Chapter IV

ANALYSIS OF THE DATA AND RESULTS OF THE STUDY

4.1: OVERVIEW

Though the collected data are valid and reliable, it would not the useful meaning in term of that the reseacher need off. The data has to be processed with the help of statistics and analyzed scientifically, interpreted intelligently there by concluded. In this study the data have been collected on selected dependent variables such as speed, muscular strength, flexibility, explosive power, triglycerides, HDL-cholesterol, LDL-cholesterol, hemoglobin, under arm pass, over hand pass and serving ability by using standard tests and procedures. The collected data have been processed by using Analysis of covariance (ANACOVA) to determine if there were any significant differences among the treatment means on each variable. When analysis of covariance showed significant differences between treatment means, Scheffe's test was applied to test the significance of difference between the paired adjusted means. The significance of the means of the obtained test results was tested at 0.05 level of confidence. It was considered as sufficient for the present study. Thus the obtained results were interpreted with earlier studies and presented in this chapter well along with graphical presentations.

4.2: ANALYSIS OF THE DATA

Analysis of the treatment effects is as one of the objectives of the study since to compare the effects of treatment of Swiss ball training, flexibility training, combined Swiss ball and flexibility training, on selected variables. The results of analysis of covariance on data collected prior to and after the experimental period on selected variables among the Swiss ball training, flexibility training, combined training and control group were presented in tables 4.1 to 4.22.

4.2.1: Analysis of Speed

The pre and post test data collected from the experimental and control groups on speed was statistically analyzed and presented in table-4.1.

Table: 4.1

ANALYSIS OF COVARIANCE ON SPEED OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	7.91	8.01	7.89	7.97	B	0.091	3	0.030	0.60
SD	0.35	0.18	0.15	0.14	W	1.828	36	0.051	
Post test Mean	7.61	7.57	7.25	7.93	B	2.320	3	0.773	11.24*
SD	0.38	0.27	0.14	0.19	W	2.476	36	0.069	
Adjusted Post test Mean	7.65	7.50	7.31	7.91	B	1.890	3	0.630	36.05*
					W	0.612	35	0.017	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.1 shows that the pre-test means on speed of Swiss ball training, flexibility training, combined training, and control groups are 7.91, 8.01, 7.89 and 7.97 respectively. Since the obtained 'F' ratio of 0.60 for the pre test means on speed (0.60) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on speed of swiss ball training, flexibility training, combined training, and control groups are 7.61, 7.57, 7.25 and 7.93 respectively. Since the obtained 'F' ratio value of 11.24 for the post test means on speed is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on speed of swiss ball training, flexibility training, combined training, and control groups are 7.65, 7.50, 7.31 and 7.91 respectively. The obtained 'F' ratio value is 36.05 of speed was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence, it was concluded that significant differences exist between the adjusted post test means of Swiss ball training, flexibility training, combined training and control groups on speed.

Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.2.

Table: 4.2

SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON SPEED

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
7.65	7.50			0.15	0.17
7.65		7.31		0.34*	0.17
7.65			7.91	0.26*	0.17
	7.50	7.31		0.19*	0.17
	7.50		7.91	0.41*	0.17
		7.31	7.91	0.60*	0.17

**Significant at .05 level*

From table-4.2 the Scheffe's post hoc analysis proved that there were significant mean differences on speed between swiss ball training and combined training, swiss ball training and control groups, flexibility training and combined training, flexibility training and control groups, combined training and control groups are 0.34, 0.26. 0.19, 0.41 and 0.60, respectively, and it were higher than the confident interval value of 0.17 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups (0.15) on speed. Since, the mean difference 0.15 was lesser than the confident interval value of 0.17 it is said to be insignificant at 0.05 level of confidence.

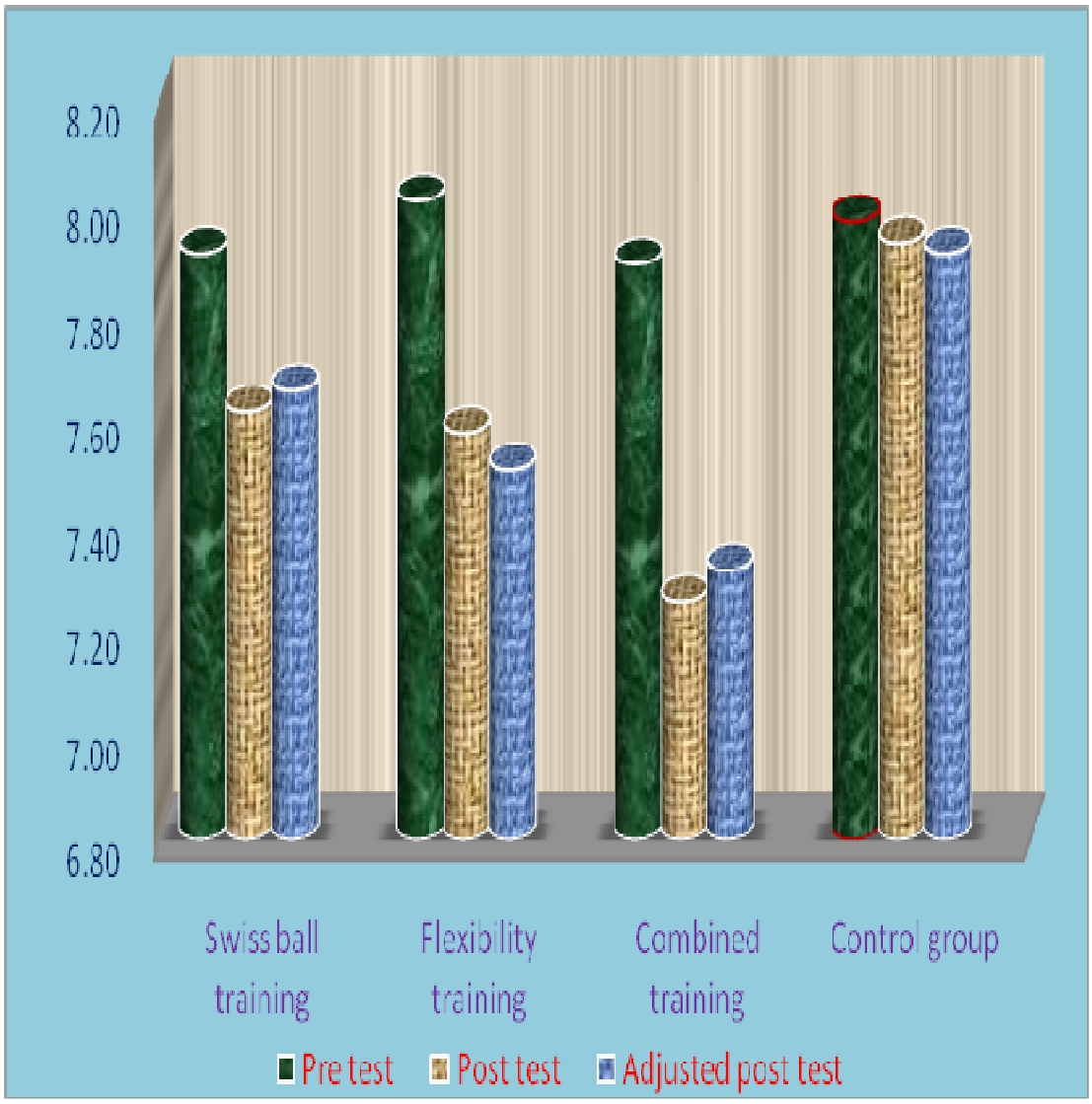
Hence it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the speed of the volleyball players was significantly improved. It was also concluded that combined training was significantly better than Swiss ball training and flexibility training in improving

speed however, no significant differences were found between swiss ball training and flexibility training groups.

The pre, post and adjusted post test mean values on speed of experimental and control groups are graphically represented for easy understanding.

Figure: 4.1

DIAGRAM SHOWING THE MEAN VALUES ON SPEED OF EXPERIMENTAL AND CONTROL GROUPS



4.2.2: Analysis of Muscular Strength

The pre and post test data collected from the experimental and control groups on muscular strength was statistically analyzed and presented in table-4.3.

Table: 4.3
ANALYSIS OF COVARIANCE ON MUSCULAR STRENGTH OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	22.80	23.30	23.70	23.90	B	7.08	3	2.36	0.21
SD	2.62	3.13	4.11	3.28	W	398.70	36	11.08	
Post test Mean	27.10	26.20	29.80	24.10	B	167.40	3	55.80	4.73*
SD	5.21	3.05	5.46	4.68	W	425.00	36	11.81	
Adjusted Post test Mean	27.69	26.32	29.54	23.65	B	184.13	3	61.38	31.44*
					W	68.33	35	1.95	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.3 shows that the pre-test means on muscular strength of Swiss ball training, flexibility training, combined training, and control groups are 22.80, 23.30, 23.70 and 23.90 respectively. The obtained 'F' ratio value is 0.21 of muscular strength was less than the required table value of 2.87, and it is insignificant for the degrees of freedom 3 and 36 at 0.05 level of confidence.

