CHAPTER IV

RESULTS AND DISCUSSIONS

In this chapter, the researcher analyses the data collected using statistical methods and use the results of such analysis to test our hypotheses.

4.1 OVERVIEW

As discussed earlier, a group of 60 students representing a cross-section of slum children were divided into four experimental groups of 15 students each – one for each of the three independent variables, plus one for the control group. Prior to the experimental treatment, measurement of the selected motor fitness, health related fitness and Physiological variables was taken for each of the 60 students (pre- test scores).

The experiments – Callisthenic exercises for Experimental Group-I (CEG), Recreational Game for Experimental Group-II (RGG), Aerobic Dance for Experimental Group-III (ADG) – were conducted based on a 12-week schedule designed for each group; the control group (CG) was not provided with any specific activity and was free to do the activities they had been doing before the test. After the experimental period ended, measurements of the motor fitness, health related fitness and Physiological variables were taken again for each of the subjects in the 4 groups (post-test scores).

The difference, if any, between the initial and final scores were to be considered as the effect of respective treatments on the selected dependent variables. To statistically assess this difference, analysis of covariance (ANCOVA) was done on the test scores of all subjects for each dependent variable, to yield the 'F' ratio. Further, where the 'F' ratio for adjusted post-test mean was observed to be material, a drill down analysis was done using Scheffe's post hoc test to identify which experimental group contributed to the significant difference.

4.2 TEST OF SIGNIFICANCE

This is the climax of the study and the basis for the conclusions. The results of the statistical analysis performed as above, were evaluated to see whether the hypotheses hold good. This is done by testing whether the pre and post test scores between the groups is significantly different or not. Accordingly, the hypotheses were held to be proven true if the F-value determined, was more than the necessary table value (as elaborated below). Alternatively, if the obtained F-value did not exceed the required table value, the hypotheses were held to be disproved.

4.3 LEVEL OF SIGNIFICANCE

To perform the test of significance, level of confidence was fixed at 0.05 which was deemed adequate for the purpose of this study. At this 0.05 level of confidence, the table value was seen at 2.77 for the degree of freedom of 3 and 56 for mean and 3 and 55 for adjusted mean. Benchmarking of the obtained F-value was to be made against this table value, for the test of significance.

4.4 RESULTS AND DISCUSSION OF MOTOR FITNESS VARIABLES

4.4.1 Speed

4.4.1.1 Results on speed

As can be seen from Table XXIV, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 8.40, 8.34, 8.24 and 8.39 respectively, while the mean of their post-test scores were 7.41, 7.37, 7.70 and 8.26 respectively.

Table XXIV Computation of Analysis of Covariance of Experimental Groups and Control Group on Speed

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	8.40	8.34	8.24	8.39	Between	0.26	3	0.08	0.57
					Within	8.13	56	0.14	
Post-test	7.41	7.37	7.70	8.26	Between	7.51	3	2.50	11.36*
					Within	12.34	56	0.22	
Adjusted Post-test	7.38	7.37	7.76	8.23	Between	7.38	3	2.46	14.28*
					Within	7.94	55	0.17	

*** Mean scores in seconds* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.57 as per the pre-test was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 11.36 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 7.38, 7.37, 7.76 and 8.23 respectively. The F-value determined for the adjusted post-test

means of 14.28 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that material difference exists between the experimental groups and the control group in their post test scores on speed, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXV

Table XXV Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Speed

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	7.37	-----	8.23	**0.85***	
7.38	-----	-----	8.23	**0.84***	
-----	-----	7.76	8.23	**0.46***	
-----	7.37	7.76	-----	**0.39**	0.43
7.38	-----	7.76	-----	**0.38**	
7.38	7.37	-----	------	**0.01**	

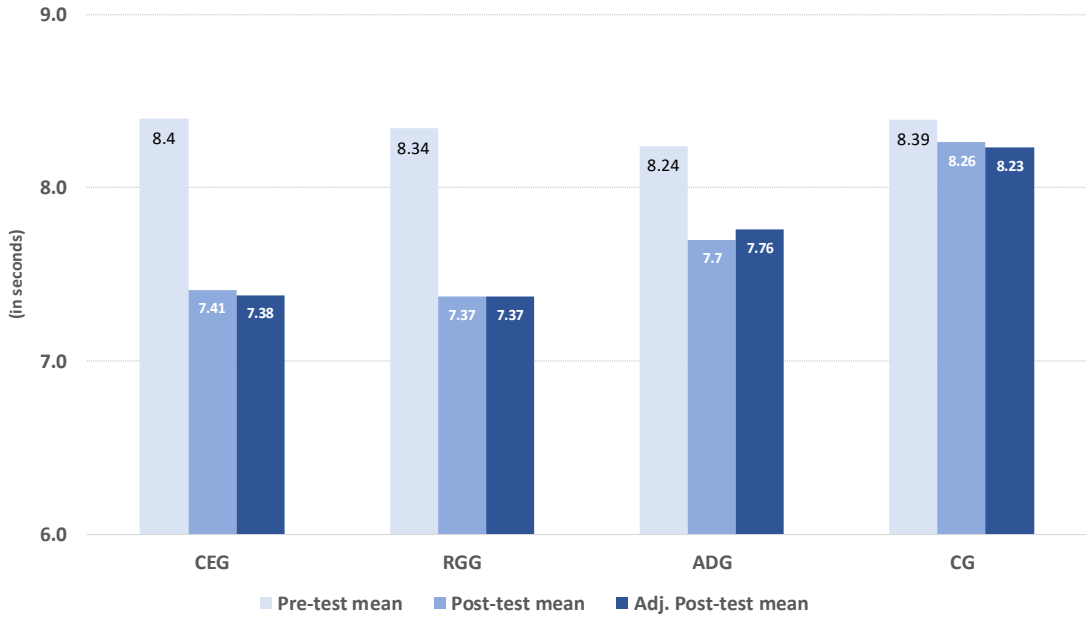
*** Mean scores in seconds* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.43 which is required for confidence level of 0.05) as seen in Table XXV indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (0.84), the recreational games group (0.85), and the aerobic dance group (0.46). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the aerobic dance group is compared with the calisthenics exercise group (0.38), and the recreational games group (0.39). Thirdly, there is almost no difference (just 0.01) in the adjusted post-test means between the calisthenics exercise group, and the recreational games group.

The various means on speed are depicted pictorially for sake of enhanced clarity in Figure 6.

Figure 6: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Speed



4.4.1.2 Discussion on speed

The test outcomes as seen in Table XXIV showed that determined adjusted means on speed for the recreational game group was 7.37, followed by the calisthenics exercise group with 7.38, aerobic dance group with 7.76 and control group with mean value of 8.23. After evaluating the delta between pre-test scores, post test scores and adjusted mean scores of the volunteers using ANCOVA, the determined F values were 0.57, 11.36 and 14.28 respectively. At 0.05 level of confidence that was deemed optimal for the study, while the determined F value on pre-test figures were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in Speed of subjects in all the three experimental groups, as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the calisthenics exercise and recreational games groups fared even better than the aerobic dance group

These results are also supported by the study conducted by Gunnar et al., (2015) which demonstrated that short burst high speed exercises and traditional soccer training consisting of small-sided games significantly improved speed of subjects. Similarly, the study by **Jagadeeswari, S. (2016)** on mentally challenged children demonstrated that the minor games significantly improved their speed. Also, research by **Bayrakdar et al., (2019)** concluded that calisthenics exercise programme resulted in an improvement in speed besides other fitness variables.

4.4.2 Agility

4.4.2.1 Results on agility

As can be seen from Table XXVI, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 10.91, 10.80, 10.83 and 10.43 respectively, while the mean of their post-test scores were 9.42, 9.19, 9.35 and 10.31 respectively.

