnelly, et al., 2009**). **Abazar, et al., 2015**, concluded in his study 12 weeks of aerobic exercise programme significantly reduce the BMI, WHR, fate rate, weight and fat mass. **Bilsborough, et**

al.,2016, compared the development and variations in body composition of early, mid and late career professional Australian Football (AF) players over three successive seasons. **Bilsborough, et al.,201**6, concluded that early career players may benefit from greater emphasis upon specific nutrition and resistance training strategies aimed at increasing FFSTM, whilst all players should balance training and diet towards the end of season to minimize increases in FM. Moreover, doing a combination of strength and endurance training is more beneficial for weight loss and change in body composition (**Hendrickson, et al., 2010**). In addition, the significant decrease of subcutaneous fat, body fat percentage and waist-to-hip ratio after performing eight weeks of combined strength and endurance training (**Maiorana, et al., 2002**, **Akbarpour, Assarzadeh and Sadeghian, 2011**). **Dolezal, and Potteiger, 1998** study indicated that concurrent training can significantly increase basal metabolism and decrease body fat relative LDL to the obtained amounts in the before-training period. **Nesic, Seper and Cvetko (2014)** concluded that the strength training, even in relatively restricted time period, influences the changes in person's physique, as well as the changes in resting energy expenditure and they suggested that the overall changes in one's physique and energy expenditure indicate that the strength training needs to be one of the crucial factors in physical activity, aimed at the improvement of person's health. **Dolezal and Potteiger (1998)** investigated that BMR increased significantly from pre to post training for resistance training program of 10 weeks and RT alone would increase BMR. **Manikowske, et al., (2012)** concluded that FFM and RMR significantly increased among women after 12 weeks in a RT exercise program.

The results of the study confirmed by the following experts' way: The result showed that both groups Strength & Endurance (SE) and Endurance & Strength (ES) significantly improved lipid profile (significantly reduces in TC, TG, LDL-C, VLDL-C and significantly increased HDL-C) and body composition (significantly decreased in body fat, body weight and increased body fat free mass but no significant) when compared to control group. Also no significant difference found between SE and ES groups in the lipid profile and body composition. It can be concluded that both SE and ES protocols nearly identical effects in positive transformation of lipid profile and body composition (**Ail-Mohamadi Maryam, et al., 2014**). Although resistance training has become more popular with women the last several years, the effects of this type of training on blood lipid levels needs more research. Nevertheless, one recently published and well-designed study indicated that five months of sustained resistance training significantly decreased total cholesterol and LDL-C in women (**Boyden et al., 1993**). The concurrent training has on development of maximal aerobic capacity, muscle strength, growth and adaptation. In addition, concurrent training use for individuals interested in general fitness and reducing body fat. Nevertheless the researchers stress on combining of resistance training and aerobic trainings or performing these trainings simultaneously to achieving optimum adaptability (**Faigenbaum, et al., 2009**). Effects of endurance training and resistance training have caused distinct publish result on important health indexes and variables such as body fat weight and lipids profiles (LDL-C, HDL-C lipoprotein, triglycerides, total cholesterol) in different studies. For example, the 12-week regular concurrent training decreases significantly the fat mass, body mass index, fat control, and waist-hip ratio (**Fazelifar, 2011**).

And the concurrent training and dietary intervention improved body composition, central adiposity, and lipid profile (**Albuquerque Filho, et al., 2014).** Versus (against), in other studies, simultaneously endurance and resistance training did not impress on lipids profiles in untrained people (**Lee, 2005; LeMura et al., 2000). Dolezal, and Potteiger, (1998)** study indicated that concurrent training can significantly increase basal metabolism and decrease body fat relative LDL to the obtained amounts in the before-training period. Restricting caloric intake and increasing caloric expenditure through physical activity and exercise are effective ways of reducing body weight and fatness while normalizing blood pressure and blood lipid profiles (**Morrow, et al., 2005**). **Askari, et al., (2012)** found out that due to the effect of eight week aerobic training the increase of HDL-c was observed in experimental group in non athletic women. **Stasiulis, et al., (2010)** found that in improvement in high-density lipoprotein cholesterol after eight week of aerobic cyclying. **Leon and Sanchez (2001)** reviewed the effects of aerobic exercise training improves **LeMura, et al., (2000)** suggested that aerobic-type exercise improves lipoprotein-lipid profiles, cardio respiratory fitness and body composition in healthy, young women, while resistance training significantly improved upper and lower body strength only. According to **Joseph, et al., (1999**) resistance exercise would properly increase HDL-C concentration. **Ossanloo, Zafari and Najar (2012)** showed that levels of HDL-C significantly modified after 12 weeks of concurrent training.