The post-test means on muscular strength of Swiss ball training, flexibility training, combined training, and control groups are 27.10, 26.20, 29.80 and 24.10 respectively. The obtained 'F' ratio value is 4.73 of muscular strength was greater

than the required table value of 2.87, it is found to be significant for the degrees of freedom 3 and 36 at 0.05 level of confidence.

The adjusted post-test means on muscular strength of swiss ball training, flexibility training, combined training, and control groups are 27.69, 26.32, 29.54 and 23.65 respectively. The obtained 'F' ratio value is 31.44 of muscular strength was greater than the required table value of 2.87, and it is found to be statistically significant for the degrees of freedom 3 and 35 at 0.05 level of confidence. The result of the study reveals that significant differences exist between the adjusted post test means of experimental and control groups on muscular strength. To determine which of the paired means had a significant difference, the Scheffe's test was used as post-hoc test and the results are presented in the table-4.4.

Table: 4.4
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON MUSCULAR STRENGTH

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
27.69	26.32			1.37	1.83
27.69		29.54		1.85*	1.83
27.69			23.65	4.04*	1.83
	26.32	29.54		3.22*	1.83
	26.32		23.65	2.67*	1.83
		29.54	23.65	5.89*	1.83

**Significant at .05 level*

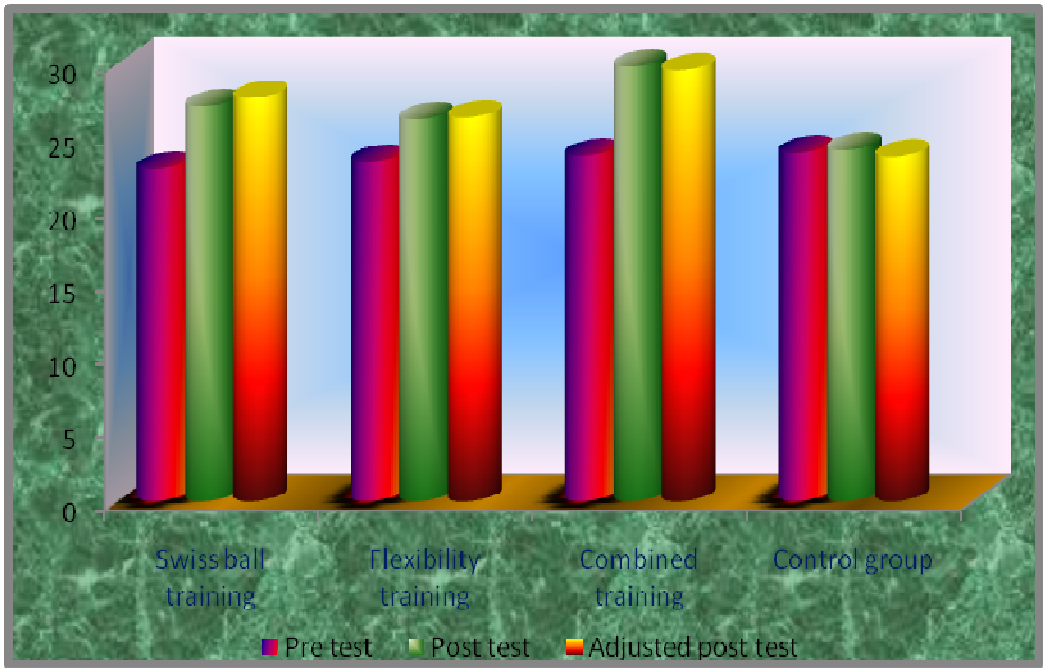
From table-4.4 the Scheffe's post hoc analysis proved that there were significant mean differences on muscular strength between swiss ball training and combined training, swiss ball training and control groups, flexibility training and

combined training, flexibility training and control groups, combined training and control groups. However there were no significant differences between swiss ball training and flexibility training groups on muscular strength (1.37).

Hence it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the muscular strength of the volleyball players was significantly improved. It was also concluded that combined training was significantly better than swiss ball training and flexibility training in improving muscular strength however, no significant differences were found between swiss ball training and flexibility training groups. The pre, post and adjusted post test mean values on muscular strength of experimental and control groups are graphically represented for better understanding.

Figure: 4.2

DIAGRAM SHOWING THE MEAN VALUES ON MUSCULAR STRENGTH OF EXPERIMENTAL AND CONTROL GROUPS



4.2.3: Analysis of Flexibility

The pre and post test data collected from the experimental and control groups on flexibility was statistically analyzed and presented in table-4.5.

Table: 4.5
ANALYSIS OF COVARIANCE ON FLEXIBILITY OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	32.30	33.50	31.90	31.10	B	30.00	3	10.00	1.03
SD	2.67	3.81	3.14	2.69	W	348.40	36	9.68	
Post test Mean	39.20	46.60	42.60	30.90	B	1336.48	3	445.49	57.01*
SD	2.04	2.95	3.17	2.88	W	281.30	36	7.81	
Adjusted Post test Mean	39.13	45.69	42.81	31.67	B	1039.04	3	346.35	108.55*
					W	111.67	35	3.19	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.5 shows that the pre-test means on flexibility of swiss ball training, flexibility training, combined training, and control groups are 32.30, 33.50, 31.90 and 31.10 respectively. The obtained 'F' ratio value is 1.03 of flexibility was less than the required table value of 2.87, it is said to be insignificant for the degrees of freedom 3 and 36 at 0.05 level of confidence.

The post-test means on flexibility of swiss ball training, flexibility training, combined training, and control groups are 39.20, 46.60, 42.60 and 30.90 respectively. The obtained 'F' ratio value is 57.01 of flexibility was greater than

the required table value of 2.87and it is found to be statistically significant for the degrees of freedom 3 and 36 at 0.05 level of confidence.

The adjusted post-test means on flexibility of swiss ball training, flexibility training, combined training, and control groups are 39.13, 45.69, 42.81 and 31.67 respectively. The obtained 'F' ratio value is 108.55 of flexibility was greater than the required table value of 2.87 and found to be significant for the degrees of freedom 3 and 35 at 0.05 level of confidence.

The result of the study reveals that significant differences exist between the adjusted post test means of experimental and control groups on flexibility. To determine which of the paired means had a significant difference, the Scheffe's test was used as post-hoc test and the results are presented in the table-4.6

Table: 4.6
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON FLEXIBILITY

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
39.13	45.69			6.56*	2.34
39.13		42.81		3.68*	2.34
39.13			31.67	7.46*	2.34
	45.69	42.81		2.88*	2.34
	45.69		31.67	14.02*	2.34
		42.81	31.67	11.14*	2.34

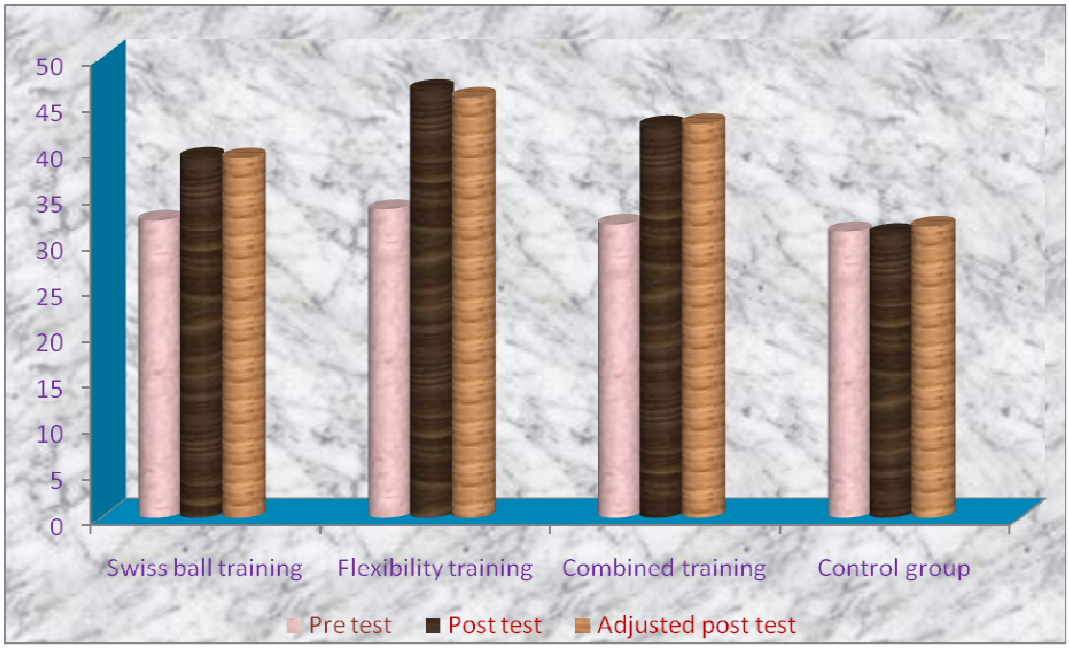
**Significant at .05 level*

From table-4.6 the Scheffe's post hoc analysis proved that there were significant mean differences on flexibility between swiss ball training and flexibility training groups, swiss ball training and combined training, swiss ball

training and control groups, flexibility training and combined training, flexibility training and control groups, combined training and control groups. Since, the mean differences 6.56, 3.68, 7.46, 2.88, 14.02 and 11.14 were greater than the confident interval value of 2.34 it is said to be significant at 0.05 level of confidence.