Table XXVI Computation of Analysis of Covariance of Experimental Groups and Control Group on Agility

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	10.91	10.80	10.83	10.43	Between	2.02	3	0.67	1.72
					Within	21.88	56	0.39	
Post-test	9.42	9.19	9.35	10.31	Between	11.31	3	3.77	11.82*
					Within	17.87	56	0.31	
Adjusted Post-test	9.34	9.17	9.30	10.46	Between	14.91	3	4.97	21.67*
					Within	12.62	55	0.23	

*** Mean scores in seconds* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.72 as per the pre-test was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and

control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 11.82 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 9.34, 9.17, 9.30 and 10.46 respectively. The F-value determined for the adjusted post-test means of 21.67 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that material difference exists between the experimental groups and the control group in their post test scores on agility, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXVII

Table XXVII Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Agility

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	9.17	-----	10.46	**1.29***	0.50
-----	-----	9.30	10.46	**1.16***	
9.34	-----	-----	10.46	**1.12***	
9.34	9.17	-----	------	**0.17**	
-----	9.17	9.30	-----	**0.13**	
9.34	-----	9.30	-----	**0.04**	

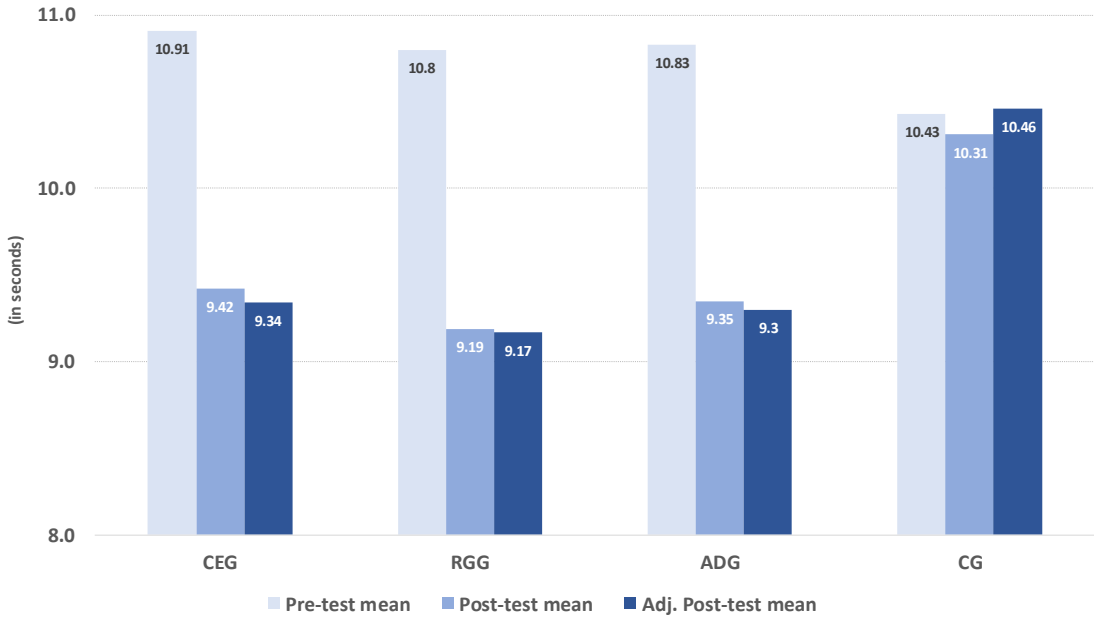
*** Mean scores in seconds* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.50 which is required for confidence level of 0.05) as seen in Table XXVII indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (1.12), the recreational games group (1.29), and the aerobic dance group (1.16). Secondly, there is a modest difference when adjusted post-test means of the recreational games group is compared with calisthenics exercise group (0.17) or aerobic dance group (0.13). Thirdly, adjusted post-test means of calisthenics exercise group and the aerobic dance group are almost similar (difference is just 0.04).

The various means on agility are depicted pictorially for sake of enhanced clarity in Figure 7.

Figure 7: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Agility



4.4.2.2 Discussion on agility

The test outcomes as seen in Table XXVI showed that determined adjusted means on agility for the recreational game group was 9.17, followed by the aerobic dance group with 9.30, the calisthenics exercise group with 9.34 and the control group with mean value of 10.46. After evaluating the delta between pre-test scores, post test scores and adjusted mean scores of the volunteers using ANCOVA, the determined F values were 1.72, 11.82 and 21.67 respectively. At 0.05 level of confidence that was deemed optimal for the study, while the determined F value on pre-test figures were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in agility of subjects in all the three experimental groups as compared to the control group as a result of the twelve-week training program. Furthermore, within the experimental groups, the recreational games group fared slightly better than the calisthenics exercise and aerobic dance groups in improving agility of the slum students.

These results are also supported by the study conducted by **Vinu (2018)** on thirty male Kabaddi players which demonstrated that aerobic dance resulted in significantly improvement in agility. Similarly, the study by **Poddar et al., (2016)** on West Bengal Tribal school students demonstrated that calisthenics exercise and recreational games programmes significantly improved agility and Lung Volume.

4.4.3 Co-ordination

4.4.3.1 Results on co-ordination

As can be seen from Table XXVIII, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 19.93, 19.86, 19.60 and 20.33 respectively, while the mean of their post-test scores were 21.93, 22.06, 22.93 and 21.00 respectively.

Table XXVIII Computation of Analysis of Covariance of Experimental Groups and Control Group on Co-ordination

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	19.93	19.86	19.60	20.33	Between	4.13	3	1.37	0.54
					Within	141.60	56	2.52	
Post-test	21.93	22.06	22.93	21.00	Between	28.18	3	9.39	3.79*
					Within	138.80	56	2.47	
Adjusted Post-test	21.93	22.11	23.16	20.72	Between	43.69	3	14.56	11.21*
					Within	71.43	55	1.29	

*** Mean scores in numbers* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77

at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.54 as per the pre-test was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 3.79 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 21.93, 22.11, 23.16, and 20.72 respectively. The F-value determined for the adjusted post-test means of 11.21 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that material difference exists between the experimental groups and the control group in their post test scores on co-ordination, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXIX

Table XXIX Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Co-ordination

Adjusted post-test Means **				Difference	Confidence
CEG	RGG	ADG	CG	in Means	Interval
-----	-----	23.16	20.72	2.44*	1.19
-----	22.11	-----	20.72	1.39*	
21.93	-----	23.16	-----	1.23*	
21.93	-----	-----	20.72	1.21*	
-----	22.11	23.16	-----	1.05	
21.93	22.11	-----	------	0.18	

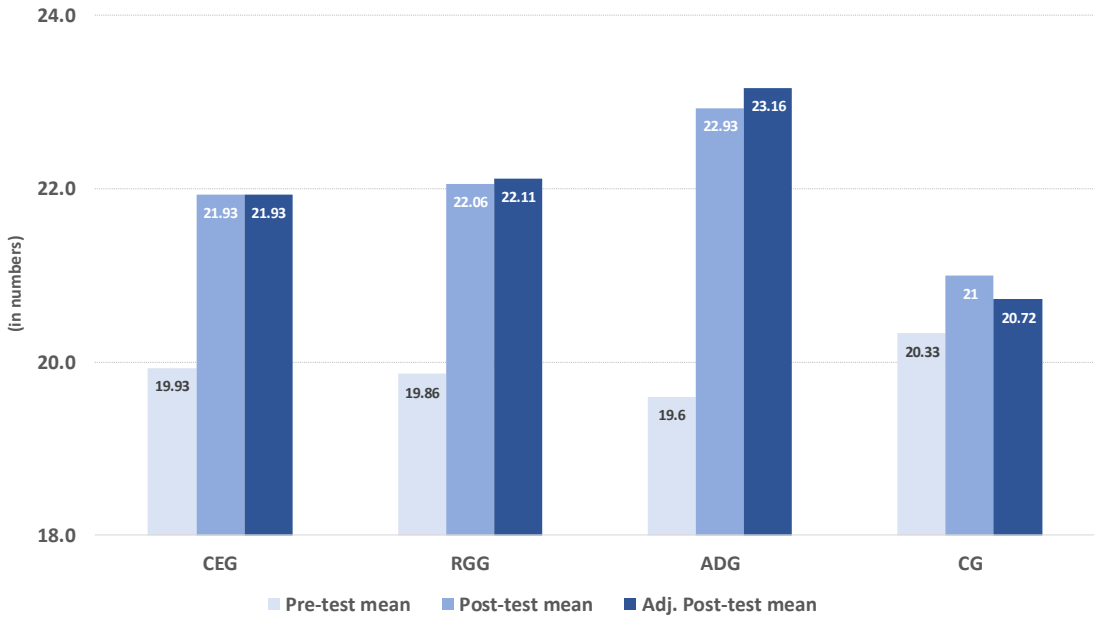
*** Mean scores in numbers* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 1.19 which is required for confidence level of 0.05) as seen in Table XXIX indicates four things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the aerobic dance group (2.44), and the recreational games group (1.39). Secondly, though the difference between calisthenics exercise group and control group was significant (1.21), there was also significant difference between the former and the aerobic dance group (1.23). Thirdly, there was a moderate but less-than-significant difference in adjusted post-test mean when the aerobic dance group is compared with the recreational game group (1.05). Lastly, adjusted post-test means of the calisthenics exercise group, and the recreational games group were somewhat similar (minimal difference of 0.18).

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 8.