The multiple mean comparisons shown in table-VIII proved that there existed significant differences between the adjusted means of flexibility training group and control group, combined training group and control group, swissball ball training and control group. Higher improvement in flexibility was observed by flexibility training followed by combined training and swiss ball training groups. For easy understanding the bar diagram is given below.

Figure: 4.3
DIAGRAM SHOWING THE MEAN VALUES ON FLEXIBILITY OF EXPERIMENTAL AND CONTROL GROUPS



4.2.4: Analysis of Explosive Power

The pre and post test data collected from the experimental and control groups on explosive power was statistically analyzed and presented in table-4.7.

Table: 4.7
ANALYSIS OF COVARIANCE ON EXPLOSIVE POWER OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	32.80	33.10	34.10	33.40	B	9.30	3	3.10	0.26
SD	3.91	3.07	3.21	3.69	W	437.80	36	12.16	
Post test Mean	37.70	40.50	43.30	34.20	B	454.48	3	151.49	11.31*
SD	3.71	3.44	3.56	3.91	W	482.30	36	13.40	
Adjusted Post test Mean	38.21	40.73	42.60	34.15	B	399.03	3	133.01	47.16*
					W	98.71	35	2.82	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.7 shows that the pre-test means on explosive power of Swiss ball training, flexibility training, combined training, and control groups are 32.80, 33.10, 34.10 and 33.40 respectively. Since the obtained 'F' ratio of 0.26 for the pre test means on explosive power fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on explosive power of swiss ball training, flexibility training, combined training, and control groups are 37.70, 40.50, 43.30 and 34.20 respectively. Since the obtained 'F' ratio value of 11.31 for the post test means on

explosive power is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on explosive power of swiss ball training, flexibility training, combined training, and control groups are 38.21, 40.73, 42.60 and 34.15 respectively. The obtained 'F' ratio value is 47.16 of explosive power was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence, it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on explosive power. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.8.

Table: 4.8
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON EXPLOSIVE POWER

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
38.21	40.73			2.52*	2.20
38.21		42.60		4.39*	2.20
38.21			34.15	4.06*	2.20
	40.73	42.60		1.87	2.20
	40.73		34.15	6.58*	2.20
		42.60	34.15	8.45*	2.20

**Significant at .05 level*

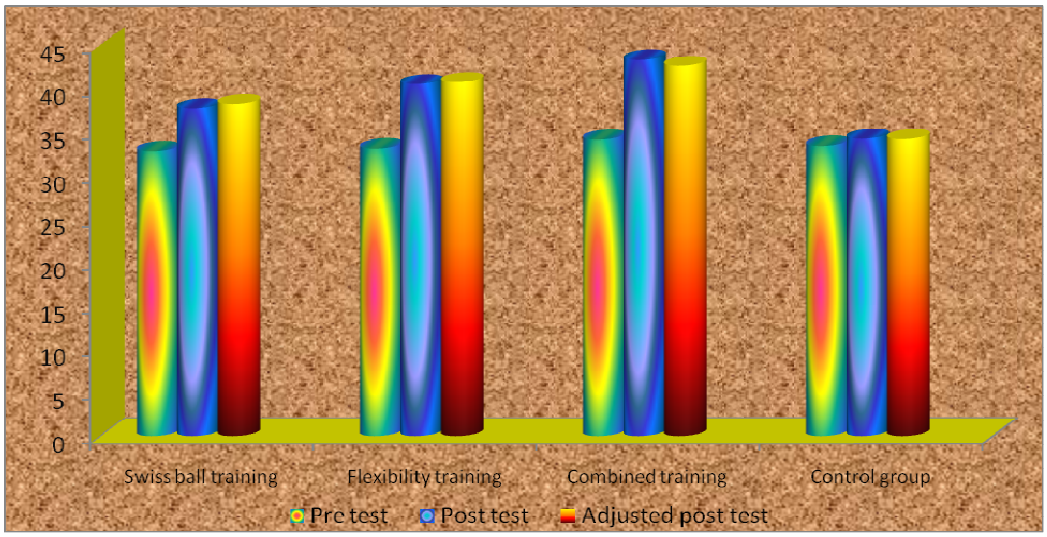
From table-4.8 the Scheffe's post hoc analysis proved that there were significant mean differences on explosive power between swiss ball training and flexibility training groups, swiss ball training and combined training, swiss ball

training and control groups, flexibility training and control groups, combined training and control groups are 2.52, 4.39. 4.06, 6.58 and 8.45 respectively, and it were higher than the confident interval value of 2.20 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups (1.87) on explosive power. Since, the mean difference 1.87 was lesser than the confident interval value of 2.20 it is said to be insignificant.

Hence, it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the explosive power of the volleyball players was significantly improved. It was also concluded that significant differences were found between swissball and flexibility training groups, swissball and combined training groups however, no significant differences were found between flexibility and combined training groups in improving explosive power.

Figure: 4.4

DIAGRAM SHOWING THE MEAN VALUES ON EXPLOSIVE POWER OF EXPERIMENTAL AND CONTROL GROUPS



4.2.5: Analysis of Triglycerides

The pre and post test data collected from the experimental and control groups on triglycerides was statistically analyzed and presented in table-4.9.

Table: 4.9
ANALYSIS OF COVARIANCE ON TRIGLYCERIDES OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean Squares	'F' ratio
Pre test Mean	139.20	140.30	138.90	140.80	B	24.20	3	8.07	0.09
SD	6.61	8.77	11.23	9.95	W	3112.20	36	86.45	
Post test Mean	133.80	135.20	132.30	141.10	B	445.40	3	148.47	2.23*
SD	6.16	7.97	7.75	10.26	W	2400.20	36	66.67	
Adjusted Post test Mean	134.30	134.80	133.00	140.30	B	315.17	3	105.06	6.20*
					W	593.42	35	16.96	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.9 shows that the pre-test means on triglycerides of Swiss ball training, flexibility training, combined training, and control groups are 139.20, 140.30, 138.90 and 140.80 respectively. Since the obtained 'F' ratio of 0.09 for the pre test means on triglycerides (0.09) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on triglycerides of swiss ball training, flexibility training, combined training, and control groups are 133.80, 135.20, 132.30 and 141.10 respectively. Since the obtained 'F' ratio value of 2.23 for the post test

means on triglycerides is lesser than the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on triglycerides of swiss ball training, flexibility training, combined training, and control groups are 134.30, 134.80, 133.00 and 140.30 respectively. The obtained 'F' ratio value is 6.20 of triglycerides was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on triglycerides. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S post hoc test is applied to find out the paired mean difference, and it is presented in table-4.10.

Table: 4.10
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON TRIGLYCERIDES

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
134.30	134.80		-	0.50	5.40
134.30	-	133.00	-	1.30	5.40
134.30	-	-	140.30	6.00*	5.40
-	134.80	133.00	-	1.80	5.40
-	134.80	-	140.30	5.50*	5.40
-	-	133.00	140.30	7.30*	5.40

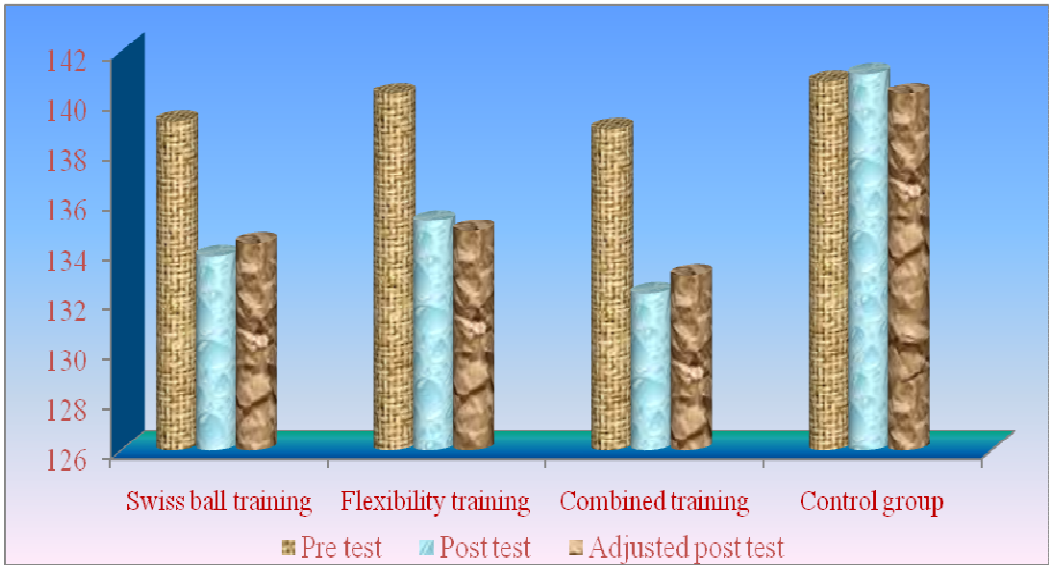
**Significant at .05 level*

From table-4.10 the Scheffe's post hoc analysis proved that there were significant mean differences on triglycerides between swiss ball training and control groups, flexibility training and control groups, combined training and control groups are 6.00, 5.50 and 7.30 respectively, and it were higher than the

confident interval value of 5.40 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups (0.50), swiss ball training and combined training groups (1.30), flexibility training and combined training groups (1.80) on triglycerides. Since, the mean differences 0.50, 1.30 and 1.80 were lesser than the confident interval value of 5.40 it is said to be insignificant at 0.05 level of confidence.

Hence, it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the triglycerides level of the volleyball players was significantly changed. It was also concluded that no significant differences exists between the experimental groups in altering the triglycerides level. The mean values on triglycerides of experimental and control groups are graphically represented for better understanding.

Figure: 4.5
DIAGRAM SHOWING THE MEAN VALUES ON TRIGLYCERIDES OF EXPERIMENTAL AND CONTROL GROUPS



4.2.6: Analysis of High Density Lipoprotein Cholesterol

The data collected from the experimental and control groups on high density lipoprotein was statistically analyzed and presented in table-4.11.

Table: 4.11
ANALYSIS OF COVARIANCE ON HIGH DENSITY LIPOPROTEIN CHOLESTEROL OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	42.70	41.90	43.20	42.10	B	10.48	3	3.49	0.26
SD	7.31	7.67	5.94	6.16	W	481.50	36	13.38	
Post test Mean	45.90	46.20	47.20	41.40	B	199.28	3	66.43	4.44*
SD	2.11	2.69	4.73	4.41	W	538.50	36	14.96	
Adjusted Post test Mean	45.68	46.75	46.50	41.76	B	161.27	3	53.76	20.21*
					W	93.10	35	2.66	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.11 shows that the pre-test means on high density lipoprotein cholesterol of Swiss ball training, flexibility training, combined training, and control groups are 42.70, 41.90, 43.20 and 42.10 respectively. Since the obtained 'F' ratio of 0.26 for the pre test means on high density lipoprotein cholesterol (0.26) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on high density lipoprotein cholesterol of swiss ball training, flexibility training, combined training, and control groups are 45.90, 46.20, 47.20 and 41.40 respectively. Since the obtained 'F' ratio value of 4.44 for

the post test means on high density lipoprotein cholesterol is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on high density lipoprotein of swiss ball training, flexibility training, combined training, and control groups are 45.68, 46.75, 46.50 and 41.76 respectively. The obtained 'F' ratio value is 20.21 of high density lipoprotein was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence, it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on high density lipoprotein. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S post hoc test is applied to find out the paired mean difference, and it is presented in table-4.12.

Table: 4.12

SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON HIGH DENSITY LIPOPROTEIN CHOLESTEROL

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
45.68	46.75			1.07	2.14
45.68		46.50		0.82	2.14
45.68			41.76	3.92*	2.14
	46.75	46.50		0.25	2.14
	46.75		41.76	4.99*	2.14
		46.50	41.76	4.74*	2.14

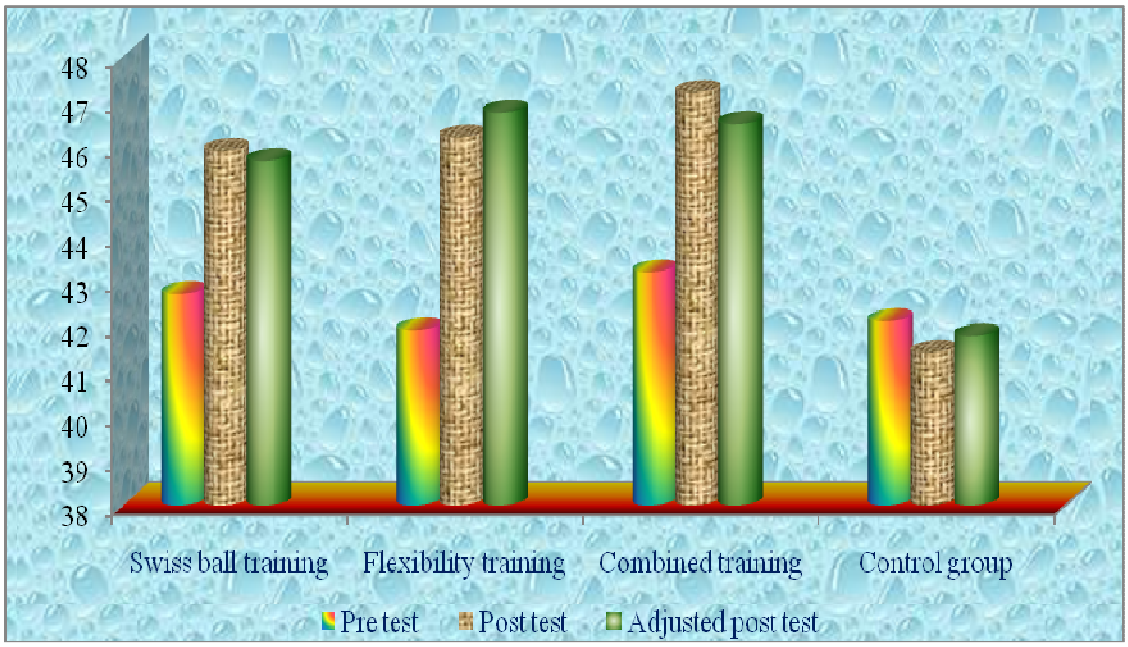
**Significant at .05 level*

From table-4.12 the Scheffe's post hoc analysis proved that there were significant mean differences on high density lipoprotein cholesterol between swiss ball training and control groups, flexibility training and control groups, combined

training and control groups are 3.92, 4.99 and 4.74 respectively, and it were higher than the confident interval value of 2.14 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups, swiss ball training and combined training groups, flexibility training and combined training groups on high density lipoprotein cholesterol. Since, the mean differences 1.07, 0.82 and 0.25 were lesser than the confident interval value of 2.14 it is said to be insignificant at 0.05 level of confidence.

Hence, it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the high density lipoprotein cholesterol level of the volleyball players was significantly changed, however, no significant differences exists between the experimental groups in improving the high density lipoprotein cholesterol level.

Figure: 4.6
DIAGRAM SHOWING THE MEAN VALUES ON HDL-C OF EXPERIMENTAL AND CONTROL GROUPS



4.2.7: Analysis of Low Density Lipoprotein Cholesterol

The data collected from the experimental and control groups on low density lipoprotein cholesterol was statistically analyzed and presented in table-4.13.

Table: 4.13
ANALYSIS OF COVARIANCE ON LOW DENSITY LIPOPROTEIN CHOLESTEROL OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean Squares	'F' ratio
Pre test Mean	91.70	90.80	92.40	89.70	B	40.90	3	13.63	0.25
SD	8.97	6.96	6.77	6.76	W	1984.20	36	55.12	
Post test Mean	83.90	82.10	81.70	90.40	B	487.68	3	162.56	2.66*
SD	8.14	8.40	6.88	7.75	W	2198.30	36	61.06	
Adjusted Post test Mean	83.52	82.34	80.84	91.40	B	656.73	3	218.91	6.13*
					W	1249.20	35	35.69	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.13 shows that the pre-test means on low density lipoprotein cholesterol of Swiss ball training, flexibility training, combined training, and control groups are 91.70, 90.80, 92.40 and 89.70 respectively. Since the obtained 'F' ratio of 0.25 for the pre test means on low density lipoprotein cholesterol (0.25) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on low density lipoprotein cholesterol of swiss ball training, flexibility training, combined training, and control groups are 83.90, 82.10, 81.70 and 90.40 respectively. Since the obtained 'F' ratio value of 2.66 for

the post test means on low density lipoprotein cholesterol is lesser than the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on low density lipoprotein cholesterol of swiss ball training, flexibility training, combined training, and control groups are 83.52, 82.34, 80.84 and 91.40 respectively. The obtained 'F' ratio value is 6.13 of low density lipoprotein was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on low density lipoprotein. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S post hoc test is applied to find out the paired mean difference, and it is presented in table-4.14