Figure 8: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Co-ordination



4.4.3.2 Discussion on co-ordination

The test outcomes as seen in Table XXVIII showed that determined adjusted means on co-ordination for the aerobic dance group was 23.16, followed by recreational game group with 22.11, calisthenics exercise group with 21.93 and control group with mean value of 20.72. After evaluating the delta between pre-test scores, post test scores and adjusted mean scores of the volunteers using ANCOVA, the determined F values were 0.54, 3.79 and 11.12 respectively. At 0.05 level of confidence that was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in co-ordination of subjects in all the three experimental groups as compared to the control group as a result of the twelve-week training program. Furthermore, within the experimental groups the aerobic dance groups fared better than the calisthenics exercise and recreational games groups in improving co-ordination of the slum students.

These results are also supported by the study conducted by **Ying et al., (2013)** on college students which demonstrated that calisthenics exercises significantly improved co-ordination. Similarly, the study by **Arzoglou et al., (2013)** on individuals with autism demonstrated that the traditional dances significantly improved the neuromuscular coordination.

4.4.4 Balance

4.4.4.1 Results on balance

As can be seen from Table XXX, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 21.82, 21.80, 22.43 and 22.58 respectively, while the mean of their post-test scores were 25.14, 26.19, 27.85 and 22.61 respectively.

Table XXX Computation of Analysis of Covariance of Experimental Groups and Control Group on Balance

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	21.82	21.80	22.43	22.58	Between	7.47	3	2.49	0.28
					Within	493.96	56	8.82	
Post-test	25.14	26.19	27.85	22.61	Between	217.33	3	72.44	4.35*
					Within	932.39	56	16.65	
Adjusted Post-test	25.54	26.61	27.53	22.11	Between	252.23	3	84.07	18.27*
					Within	253.03	55	4.60	

*** Mean scores in seconds* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.28 as per the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 4.35 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 25.54, 26.61, 27.53, and 22.11 respectively. The F-value determined for the adjusted post-test means of 18.27 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that material difference exists between the experimental groups and the control group in their post test scores on balance, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXXI

Table XXXI Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Balance

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	-----	27.53	22.11	4.99*	2.25
-----	26.61	-----	22.11	4.50*	
25.54	-----	-----	22.11	3.43*	
25.54	-----	27.53	-----	1.99	
25.54	26.61	-----	------	1.07	
-----	26.61	27.53	-----	0.92	

*** Mean scores in seconds* **Significant at 0.05 level of confidence*

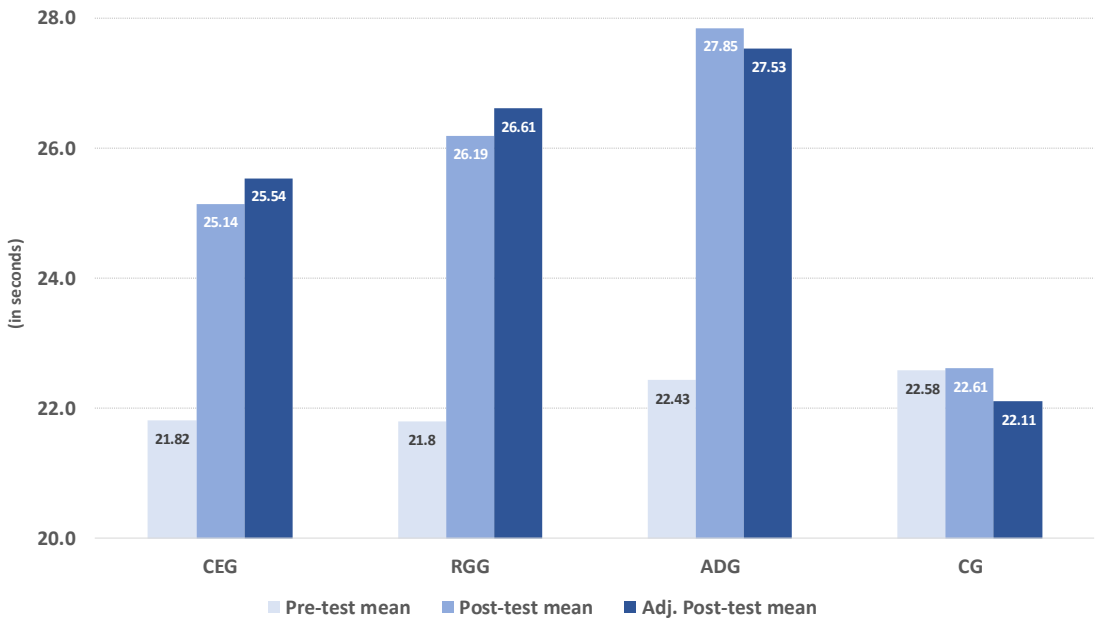
The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 2.25 which is required for confidence level of 0.05) as seen in Table XXXI indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (3.43), the recreational games group (4.50), and the aerobic dance group (4.99). Secondly, there is a less-than-significant

difference in adjusted post-test mean when the aerobic exercise group is compared with the calisthenics exercise group (1.99) and the recreational games group (0.92). Thirdly, less-than-significant difference (1.07) was also observed when the adjusted post-test means of the calisthenics exercise group, was compared with the recreational games group.

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 9.

Figure 9: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Balance



4.4.4.2 Discussion on balance

The test outcomes as seen in Table XXX showed that determined adjusted means on balance for the aerobic dance group was 27.53 followed by the calisthenics exercise group with 25.54, the recreational game group with 26.61 and control group with mean value of 22.11. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the volunteers using ANCOVA, the determined F values were 0.28, 4.35 and 18.27 respectively. At 0.05 level of confidence that was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and

adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in subjects' Balance in all the three experimental groups as compared to the control group as a result of the twelve-week training program. Furthermore, within the experimental groups the aerobic dance groups fared better than the calisthenics exercise and recreational games groups in improving balance of the slum students.

These results are also supported by the study conducted by **Genc (2020)** on tennis players which demonstrated that calisthenics exercises significantly improved balance. Similarly, the study by **Bavli (2016)** on basketball players demonstrated that the eight weeks of step aerobic exercises significantly improved the Balance.

4.5 RESULTS ON HEALTH RELATED FITNESS VARIABLES

4.5.1 Cardio-Respiratory Endurance

4.5.1.1 Results on cardio-respiratory endurance

As can be seen from Table XXXII, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 1508, 1498, 1450, and 1564 respectively, while the mean of their post-test scores were 1652, 1730, 1745, and 1570 respectively.

Table XXXII Computation of Analysis of Covariance of Experimental Groups and Control Group on Cardio-respiratory Endurance

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	1508	1498	1450	1564	Between	99565	3	33188	1.72
					Within	1079720	56	19280	
Post-test	1652	1730	1745	1570	Between	292860	3	97620	4.84*
					Within	1127613	56	20135	
Adjusted Post-test	1649	1735	1788	1524	Between	548596	3	182865	20.55*
					Within	489208	55	8894	

*** Mean scores in meters* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77

at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.72 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups at the beginning. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 4.84 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated

as 1649, 1735, 1788 and 1524 respectively. The F-value determined for the adjusted post-test means of 20.55 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that material difference exists between the experimental groups and the control group in their post test scores on Cardio-Respiratory Endurance, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXXIII.

Table XXXIII Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Cardio-respiratory Endurance

Adjusted post-test Means **				Difference	Confidence
CEG	**RGG**	**ADG**	**CG**	**in Means**	**Interval**
-----	-----	1788	1524	264*	99.2
-----	1735	-----	1524	211*	
1649	-----	1788	-----	139*	
1649	-----	-----	1524	125*	
1649	1735	-----	-----	86	
-----	1735	1788	-----	53	