Table: 4.14
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON LOW DENSITY LIPOPROTEIN CHOLESTEROL

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
83.52	82.34	-	-	1.18	7.84
83.52	-	80.84	-	2.68	7.84
83.52	-	-	91.40	7.88*	7.84
-	82.34	80.84	-	1.50	7.84
-	82.34	-	91.40	9.06*	7.84
-	-	80.84	91.40	10.56*	7.84

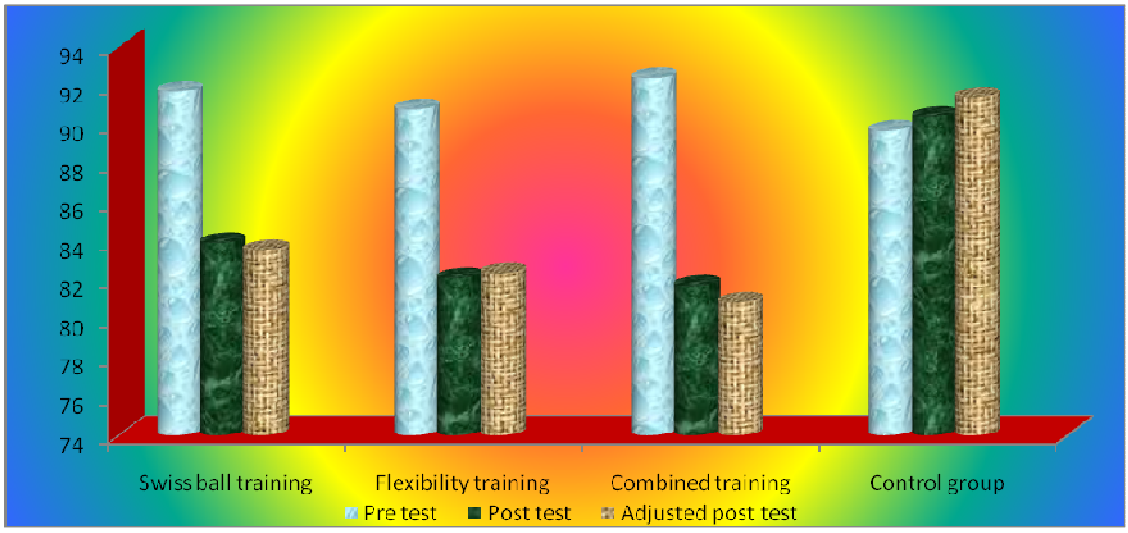
**Significant at .05 level*

From table-4.14 the Scheffe's post hoc analysis proved that there were significant mean differences on low density lipoprotein cholesterol between swiss

ball training and control groups, flexibility training and control groups, combined training and control groups are 7.88, 9.06 and 10.56 respectively, and it were higher than the confident interval value of 7.84 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups, swiss ball training and combined training groups, flexibility training and combined training groups on low density lipoprotein cholesterol. Since, the mean differences 1.18, 2.68 and 1.50 were lesser than the confident interval value of 7.84 it is said to be insignificant at 0.05 level of confidence.

Hence, it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the low density lipoprotein cholesterol level of the volleyball players was significantly changed. It was also concluded that no significant differences exists between the experimental groups in altering the low density lipoprotein cholesterol level.

Figure: 4.7
DIAGRAM SHOWING THE MEAN VALUES ON LDL-C OF EXPERIMENTAL AND CONTROL GROUPS



4.2.8: Analysis of Hemoglobin

The pre and post test data collected from the experimental and control groups on hemoglobin was statistically analyzed and presented in table-4.15.

Table: 4.15
ANALYSIS OF COVARIANCE ON HAEMOGLOBIN OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean Squares	'F' ratio
Pre test Mean	12.84	13.07	13.02	13.05	B	0.33	3	0.11	0.11
SD	0.89	1.29	0.91	0.96	W	37.79	36	1.05	
Post test Mean	13.86	13.73	14.03	13.09	B	5.06	3	1.69	1.92*
SD	0.81	1.06	0.80	1.05	W	31.62	36	0.88	
Adjusted Post test Mean	13.99	13.69	14.01	13.04	B	6.15	3	2.05	35.93*
					W	1.99	35	0.06	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.15 shows that the pre-test means on hemoglobin of Swiss ball training, flexibility training, combined training, and control groups are 12.84, 13.07, 13.02 and 13.05 respectively. Since the obtained 'F' ratio of 0.11 for the pre test means on hemoglobin (0.11) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on hemoglobin of swiss ball training, flexibility training, combined training, and control groups are 13.86, 13.73, 14.03 and 13.09 respectively. Since the obtained 'F' ratio value of 1.92 for the post test means on hemoglobin is lesser than the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on hemoglobin of swiss ball training, flexibility training, combined training, and control groups are 13.99, 13.69, 14.01 and 13.04 respectively. The obtained 'F' ratio value is 35.93 of hemoglobin was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on hemoglobin. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.16

Table: 4.16
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON HAEMOGLOBIN

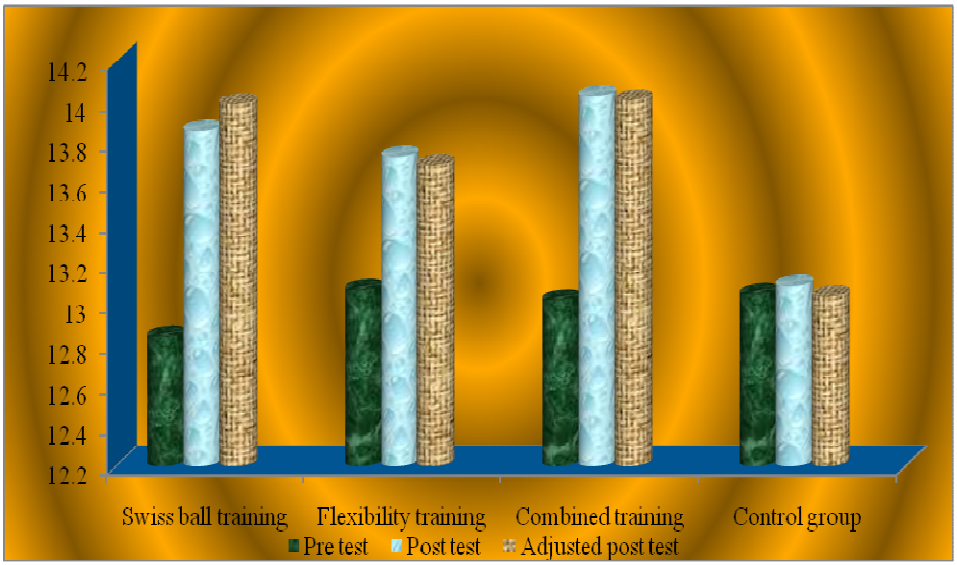
Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
13.99	13.69	-	-	0.30	0.32
13.99	-	14.01	-	0.02	0.32
13.99	-	-	13.04	0.95*	0.32
-	13.69	14.01	-	0.32	0.32
-	13.69	-	13.04	0.65*	0.32
-	-	14.01	13.04	0.97*	0.32

**Significant at .05 level*

From table-4.16 the Scheffe's post hoc analysis proved that there were significant mean differences on hemoglobin between swiss ball training and control groups, flexibility training and control groups, combined training and control groups are 0.95, 0.65 and 0.97 respectively, and it were higher than the confident interval value of 0.32 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups (0.30), swiss ball training and combined training groups (0.02), flexibility training and combined training groups (0.32) on hemoglobin. Since, the mean differences 0.30, 0.02 and 0.32 were lesser than the confident interval value of 0.32 it is said to be insignificant at 0.05 level of confidence.

Hence, it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the hemoglobin level of the volleyball players was significantly changed. It was also concluded that no significant differences exists between the experimental groups in altering the hemoglobin level. The mean values on hemoglobin of experimental and control groups are graphically represented for better understanding.

Figure: 4.8
DIAGRAM SHOWING THE MEAN VALUES ON HEMOGLOBIN OF EXPERIMENTAL AND CONTROL GROUPS



4.2.9: Analysis of Under Arm Pass

The pre and post test data collected from the experimental and control groups on under arm pass was statistically analyzed and presented in table-4.17.

Table: 4.17
ANALYSIS OF COVARIANCE ON UNDER ARM PASS OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball training	Flexibility training	Combined training	Control Group	S o V	Sum of Squares	Df	Mean Squares	'F' ratio
Pre test Mean	26.90	27.30	28.40	27.70	B	12.28	3	4.09	0.51
SD	2.92	3.20	2.84	2.31	W	289.50	36	8.04	
Post test Mean	31.90	32.40	35.80	28.20	B	290.28	3	96.76	9.56*
SD	4.20	2.59	2.82	2.86	W	364.50	36	10.13	
Adjusted Post test Mean	32.57	32.67	34.99	28.08	B	249.88	3	83.29	35.66*
					W	81.76	35	2.34	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.17 shows that the pre-test means on under arm pass of Swiss ball training, flexibility training, combined training, and control groups are 26.90, 27.30, 28.40 and 27.70 respectively. Since the obtained 'F' ratio of 0.51 for the pre test means on under arm pass (0.51) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on under arm pass of swiss ball training, flexibility training, combined training, and control groups are 31.90, 32.40, 35.80 and 28.20 respectively. Since the obtained 'F' ratio value of 9.56 for the post test means on under arm pass is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on under arm pass of swiss ball training, flexibility training, combined training, and control groups are 32.57, 32.67, 34.99 and 28.08 respectively. The obtained 'F' ratio value is 35.66 of under arm pass was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on under arm pass. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.18.

Table: 4.18
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL ON UNDER ARM PASS

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
32.57	32.67			0.10	2.01
32.57		34.99		2.42*	2.01
32.57			28.08	4.49*	2.01
	32.67	34.99		2.32*	2.01
	32.67		28.08	4.59*	2.01
		34.99	28.08	6.91*	2.01

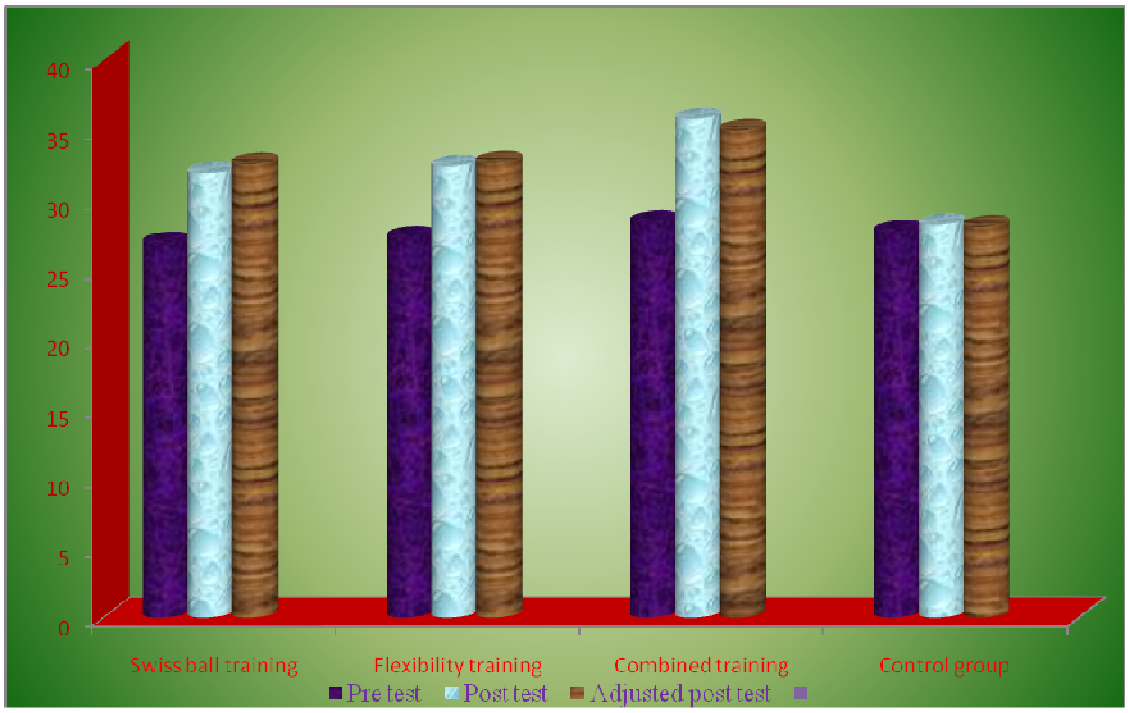
**Significant at .05 level*

From table-4.18 the Scheffe's post hoc analysis proved that there were significant mean differences on under arm pass between swiss ball training and combined training, swiss ball training and control groups, flexibility training and combined training, flexibility training and control groups, combined training and control groups are 2.42, 4.49. 2.32, 4.59 and 6.91 respectively, and it were higher than the confident interval value of 2.01 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups on under arm pass. Since, the mean difference 0.10 was lesser than the confident interval value of 2.01 it is said to be insignificant at 0.05 level of confidence.

Hence it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the under arm pass of the volleyball players was significantly improved. It was also concluded that combined training was significantly better than Swiss ball training and flexibility training in improving under arm pass. The mean values on under arm pass of experimental and control groups are graphically represented for better understanding.

Figure: 4.9

DIAGRAM SHOWING THE MEAN VALUES ON UNDER ARM PASS OF EXPERIMENTAL AND CONTROL GROUPS



4.2.10: Analysis of Over Hand Pass

The pre and post test data collected from the experimental and control groups on over hand pass was statistically analyzed and presented in table-4.19.

Table: 4.19
ANALYSIS OF COVARIANCE ON OVER HAND PASS OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Pre test Mean	34.90	35.90	35.10	36.60	B	18.28	3	6.09	0.55
SD	3.35	3.70	2.96	3.31	W	401.10	36	11.14	
Post test Mean	40.10	41.60	43.90	36.30	B	305.68	3	101.89	13.47*
SD	2.85	2.55	3.07	2.50	W	272.30	36	7.56	
Adjusted Post test Mean	40.55	41.43	44.22	35.70	B	367.62	3	122.54	35.32*
					W	121.43	35	3.47	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.19 shows that the pre-test means on over hand pass of Swiss ball training, flexibility training, combined training, and control groups are 34.90, 35.90, 35.10 and 36.60 respectively. Since the obtained 'F' ratio of 0.55 for the pre test means on over hand pass (0.55) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on over hand pass of swiss ball training, flexibility training, combined training, and control groups are 40.10, 41.60, 43.90 and 36.30 respectively. Since the obtained 'F' ratio value of 13.47 for the post test means on over hand pass is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on over hand pass of swiss ball training, flexibility training, combined training, and control groups are 40.55, 41.43, 44.22 and 35.70 respectively. The obtained 'F' ratio value is 35.32 of over hand pass was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on over hand pass. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.20.

Table: 4.20
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON OVER HAND PASS

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
40.55	41.43			0.88	2.44
40.55		44.22		3.67*	2.44
40.55			35.70	4.85*	2.44
	41.43	44.22		2.79*	2.44
	41.43		35.70	5.73*	2.44
		44.22	35.70	8.52*	2.44

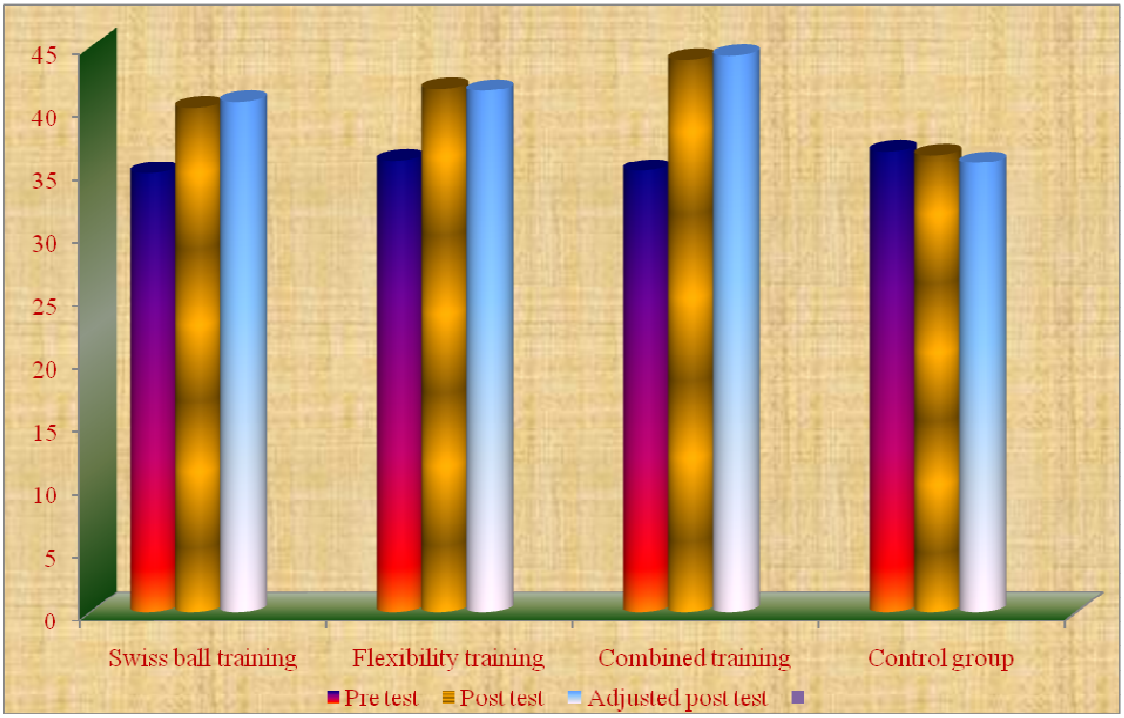
**Significant at .05 level*

From table-4.20 the Scheffe's post hoc analysis proved that there were significant mean differences on over hand pass between swiss ball training and combined training, swiss ball training and control groups, flexibility training and combined training, flexibility training and control groups, combined training and control groups are 3.67, 4.85. 2.79, 5.73 and 8.52 respectively, and it were higher than the confident interval value of 2.44 at 0.05 level of confidence. There were no

significant differences between swiss ball training and flexibility training groups on over hand pass, since, the mean difference 0.88 was lesser than the confident interval value of 2.44 it is said to be insignificant at 0.05 level of confidence.