*** Mean scores in meters* **Significant at 0.05 level of confidence*

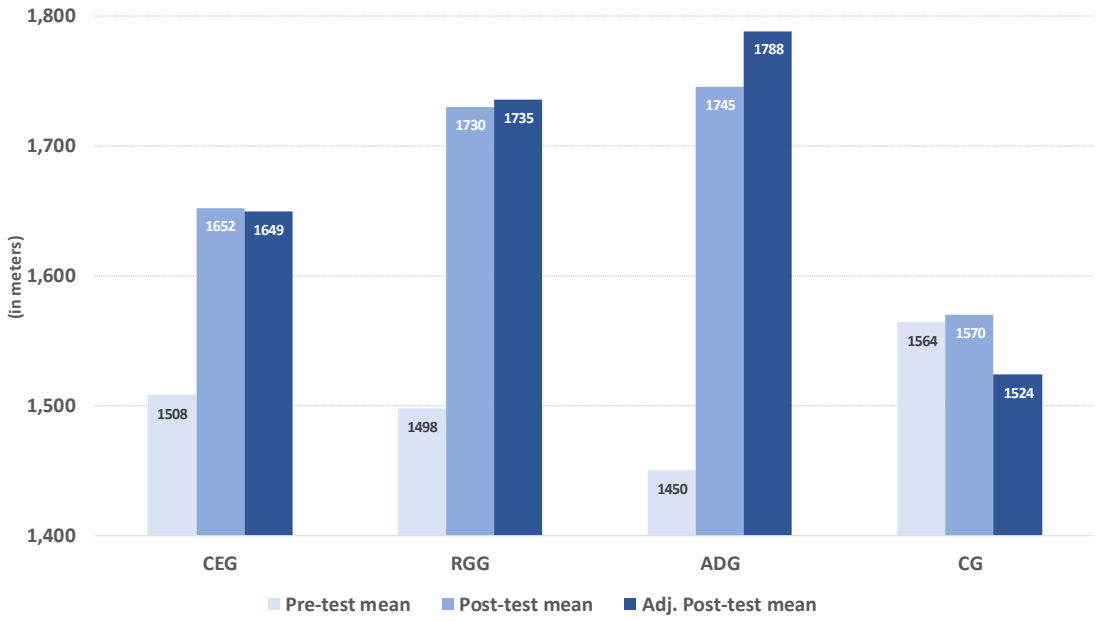
The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 99.2 which is required for confidence level of 0.05) as seen in Table XXXIII indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the recreational games (211), and the aerobic dance (264) groups. Secondly, though the difference between adjusted post-test means of calisthenics exercise group and control group was significant (125), there was also significant difference between the former and the aerobic dance group (139). Thirdly, there was a moderate but less-than-significant difference in adjusted post-test mean when the recreational game

group is compared with the calisthenics exercise group (86) or with the aerobic dance group (53).

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 10.

Figure 10: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Cardio-respiratory Endurance



4.5.1.2 Discussion on cardio-respiratory endurance

The test outcomes as seen in Table XXXII showed that determined adjusted means on Cardio-Respiratory Endurance for the aerobic dance group was 1788, followed by recreational game group with 1735, the calisthenics exercise group with 1649 and the control group with 1524. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 1.72, 4.84 and 20.55 respectively. At 0.05 level of confidence that was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in Cardio-Respiratory Endurance of subjects in all the three experimental groups as compared to the control group

as a result of the twelve-week training program. Furthermore, within the experimental groups the aerobic dance groups fared better than the calisthenics exercise and recreational games groups in improving Cardio-Respiratory Endurance of the slum students.

These results are also supported by the study conducted by **Watterson (1984)** which demonstrated that aerobic dance program significantly improved Cardio-Respiratory Endurance of subjects. Similarly, the study by **Sallis et al., (1997)** demonstrated that the physical activity during physical education classes and outside of school significantly improved the Cardio-Respiratory Endurance of subjects.

4.5.2 Flexibility

4.5.2.1 Results on flexiblity

As can be seen from Table XXXIV, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 13.66, 14.33, 13.06, and 14.20 respectively, while the mean of their post-test scores were 16.73, 17.40, 17.20, and 14.53 respectively.

Table XXXIV Computation of Analysis of Covariance of Experimental Groups and Control Group on Flexibility

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	13.66	14.33	13.06	14.20	Between	14.93	3	4.99	1.53
					Within	182.00	56	3.25	
Post-test	16.73	17.40	17.20	14.53	Between	78.26	3	26.09	5.02*
					Within	290.66	56	5.19	
Adjusted Post-test	16.84	17.02	17.73	14.25	Between	101.52	3	33.84	9.46*
					Within	196.56	55	3.57	

*** Mean scores in centimetres* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.53 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 5.02 for the post test scores was more than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 16.84, 17.02, 17.73 and 14.25 respectively. The F-value determined for the adjusted post-test means of 9.46 was also materially higher compared to the necessary table F-value of 2.77. This reinforces the fact that significant difference is seen between the experimental groups and the control group in their post test scores on flexibility, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXXV.

Table XXXV Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Flexibility

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	-----	**17.73**	**14.25**	**3.48***	1.98
-----	**17.02**	-----	**14.25**	**2.77***	
16.84	-----	-----	**14.25**	**2.58***	
16.84	-----	**17.73**	-----	**0.89**	
-----	**17.02**	**17.73**	-----	**0.71**	
16.84	**17.02**	-----	------	**0.18**	

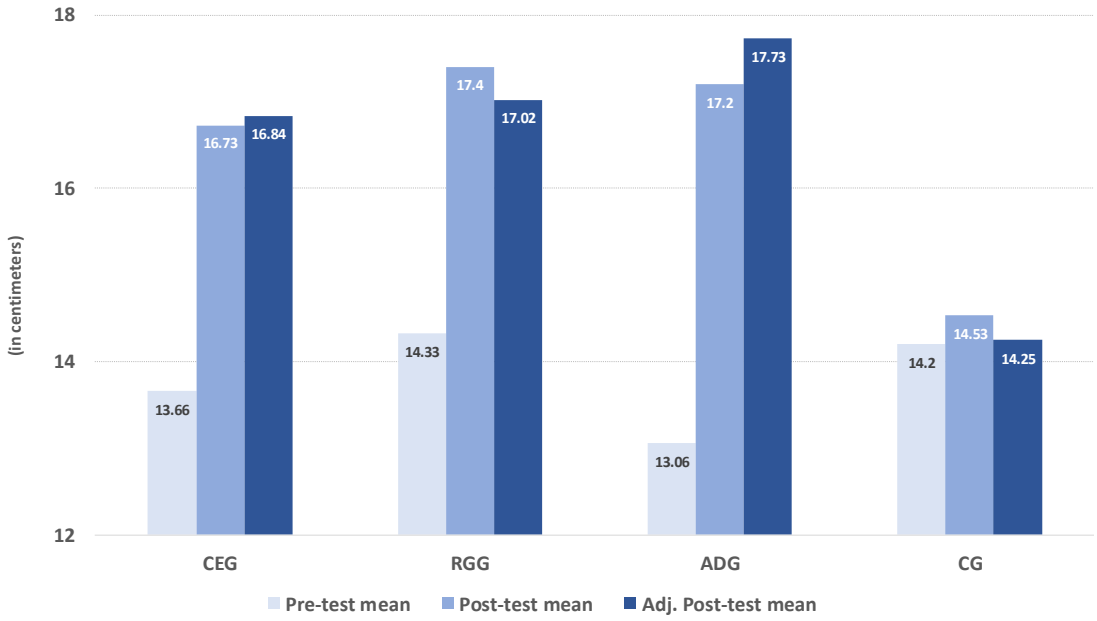
*** Mean scores in seconds* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 1.98 which is required for confidence level of 0.05) as seen in Table XXXV indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (2.58), the recreational games group (2.77), and the aerobic dance group (3.48). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the aerobic dance group is compared with the calisthenics exercise group (0.89), and the recreational games group (0.71). Thirdly, the adjusted post-test means of the calisthenics exercise group, and the recreational games group are almost similar (difference is just 0.18).

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 11.

Figure 11: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Flexibility



4.5.2.2 Discussion on flexibility

The test outcomes as seen in Table XXXIV showed that determined adjusted means on flexibility for the aerobic dance group was 17.73, followed by recreational game group with 17.02, the calisthenics exercise group with 16.84 and the control group with 14.25. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 1.53, 5.02 and 9.46 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a significant improvement in flexibility of subjects in the all the three experimental groups, as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the aerobic dance group fared better than the calisthenic exercise and recreational games groups in improving Flexibility of the slum students.

These results are also supported by the study conducted by **Suna et al., (2020)** on sedentary women that showed pilates and calisthenic exercises significantly improved flexibility. Similarly, the study by **Irez et al., (2014)** demonstrated that the aerobic dance and Step-dance exercises significantly improved the Flexibility in University students.

4.5.3 Muscular Strength

4.5.3.1 Results on muscular strength

As can be seen from Table XXXVI, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 39.06, 39.20, 41.00, and 39.80 respectively, while the mean of their post-test scores were 46.33, 43.80, 44.06 and 40.00 respectively.

Table XXXVI Computation of Analysis of Covariance of Experimental Groups and Control Group on Muscular Strength

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	39.06	39.20	41.00	39.80	Between	35.00	3	11.66	1.59
					Within	409.73	56	7.31	
Post-test	46.33	43.80	44.06	40.00	Between	310.18	3	103.39	11.38*
					Within	508.66	56	9.08	
Adjusted Post-test	46.90	44.26	43.06	39.97	Between	365.35	3	121.78	28.00*
					Within	239.22	55	4.35	

*** Mean scores in numbers* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.59 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 11.38 for the post test scores was greater than the necessary table F-value was 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 46.90, 44.26, 43.06 and 39.97 respectively. The F-value determined for the adjusted post-test means of 28.00 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that significant difference

exists between the experimental groups and the control group in their post test scores on muscular strength, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXXVII.