Hence it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the over hand pass of the volleyball players was significantly improved. It was also concluded that combined training was significantly better than Swiss ball training and flexibility training in improving over hand pass. The mean values on over hand pass of experimental and control groups are graphically represented for better understanding.

Figure: 4.10
DIAGRAM SHOWING THE MEAN VALUES ON OVER HAND PASS OF EXPERIMENTAL AND CONTROL GROUPS



4.2.11: Analysis of Serving Ability

The pre and post test data collected from the experimental and control groups on serving ability was statistically analyzed and presented in table-4.21.

Table: 4.21
ANALYSIS OF COVARIANCE ON SERVING ABILITY OF EXPERIMENTAL AND CONTROL GROUPS

	Swiss ball Training	Flexibility Training	Combined Training	Control Group	S o V	Sum of Squares	Df	Mean Squares	'F' ratio
Pre test Mean	24.90	25.50	26.20	25.70	B	8.68	3	2.89	0.62
SD	1.66	2.32	2.44	2.16	W	169.10	36	4.70	
Post test Mean	30.10	29.30	34.30	26.33	B	283.16	3	94.39	12.21*
SD	2.28	2.83	2.63	3.29	W	278.34	36	7.73	
Adjusted Post test Mean	30.60	29.35	33.84	26.28	B	252.63	3	84.21	15.79*
					W	186.69	35	5.33	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 35 is 2.87 and degree of freedom 3 and 36 is 2.87)
**Significant at .05 level of confidence*

Table-4.21 shows that the pre-test means on serving ability of Swiss ball training, flexibility training, combined training, and control groups are 24.90, 25.50, 26.20 and 25.70 respectively. Since the obtained 'F' ratio of 0.62 for the pre test means on serving ability (0.62) fails to reach the required table value of 2.87, it is found to be insignificant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The post-test means on serving ability of swiss ball training, flexibility training, combined training, and control groups are 30.10, 29.30, 34.30 and 26.33 respectively. Since the obtained 'F' ratio value of 12.21 for the post test means on

serving ability is greater than the required table value of 2.87, it is found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 36.

The adjusted post-test means on serving ability of swiss ball training, flexibility training, combined training, and control groups are 30.60, 29.35, 33.84 and 26.28 respectively. The obtained 'F' ratio value is 15.79 of serving ability was greater than the required table value of 2.87 for the degrees of freedom 3 and 35 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of experimental and control groups on serving ability. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-4.22.

Table: 4.22
SCHEFFE'S POST HOC TEST FOR THE DIFFERENCES AMONG PAIRED MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON SERVING ABILITY

Swiss ball Training	Flexibility Training	Combined Training	Control Group	Mean Difference	Confidence Interval
30.60	29.35			1.25	3.03
30.60		33.84		3.24*	3.03
30.60			26.28	4.32*	3.03
	29.35	33.84		4.49*	3.03
	29.35		26.28	3.07*	3.03
		33.84	26.28	7.56*	3.03

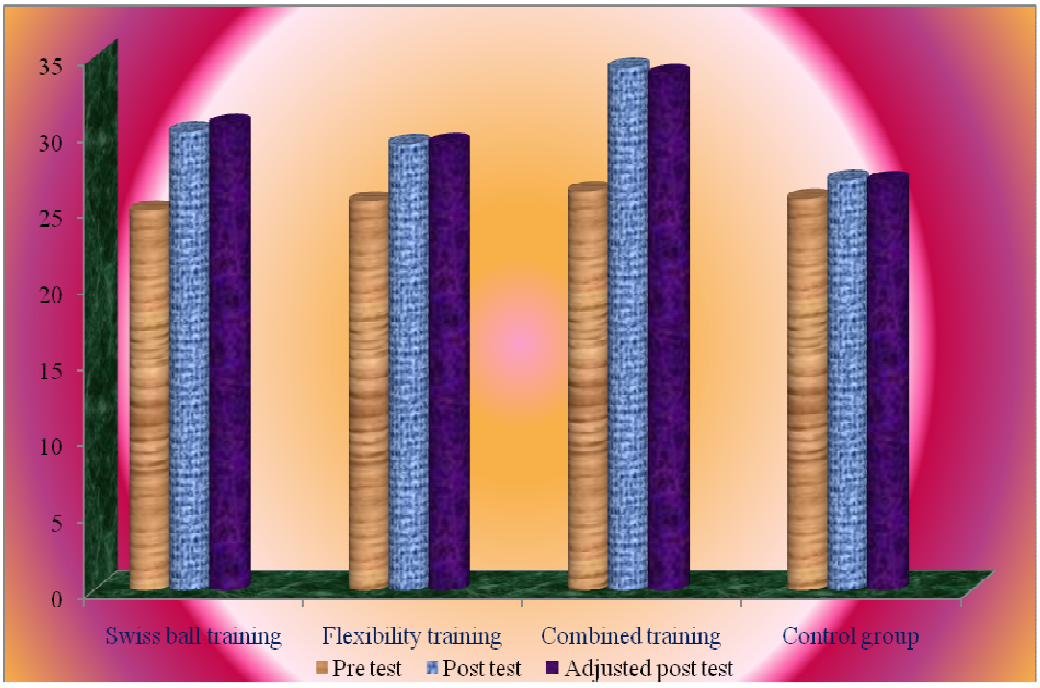
**Significant at .05 level*

From table-4.22 the Scheffe's post hoc analysis proved that there were significant mean differences on serving ability between swiss ball training and combined training, swiss ball training and control groups, flexibility training and combined training, flexibility training and control groups, combined training and

control groups are 3.24, 4.32. 4.49, 3.07 and 7.56 respectively, and it were higher than the confident interval value of 3.03 at 0.05 level of confidence. There were no significant differences between swiss ball training and flexibility training groups on serving ability, since, the mean difference 1.25 was lesser than the confident interval value of 3.03 it is said to be insignificant at 0.05 level of confidence.

Hence it was concluded that due to the effect of Swiss ball training, flexibility training, and combined training the serving ability of the volleyball players was significantly improved. It was also concluded that combined training was significantly better than Swiss ball training and flexibility training in improving serving ability. The mean values on serving ability of experimental and control groups are graphically represented for better understanding.

Figure: 4.11
DIAGRAM SHOWING THE MEAN VALUES ON SERVING ABILITY OF EXPERIMENTAL AND CONTROL GROUPS



4.3: RESULTS OF THE STUDY

4.3.1: Physical Fitness Components

Due to the effect of Swiss ball training, flexibility training, and combined training the speed and muscular strength of the volleyball players was significantly improved however, combined Swiss ball and flexibility training was significantly better than isolated Swiss ball training and flexibility training in improving speed and muscular strength. On the other hand no significant differences were found between isolated Swiss ball and flexibility training in improving speed and muscular strength

In improving flexibility of the volleyball player's significant differences were found among experimental groups however flexibility training was significantly better than combined training and Swiss ball training.

The explosive power of the volleyball player's was significantly improved as a result of isolated and combined Swiss ball and flexibility training. Significant differences were found between swissball and flexibility training groups, swissball and combined training groups however, no significant differences were found between flexibility and combined training groups in improving explosive power.

4.3.2: Biochemical Parameters

As for as biochemical variables are concerned the triglycerides, high density lipoprotein cholesterol, low density lipoprotein cholesterol and hemoglobin level of the volleyball players were significantly changed due to the

effect of isolated and combined Swiss ball and flexibility training, however, no significant differences were found between the experimental groups in altering the selected biochemical parameters.

4.3.3: Skill Performance Variables

Due to the impact of twelve weeks of isolated and combined Swiss ball and flexibility training the over hand pass, under arm pass and serving ability of the volleyball players was significantly improved, however, combined Swiss ball and flexibility training was significantly better than isolated Swiss ball training and flexibility training in improving the selected volleyball skill performances.

4.4: DISCUSSION ON FINDINGS

The above findings can also be substantiated by observations made by renowned experts in the science of sports training. One advanced Swiss ball exercise providing a significant whole-body stimulus (Marshall & Desai, 2010). A primary benefit of exercising with an exercise ball as opposed to exercising directly on a hard flat surface is that the body responds to the instability of the ball to remain balanced, engaging many more muscles (Vera-Garcia, Grenier & McGill, 2000). Most frequently, the core body muscles such as the abdominal muscles and back muscles are the focus of exercise ball fitness programs. Those muscles become stronger over time to keep balance (Mayo, 2007).

Both men and women, younger and elderly, and individuals with and without pain benefitted equally from Swiss ball with elastic resistance exercises (Sundstrup *et al*., 2012). Swiss-ball core strength training exercises can be used to provide improvement in the 60 and 90° s trunk flexion/extension, 60 and 240° s-1 lower limb flexion/extension, abdominal endurance, lower back muscular endurance, lower limb endurance, lower back flexibility, and dynamic balance measures in sedentary women (Sekendiz, Cug & Korkusuz, 2010). Swiss ball training has significant effect on abdominal strength of sedentary girls (Mathew & Vasanthi, 2013)

Resistance training in an unstable environment at intensity sufficient to elicit strength gains (Drinkwater, Pritchett & Behm, 2007), increase in work capacity and abdominal power (Cowley, Swensen & Sforzo, 2007). Similar enhancement of power was found in concentric phase of countermovement squats on stable and unstable support surface regardless of weights lifted (Zemkova & Hamar, 2013). Swiss ball provides a training stimulus for the rectus abdominus (Marshall & Murphy, 2005) and core stability (Stanton, Reaburn & Humphries, 2004). Muscle activity was greater when exercises were performed on a Swiss ball in comparison to a stable surface (Duncan, 2009). No differences were observed in 1RM strength or muscle EMG activity and elbow range-of-motion during the barbell chest press exercise performed on a stable (*flat bench*) and unstable surface (*exercise ball*) (Goodman *et al*., 2008).

Authors have claimed that resistance exercises performed on unstable equipment are specific to sports skills because of the balance, proprioception, and core stability required to perform these exercises successfully (Bigatton, 2002; Boyle, 2004; Chek, 1999). Therefore, performing resistance exercises on unstable equipment will make an individual to enhance the performance of sports skills.

Based on the current literature, prescription of core stability exercises should vary based on the phase of training and the health status of the athlete. Preseason and in-season free weight exercises performed on a stable and unstable support surface are recommended for increases in core strength and power. Free weight exercises performed in this manner are specific to the core stability requirements of sports-related skills due to moderate levels of instability and high levels of force production. Swiss ball exercises involving isometric muscle actions, small loads, and long tension times are recommended for increases in core endurance.

The result of the present study are also in agreement with the studies conducted by Burke (2000) who compared 2 methods of delivering the same proprioceptive neuromuscular facilitation (PNF) flexibility exercise protocol: one manual and the other machine. Both training groups had significant improvements on trunk flexion and right hip flexion. Concentric, eccentric torque and range of motion (ROM) are changed after chronic stretching programs (Nittoli, 1995).

Optimal method of stretching will improve hip flexion range of motion. Static stretching of the hamstring produced the greatest increases in both passive and active hip flexion ROM (Sundquist, 1996). Strength differences can occur with an acute exposure to partial ROM resistance exercise, also provides insight into joint action duration in the execution of full ROM and partial ROM resistance exercise (Mookerjee & Ratamess, 1999). Resistance training may be able to increase range of motion of a number of joints of inactive older individuals possibly due to an improvement in muscle strength (Fatouros *et al*., 2002).

Individuals can improve their muscular endurance and flexibility using relatively low-intensity Pilates exercises that do not require equipment or a high degree of skill and are easy to master and use within a personal fitness routine (Kloubec, 2010). Weight training can increase flexibility in previously sedentary middle-aged women in some, but not all joint movements (Monteiro *et al*., 2008). Resistance training can improve flexibility in young sedentary women in 8 weeks (Santos, 2010). Eight weeks of low-frequency, supervised, progressive strength training emphasizing free weight, multijoint movements can safely cause significant gains in muscle strength, absolute endurance, and flexibility (Adams *et al*., 2001). Participation in a similarly structured weight training program to develop muscular strength would not impair flexibility but might increase it (Thrash & Kelly, 1987).

It has been reported that exercise produce biochemical changes in the cardio respiratory system and other important alterations in the body composition such as proteins, carbohydrates, lipids and triglyceride levels (Scharhag *et al*., 2008). Exercise often plays an important role in raising high density lipoprotein cholesterol. Endurance athletes have much higher HDL-cholesterol than sedentary individuals. The amount of habitual physical activity was strongly correlated to HDL-cholesterol. High levels of HDL-cholesterol among elite athletes are sports dependent, with runners and wrestlers having significantly higher HDL-cholesterol than throwers and weight lifters (Lee *et al*., 2009). Exercise induced decline in LDL-cholesterol levels (Subramanian & Venkatesan (2012). Positive changes in blood lipids of footballers are possible due to strength and endurance training (Savucu *et al*., 2001). It has been found in this study that due to the effect of isolated and combined swiss ball and flexibility training the selected biochemical variables were significantly altered. Hence it is suggested that players should undergo regular specific physical activities in order to keep normal values of the biochemical substances.

Strength training may contribute to the development and maintenance of flexibility even without the inclusion of additional stretching, but strength and flexibility can be prescribed together to get optimal improvements in flexibility Simao, 2011). Similar improvements in strength can achieve with combined balance and flexibility training (Misic *et al*., 2009).The combination of resistive

exercise and stretching can improve the functional status and decreased diastolic blood pressure (Rafaella *et al*., 2012). Combination of strength and aerobic training can alsoincreas hip flexion and extension (Fatouros *et al*., 2002). Combined balance and plyometric training enhanced to a greater degree, activities such as 10m sprints and shuttle runs (Chaouachi *et al*., 2013). Combined training could be an important consideration for reducing the high velocity impacts of particular training. Based on the present study and the literature, swissball training should be incorporated in conjunction with traditional flexibility training to provide a greater variety of training experiences without sacrificing training benefits.

Physical fitness variables are very important for volleyball players and form a condition for higher performance. The components of physical fitness like strength, speed, endurance, flexibility and the various coordinative abilities are essential for a high technique and tactical efficiency (Mal, 1982). Depending upon the demand of the game, each factor of physical fitness should be optimally developed. The higher the fitness level, the faster the recovery of skeletal muscles following a fatiguing bout of exercise. The higher the training level, the less likely that the expected effects of fatigue that are seen in untrained populations would occur (Carpenter *et al*., 1998; Bompa, 1994).

Research findings on Swiss ball and flexibility training were reviewed. The investigator prepared to offer opinions based on the strength of collective studies. Each kind of training produces the greatest improvement on selected physical,

biochemical and skill performance variables of volleyball players. Improvement in skill performance is the most practical criterion for comparing training effectiveness of various types of exercise. Most improvements are observed when Swissball training was combined with flexibility training. It appears that combined Swiss ball and flexibility training may be superior to isolated Swiss ball and flexibility training for improving performance although more research needs to be conducted to conclusively define an answer. It is unclear as to whether Swiss ball training is superior to flexibility training in increasing biochemical parameters, with the majority of studies indicating no difference. There are fewer reports comparing the effects of the two forms of training such as Swiss ball and flexibility training.

Hence, in order to maintain optimal training levels and take advantage of the potential benefits, it is suggested that Swiss ball and flexibility training sessions not be missed by the volleyball players. Combined Swiss ball and flexibility training has been proven to boost physical, biochemical and skill performance variables, all of which are essential to Volleyball players.

4.5: DISCUSSION OF HYPOTHESES

1. In the first hypothesis it was stated that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of swiss ball training.

   Based on the results of the study the above formulated hypothesis is accepted.

2. In the second hypothesis it was stated that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of flexibility training.

   Based on the results of the study the above formulated hypothesis is accepted.

3. In the third hypothesis it was stated that there would be significant improvement on selected physical fitness, biochemical and volleyball skill performance variables due to the impact of combined swiss ball and flexibility training.

   Based on the results of the study the above formulated hypothesis is accepted.

4. In the forth hypothesis it was stated that the combined swiss ball and flexibility training would be better in improving the selected physical

fitness, biochemical and volleyball skill performance variables among volleyball players than isolated swiss ball and flexibility training.

Based on the results of the study the above formulated fourth hypothesis was partially accepted.

5. In the fifth hypothesis it was stated that the control group may not improve in any of the chosen variables.

Based on the results of the study the above formulated hypothesis number five was accepted.