Table XXXVII Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Muscular strength

Adjusted post-test Means **				Difference	Confidence
CEG	RGG	ADG	CG	in Means	Interval
46.9	**-----**	**-----**	**39.97**	**6.92***	2.19
-----	**44.26**	**-----**	**39.97**	**4.28***	
46.9	**-----**	**43.06**	**-----**	**3.83***	
-----	**-----**	**43.06**	**39.97**	**3.09***	
46.9	**44.26**	**-----**	**------**	**2.64***	
-----	**44.26**	**43.06**	**-----**	**1.19**	

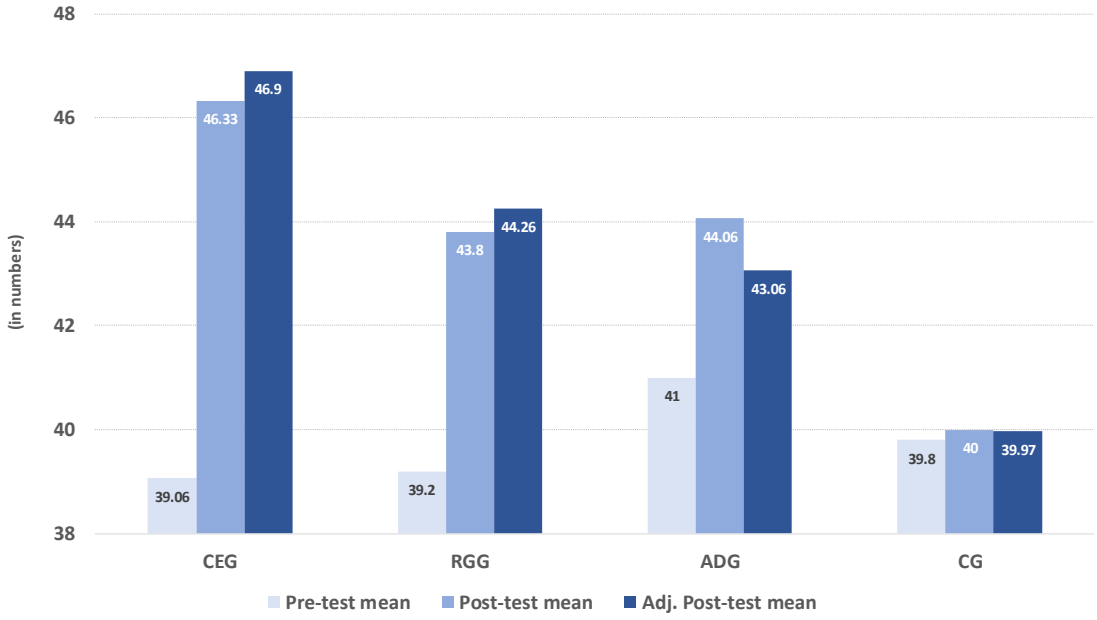
*** Mean scores in numbers* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 2.19 which is required for confidence level of 0.05) as seen in Table XXXVII indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (6.92), the recreational games group (4.28), and the aerobic dance group (3.09). Secondly, there was also a significant difference in adjusted post-test means when the calisthenics exercise group is compared with the recreational games group (2.64), and with the aerobic dance group (3.83). Thirdly, there was a moderate but less-than-significant difference when the adjusted post-test mean of the recreational game group is compared with that of the aerobic dance group (1.19).

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 12.

Figure 12: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Muscular Strength



4.5.3.2 Discussion on muscular strength

The test outcomes as seen in Table XXXVI showed that determined adjusted means on muscular strength for the calisthenics exercise group was 46.90 followed by recreational game group with 44.26, aerobic dance group with 43.06 and control group with 39.97. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 1.59, 11.38 and 28.00 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in muscular strength of subjects in all the three experimental groups as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the calisthenics exercise fared materially better than the recreational game and aerobic dance groups in improving Muscular Strength of the slum students.

These results are also supported by the study conducted by **Santos et al., (2015)** on school children that demonstrated that calisthenics strength exercises significantly improved muscular strength. Similarly, the study by **Koutedakis et al., (2007)** demonstrated that different aerobic and strength training routines significantly improved muscular strength of dance students.

4.5.4 Body Composition

4.5.4.1 Results on body composition

As can be seen from Table XXXVIII, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 18.90, 18.21, 18.88 and 18.43 respectively, while the mean of their post-test scores were 16.58, 16.57, 16.87 and 18.33 respectively.

Table XXXVIII Computation of Analysis of Covariance of Experimental Groups and Control Group on Body Composition

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	18.90	18.21	18.88	18.43	Between	5.25	3	1.75	0.44
					Within	220.33	56	3.93	
Post-test	16.58	16.57	16.87	18.33	Between	31.58	3	10.52	3.41*
					Within	172.67	56	3.08	
Adjusted Post-test	16.36	16.87	16.67	18.46	Between	39.43	3	13.14	14.97*
					Within	48.28	55	0.87	

*** Mean scores in percentage* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.44 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 3.41 for the post test scores was greater than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 16.36, 16.87, 16.67 and 18.46 respectively. The F-value determined for the adjusted post-test means of 14.97 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that significant difference exists between the experimental groups and the control group in their post test scores on body composition, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XXXIX.

Table XXXIX Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Body Composition

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
16.36	**-----**	**-----**	**18.46**	**2.10***	0.98
-----	**-----**	**16.67**	**18.46**	**1.79***	
-----	**16.87**	**-----**	**18.46**	**1.59***	
16.36	**16.87**	**-----**	**------**	**0.51**	
16.36	**-----**	**16.67**	**-----**	**0.30**	
-----	**16.87**	**16.67**	**-----**	**0.20**	

*** Mean scores in percentages* **Significant at 0.05 level of confidence*

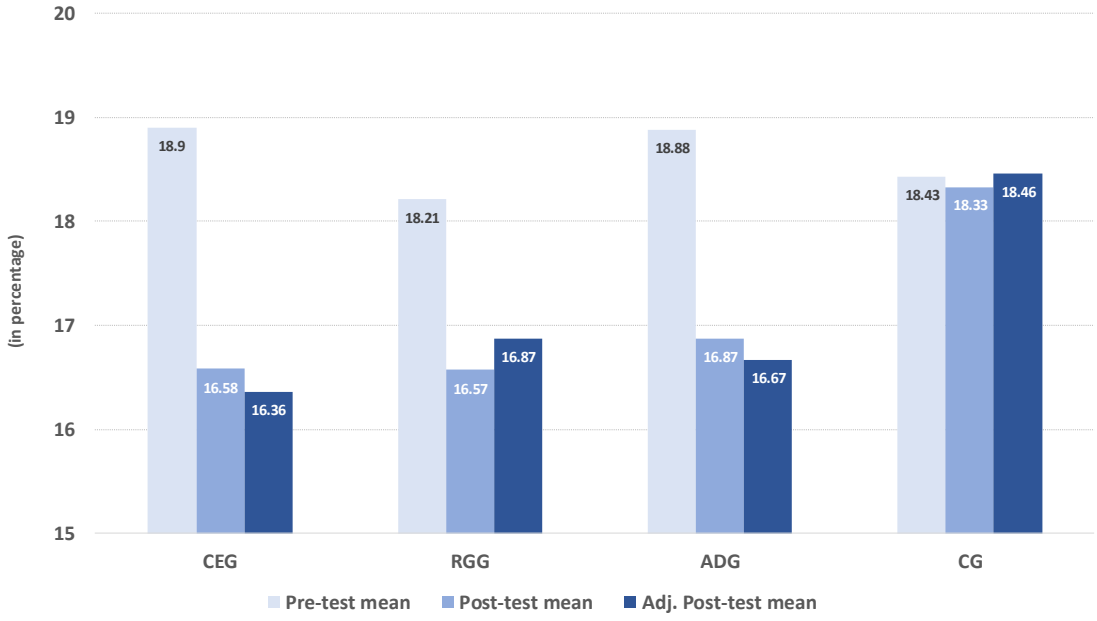
The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.98 which is required for confidence level of 0.05) as seen in Table XXXIX indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (2.10), the recreational games group (1.59), and the aerobic dance group (1.79). Secondly, there is a moderate but less-than-

significant difference in adjusted post-test mean when the calisthenics exercise group is compared with the recreational game group (0.51), and the aerobic dance group (0.30). Thirdly, there is almost no difference (just 0.20) in the adjusted post-test means of the recreational game group, and the aerobic dance group.

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 13.

Figure 13: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Body Composition



4.5.4.2 Discussion on body composition

The test outcomes as seen in Table XXXVIII showed that determined adjusted means on body composition for the calisthenics exercise group was 16.36 followed by aerobic dance group with 16.67, recreational game group with 16.87 and control group with 18.46. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 0.44, 3.41 and 14.97 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted

means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in body composition of subjects in all the three experimental groups as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the calisthenics exercise group fared slightly better than the recreational game and aerobic dance groups in improving Body Composition of the slum students.

These results are also supported by the study conducted by **Cigerci et al., (2020)** on soccer players showed that calisthenics exercises significantly improves the body composition. Similarly, the study by **Dowdyet al., (1985)** demonstrated that aerobic dance significantly improved body composition of young middle-aged women.

4.6 RESULTS ON PHYSIOLOGICAL VARIABLES

4.6.1 Resting Pulse Rate

4.6.1.1 Results on resting pulse rate

As can be seen from Table XL, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 72.66, 72.13, 74.06 and 72.40 respectively, while the mean of their post-test scores were 68.73, 68.86, 69.53 and 72.26 respectively.

Table XL Computation of Analysis of Covariance of Experimental Groups and Control Group on Resting Pulse Rate

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	72.66	72.13	74.06	72.40	Between	33.38	3	11.12	1.44
					Within	431.60	56	7.70	
Post-test	68.73	68.86	69.53	72.26	Between	122.31	3	40.77	7.73*
					Within	295.33	56	5.27	
Adjusted Post-test	68.83	69.33	68.69	72.54	Between	146.66	3	48.88	26.69*
					Within	100.74	55	1.83	

*** Mean scores in numbers* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.44 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 7.73 for the post test scores was greater than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 68.83, 69.33, 68.69 and 72.54 respectively. The F-value determined for the

adjusted post-test means of 26.69 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that significant difference is seen between the experimental groups and the control group in their post test scores on resting pulse rate, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XLI.

Table XLI Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Resting Pulse Rate

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	-----	**68.69**	**72.54**	**3.85***	1.42
68.83	-----	-----	**72.54**	**3.71***	
-----	**69.33**	-----	**72.54**	**3.22***	
-----	**69.33**	**68.69**	-----	**0.63**	
68.83	**69.33**	-----	------	**0.49**	
68.83	-----	**68.69**	-----	**0.14**	

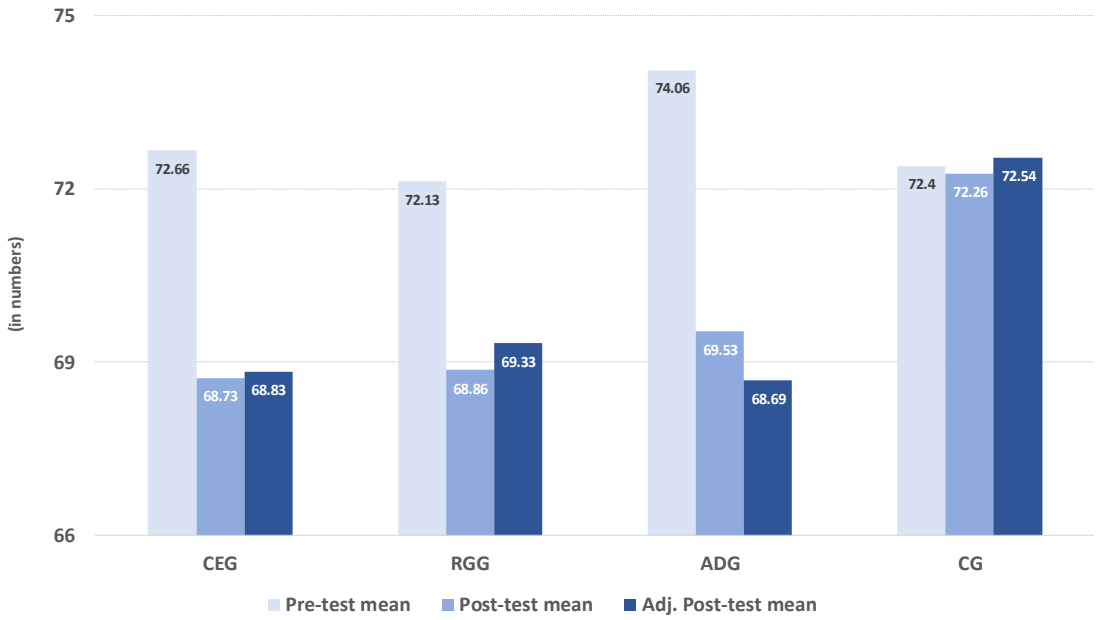
*** Mean scores in numbers* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 1.42 which is required for confidence level of 0.05) as seen in Table XLI indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (3.71), the recreational games group (3.22), and the aerobic dance group (3.85). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the recreational games group is compared with the calisthenics exercise group (0.49), and the aerobic dance group (0.63). Thirdly, the adjusted post-test means of the calisthenics exercise group, and the aerobic dance group were almost similar (difference of just 0.14)

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 14.

Figure 14: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Resting Pulse Rate



4.6.1.2 Discussion on resting pulse rate

The test outcomes as seen in Table XL showed that determined adjusted means on Resting Pulse Rate for aerobic dance group was 68.69, followed by calisthenics exercise group with 68.83, recreational game group with 69.33 and control group with mean value of 72.54. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 1.44, 7.73 and 26.69 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in resting pulse rate of subjects in all the three experimental groups as compared to the control group, as a result of the twelve-week training program. Furthermore, among the experimental groups the aerobic dance group

fared better than the recreational game and calisthenics exercise groups in improving Resting Pulse Rate of the slum students.

These results are also supported by the study conducted by **Ravindran (2019)** on college women which demonstrated that aerobic dance training significantly improved resting pulse rate. Similarly, the study by **Park et al., (2009)** on university students demonstrated that recreational games activity significantly improved resting pulse rate.

4.6.2 Vital Capacity

4.6.2.1 Results on vital capacity

As can be seen from Table XLII, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 1.95, 1.81, 1.79 and 1.84 respectively, while the mean of their post-test scores were 2.33, 2.25, 2.27 and 1.86 respectively.

Table XLII Computation of Analysis of Covariance of Experimental Groups and Control Group on Vital Capacity

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	1.95	1.81	1.79	1.84	Between	0.22	3	0.07	1.82
					Within	2.34	56	0.04	
Post-test	2.33	2.25	2.27	1.86	Between	2.03	3	0.67	18.69*
					Within	2.03	56	0.03	
Adjusted Post-test	2.25	2.28	2.31	1.87	Between	1.96	3	0.65	58.77*
					Within	0.61	55	0.01	

*** Mean scores in liters* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77

at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 1.82 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and

control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 18.69 for the post test scores was greater than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 2.25, 2.28, 2.31 and 1.87 respectively. The F-value determined for the adjusted post-test means of 58.77 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that significant difference exists between the experimental groups and the control group in their post test scores on vital capacity, as a result of the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XLIII.

Table XLIII Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Vital Capacity

Adjusted post-test Means **				Difference	Confidence
CEG	RGG	ADG	CG	in Means	Interval
-----	-----	**2.31**	**1.87**	**0.44***	0.10
-----	**2.28**	-----	**1.87**	**0.41***	
2.25	-----	-----	**1.87**	**0.38***	
2.25	-----	**2.31**	-----	**0.06**	
-----	**2.28**	**2.31**	-----	**0.03**	
2.25	**2.28**	-----	------	**0.02**	

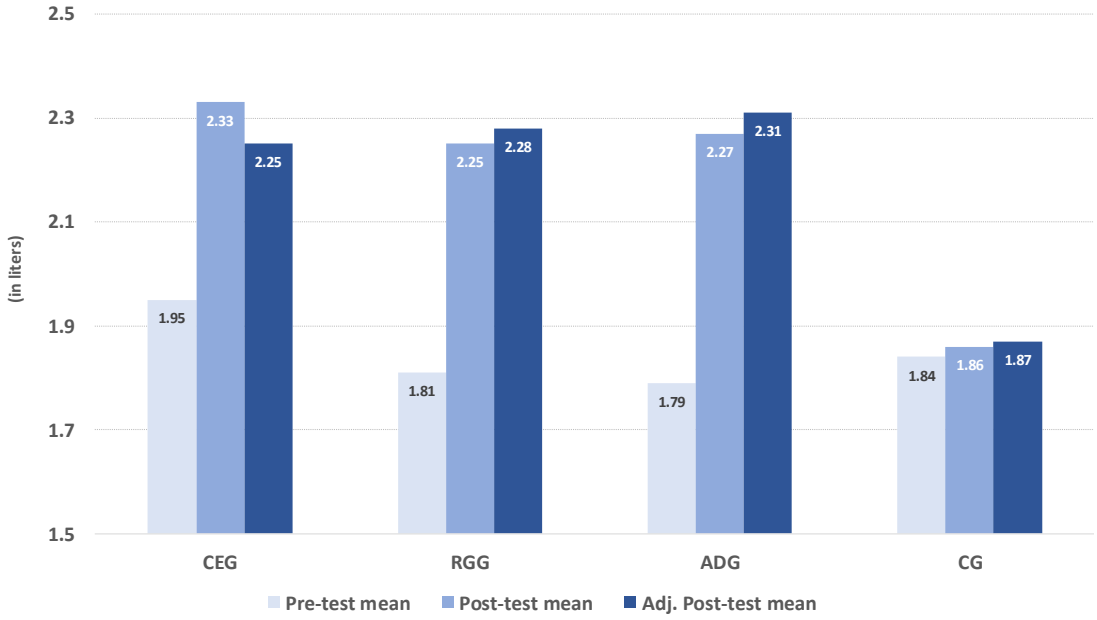
*** Mean scores in liters* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.10 which is required for confidence level of 0.05) as seen in Table XLIII indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (0.38), the recreational games group (0.41), and the aerobic dance group (0.44). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the calisthenics exercise group is compared with the aerobic dance group (0.06). Thirdly, the adjusted post-test mean of recreation game group lies between that of aerobic dance and calisthenics exercise groups; as a result, there is negligible difference when recreational game group is compared with the other two experimental groups.

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 15.

Figure 15: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Vital Capacity



4.6.2.2 Discussion on vital capacity

The test outcomes as seen in Table XLII showed that determined adjusted means on Vital Capacity for aerobic dance group was 2.31 followed by recreational game group with 2.28, calisthenics exercise group with 2.25 and control group with 1.87. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 1.82, 18.69 and 58.77

respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in vital capacity of subjects in the calisthenics exercise, recreational game, aerobic dance groups as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the aerobic dance group fared better than the recreational game and calisthenics exercise groups in improving Vital Capacity of slum students.

These results are also supported by the study conducted by **Dar et al., (2017)** that demonstrated aerobic dance and pranayama significantly improved vital capacity of college students. Similarly, the study by **Rai (2020)** demonstrated that calisthenics exercises significantly improved vital capacity of rural school boys.

4.6.3 Respiration Rate

4.6.3.1 Results on respiration rate

As can be seen from Table XLIV, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 19.80, 19.86, 20.06 and 19.46 respectively, while the mean of their post-test scores were 18.00, 17.80, 17.86 and 19.27 respectively.

Table XLIV Computation of Analysis of Covariance of Experimental Groups and Control Group on Respiration rate

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	19.80	19.86	20.06	19.46	Between	2.00	3	0.93	0.57
					Within	90.80	56	1.62	
Post-test	18.00	17.80	17.86	19.27	Between	21.66	3	7.22	4.44*
					Within	91.06	56	1.62	
Adjusted Post-test	18.00	17.75	17.70	19.47	Between	30.59	3	10.19	9.89*
					Within	56.69	55	1.03	

*** Mean scores in numbers* ** Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77

at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.57 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 4.44 for the post test scores was greater than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 18.00, 17.75, 17.70 and 19.47 respectively. The F-value determined for the adjusted post-test means of 9.89 was also materially higher compared to the necessary table

F-value of 2.77. These reinforce the fact that significant difference exists between the experimental groups and the control group in their post test scores on respiration rate, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XLV.

Table XLV Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Respiration rate

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	-----	17.70	19.47	1.76*	1.06
-----	17.75	-----	19.47	1.71*	
18.00	-----	-----	19.47	1.47*	
18.00	-----	17.70	-----	0.29	
18.00	17.75	-----	------	0.24	
-----	17.75	17.70	-----	0.05	

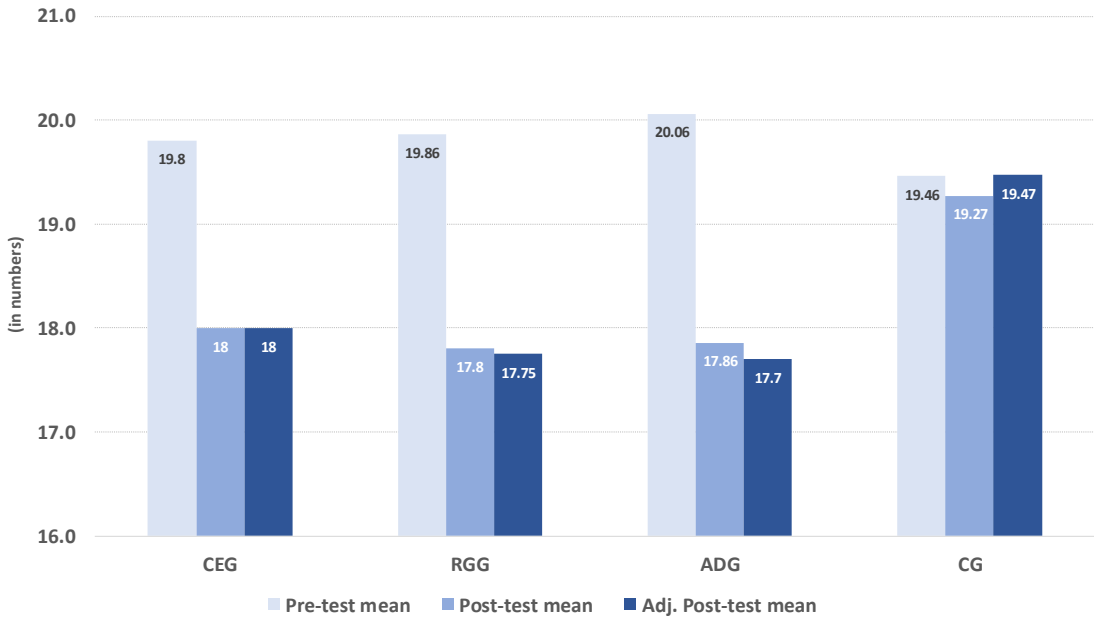
*** Mean scores in numbers* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.50 which is required for confidence level of 0.05) as seen in Table XLV indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (1.47), the recreational games group (1.71), and the aerobic dance group (1.76). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the calisthenics exercise group is compared with the recreational game group (0.29), and the aerobic dance group (0.24). Thirdly, there is almost no difference (just 0.04) in the adjusted post-test means of the recreational game group, and the aerobic dance group.

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 16.

Figure 16: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Respiration rate



4.6.3.2 Discussion on respiration rate

The test outcomes as seen in Table XLIV showed that determined adjusted means on Respiration Rate for aerobic dance group was 17.70 followed by recreational game group with 17.75, calisthenics exercise group with 18.00, and control group with 19.47. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 0.57, 4.44 and 9.89 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in respiration rate of subjects in the calisthenics exercise, recreational game, aerobic dance groups as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups

the aerobic dance and recreational game groups fared slightly better than the calisthenics exercise group in improving respiration rate of slum students.

These results are also supported by the study conducted by **Srivastava, R.(2016)** on school boys demonstrated that pilates, calisthenics exercises and yogasanas significantly improved respiration rate and resting heart rate. Similarly, the study by **Darby et al., (1995)** on experienced, female aerobic dancers demonstrated that aerobic dance exercise of varied impact, step, and cadence had a significant effect on physiological variables such as heart rate, oxygen consumption and respiratory rate.

4.6.4 Breath Holding Time

4.6.4.1 Results on breath holding time

As can be seen from Table XLVI, the mean of pre-test scores of calisthenics exercise, recreational game, aerobic dance and control group were 36.3, 36.40, 36.48 and 36.88 respectively, while the mean of their post-test scores were 41.34, 41.08, 41.76 and 36.91 respectively.

Table XLVI Computation of Analysis of Covariance of Experimental Groups and Control Group on Breath holding time

Test	Means **				Source of variance	Sum of Squares	Df^	Mean square	F-value
	CEG	RGG	ADG	CG					
Pre-test	36.30	36.40	36.48	36.88	Between	2.86	3	0.95	0.02
					Within	1967.28	56	35.13	
Post-test	41.34	41.08	41.76	36.91	Between	229.88	3	76.62	3.19*
					Within	1343.70	56	23.99	
Adjusted Post-test	41.48	41.17	41.78	36.66	Between	263.69	3	87.89	11.76*
					Within	410.98	55	7.47	

*** Mean scores in seconds* * Significant at 0.05 level of confidence*

^ Benchmark table value for Degree of Freedom or df at (3&56) at 0.05 level = 2.77
at (3&55) at 0.05 level = 2.77

Further, the determined F-value of 0.02 for the pre-test scores was lesser than the necessary table F-value of 2.77 implying immaterial delta between the experimental and control groups. This clearly demonstrates the robust randomization while allocating the subjects among groups.

Furthermore, the determined F-value of 3.19 for the post test scores was greater than the necessary table F-value of 2.77 indicating material delta between the experimental and control groups at the end of the experiment. Additionally, the adjusted post-test means of calisthenics exercise, recreational game, aerobic dance and control group were calculated as 41.48, 41.17, 41.78 and 36.66 respectively. The F-value determined for the adjusted post-test means of 11.76 was also materially higher compared to the necessary table F-value of 2.77. These reinforce the fact that significant difference exists between the experimental groups and the control group in their post test scores on agility, due to the experimental treatment.

Since material delta were witnessed in the adjusted post test scores, post hoc analysis using Scheffe's confidence interval test was conducted and the outcomes are depicted in Table XLVII

Table XLVII Scheffe's Test for Post-hoc Analysis of Adjusted Post Test Means on Breath holding time

Adjusted post-test Means **				Difference in Means	Confidence Interval
CEG	RGG	ADG	CG		
-----	-----	41.78	36.66	5.12*	2.87
41.48	-----	-----	36.66	4.82*	
-----	41.17	-----	36.66	4.50*	
-----	41.17	41.78	-----	0.61	
41.48	41.17	-----	------	0.31	
41.48	-----	41.78	-----	0.29	

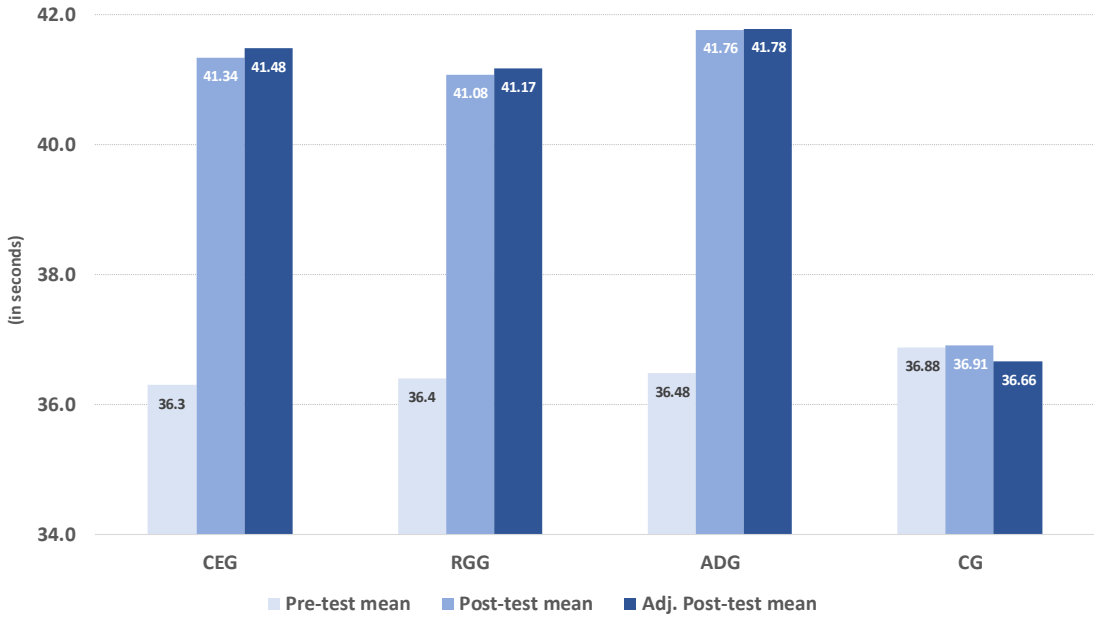
*** Mean scores in seconds* **Significant at 0.05 level of confidence*

The comparison of adjusted post-test means of each group with that of each of the other three groups (based on a confidence interval value of 0.50 which is required for confidence level of 0.05) as seen in Table XLVII indicates three things.

First, the difference in adjusted post-test mean is significant when the control group is compared with the calisthenics exercise group (4.82), the recreational games group (4.50), and the aerobic dance group (5.12). Secondly, there is a moderate but less-than-significant difference in adjusted post-test mean when the recreational games group is compared with the aerobic dance group (0.61). Thirdly, the adjusted post-test mean of calisthenics exercise group lies between that of recreational game and aerobic dance groups; as a result, there is negligible difference when calisthenics exercise group is compared with the other two experimental groups.

The various means on co-ordination are depicted pictorially for sake of enhanced clarity in Figure 17.

Figure 17: Pictorial Depiction of Pre, Post and Adjusted Post Test Means on Breath holding time



4.6.4.2 Discussion on breath holding time

The test outcomes as seen in Table XLVI showed that determined adjusted means on breath holding time for aerobic dance group was 41.78 followed by calisthenics exercise group with 41.48, recreational game group with 41.17 and control group with mean value of 36.66. After evaluating the difference between pre-test scores, post test scores and adjusted mean scores of the subjects using ANCOVA, the determined F values were 0.02, 3.19 and 11.76 respectively. At 0.05 level of confidence which was deemed optimal for the study, while the determined F value on pre-test scores were not material since it was lower than the necessary table F-value of 2.77, the determined F-values on post-test and adjusted means were material. Further, post hoc analysis using Scheffe's confidence test clearly demonstrates a measurable improvement in breath holding time of subjects in the calisthenics exercise, recreational game, aerobic dance groups as compared to the control group as a result of the twelve-week training program. Furthermore, among the experimental groups the aerobic dance group fared slightly better than the calisthenics exercise and recreational games groups.

These results are also supported by the study conducted by **Babu et al., (2020)** on untrained young men, demonstrated that different intensities of aerobic training notably altered resting heart rate and breath holding time. Similarly, the study by **Kozhokar et al., (2019)** demonstrated that their health-improving fitness programme had complex positive effects on the fundamental components of the physical condition, including lung capacity and breath holding time, on young men and girls.

4.7 DISCUSSION ON THE HYPOTHESES

1. First hypothesis: It was presumed that there would be a material beneficial impact on the chosen motor fitness, health related fitness and physiological variables owing to the effect of callisthenic exercise among chennai slum students
2. Second hypothesis: It was presumed that there would be a material beneficial impact on the chosen motor fitness, health related fitness and physiological variables owing to the effect of recreational games among chennai slum students.
3. Third hypothesis: It was presumed that there would be a material beneficial impact on the chosen motor fitness, health related fitness and physiological variables owing to the effect of aerobic dance among chennai slum students.
4. Fourth hypothesis: It was presumed that there would be a material beneficial impact on chosen motor fitness, health related fitness and physiological variables owing to the effect of callisthenic exercises, recreational games and aerobic dance among chennai slum students.

The effects of the experimental training program with chennai slum students, on motor fitness variables, health-related fitness variables and physiological variables, has been measured, analysed statistically, and discussed in this Chapter. To elaborate further, Tables XXIV to XLVII and the discussions thereunder have clearly demonstrated the significant positive effect that each of the independent variables – namely calisthenics exercise, recreational game, aerobic dance – had on each of the dependent variables – namely Speed, Agility, Co-ordination, and Balance (being part of motor fitness variables); Cardio-Respiratory Endurance, Flexibility, Muscular Strength, and Body Composition (being part of Health-related fitness variables); Resting pulse rate, Vital capacity, Respiration rate, and Breath Holding Time (being part of Physiological variables).

Further, while all the experimental groups outperformed the control group, a closer look revealed that one experimental group could outperformed the other experimental groups when it came to specific dependent variables. Accordingly, based on the drill down analysis using Scheffe's post hoc test, relative superiority among experimental groups was gauged to reveal the following outcomes

Table XLVIII Relative outperformance within experimental groups

	Dependent Variable	Calisthenics Exercise	Recreational Games	Aerobic Dance
Motor Fitness Variables	Speed	✓	✓	
	Agility		✓	
	Co-ordination			✓
	Balance			✓
Health-related Fitness Variables	Cardio-Respiratory Endurance			✓
	Flexibility			✓
	Muscular Strength	✓		
	Body Composition	✓		
Physiological Variables	Resting pulse rate			✓
	Vital capacity			✓
	Respiration rate			✓
	Breath Holding Time			✓

✓ Indicates outperformance by that experimental group

These results therefore prove all the hypotheses covered by the study, and the same are accepted to be valid.