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Effects of aerobic training and resistance training in series and parallel on muscular endurance, cardio vascular endurance and stroke volume at rest

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Abstract
The aim of this study was to determine the Effect of Aerobic Training and Resistance training in series and parallel on Muscular Endurance, Cardiovascular Endurance and Stroke volume at rest. To achieve these purpose forty five (N=45) B.P.Ed., women students were selected during the academic year 2015-2016 randomly from Rayalaseema College of Physical Education, Rayavaram, Proddatur, Y.S.R District, Andhra Pradesh, India. Their age is between 20 and 22 years. The subjects were randomly divided into three groups and each group contained fifteen (n=15) subjects. Group-I underwent Aerobic training and Resistance training in series, group-II underwent Aerobic training and Resistance training in parallel and group-III acted as control. The subjects were free to withdraw their consent in case they feel any difficulty during experiment and testing period.

Keywords: aerobic training, resistance training, series, parallel, muscular endurance, cardiovascular endurance and stroke volume at rest

Introduction

According to American College of Sports Medicine, persons of any age may significantly develop their habitual playing capacity safely if there are no contraindications to exercise and a rational program is developed. It is very important that each individual is prescribed the proper load and play capacity in progressive manner.

Raglan J.S. and Willson (2000) [5] it is commonly accepted that success in aerobic sports is largely dependent on a successful early season training period in which athletes trains at a significantly greater volume that the amount require for physical fitness. This purposeful elevating of training volume for the specific intent of enhancing athletic performance. Morgan W.P. (1987) [4] believed that over training leads to improve aerobic performance through a complex interaction of various neurological, cardiovascular, biochemical and muscular adaptations.

Gary Moran & Georgy Mc Glynn (1990) [2] revealed that Resistance Training (RT) is an exercise program where force or stationary weights are used for the purpose of increasing muscular strength, muscular endurance and power through which skill can be improved.

Dudley G.A (1985) [1] reveals that combined resistance training (RT) and aerobic training (AT) activities appears to interpreter primarily with strong performance at high velocities of movement. When strength and aerobic training are alone in excess, maximal power performance is blunted. Possible explanations for this less than optimal strength and power development include adverse neural changes and the alterations of muscle proteins in the fibers. In contrast no adverse effects on aerobic power have yet been observed, despite the expected cellular changes caused by heavy resistance exercise.

Tudor O. Bompa (1999) [6] strength will always be important as a base. It can be seen that strength is definitely important, but power and speed are more important than any other qualities. Power represents as one of the improvement of athletic fitness that may be indicative

Methodology

To achieve these purpose 45 girls of 15 each students from B.P.Ed., women students were selected during the academic year 2015-2016 randomly from Rayalaseema College of Physical Education, Rayavaram, Proddatur, Y.S.R District, Andhra Pradesh, India. Their age is between 20 and 22 years. The subjects were successfully completed the minimum strength requirement test recommended by Voight and Draovitch (1991), Which consisted of five push-ups, five squat thrust, standing long jump and skipping rope for thirty seconds. The subjects were randomly divided into three groups and each group contained fifteen (n=15) subjects. Group -I underwent Aerobic Training and Resistance training in series, group -II underwent Aerobic Training and Resistance training in parallel and group- III acted as control. The subjects were free to withdraw their consent in case they feel any difficulty during experiment and testing period. However there were no dropouts in the study and all the volunteered subjects cooperated well throughout the period of

experimentation.

Training Programme

During training period the two experimental groups namely series training group and parallel training group underwent their respective training program, four days for week for 12 week in addition to their regular physical education activities. Group I (series group) underwent Aerobic training only for six weeks and resistance training in the next six weeks. Group II (parallel group) underwent Aerobic training and Resistance training in alternative sessions. Every training session workout lasted for about 45-60 minutes including warm-up and limbering down exercise. Group III (control group) did not participate in any specific training. However, they performed regular physical education activities. The subjects were verbally motivated to perform better in training. All the training sessions were fully supervised and none of them reported any injury. However, muscle soreness, discomfort and fatigue were reported in the early weeks which subside later and there were no dropout in the study.

Testing Procedure

Muscular Endurance

To assess the muscular endurance used Plain floor and Stop watch. The subject lies flat on the back with knee bend and feet on the floor with the heals not more than one foot from the buttocks. The fingers are interlocked and placed behind the neck with the elbows touching the floor. The feet are hold securely by a partner. The subject then curls up to a sitting position and touch the elbows to the knee. This exercise is repeated as many times possible in the requirements.

Cardio vascular endurance

The 400 metre standard track was kept with markings at every fifty metre. The subject was divided in to two groups when one group was running the designated partners from other group acted as lap scores. The subjects were instructed to run, jog and walk according to their capacity without stopping for 12 minutes. The subjects of the first group started running on the whistle and continued to run, jog or walk and covered as much as possible distance during 12 minutes period, on expiry of 12 minutes the whistle was blown to stop and then the subjects were stopped, progressing forward but they should stand on the spot where they have stopped on whistle. Partners helping as lap scores kept the record of the number of laps completed Harrison Clark.H (1976) [3].

Stroke Volume At Rest

To record stroke volume at rest use M-mode Doppler Echocardiography and Transducer. For the collection of data on stroke volume at rest Rowland *et al*., (2000) [5] and Vinet *et al*., method was used. The score was recorded in ml/beat for each subject.

Statistical Analysis

The data were collected from the three groups prior to and after the experiment period. Cardio respiratory Endurance, Heart rate at Rest and Respiratory rate at rest was statistically examined by employing analysis of covariance (ANCOVA). To find out significant difference level of confidence was fixed at 0.05.

Results & discussion

Muscular endurance

The analysis of covariance for pre-test and post-test data on Muscular endurance of series, parallel and control groups were analyzed and presented in table-1.

Table 1: analysis of covariance for the pre-test and post-test data on muscular endurance of series, parallel and control groups

Test		Series group	Parallel group	Control group	Source of variance	df	Sum of square	Mean square	Obtained 'F' ratio
Pre-test	X	28.00	28.13	28.13	B	2	0.180	0.090	0.040
	σ	1.65	1.36	1.51	W	42	95.465	2.273	
Post -test	X	29.40	30.47	27.93	B	2	48.535	24.268	6.874*
	σ	1.72	1.92	1.98	W	42	148.266	3.530	
Adjusted post–test	X	29.50	30.42	27.88	B	2	49.327	24.663	29.282*
					W	41	34.533	0.842	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 level with df 2 and 42 and 2 and 41 are 3.22 and 3.23 respectively.

Table- I shows that the pre–test means of series, parallel and control groups are 28.00, 28.13 and 28.13 number/minutes respectively. The obtained 'F' ratio of 0.040 for pre-test mean is less than the table value of 3.22 for df 2 and 42 required for significance at 0.05 level. The post-test means of series, parallel and control groups are 29.40, 30.47 and 27.93 respectively. The obtained 'F' ratio of 6.874 for post-test means is greater than the table value of 3.22 for df 2 and 42 required for significance at 0.05 level. The adjusted post-test means of series, parallel and control groups are 29.50, 30.42 and 27.88 respectively. The obtained 'F' ratio of 29.282 is greater than the table value of 3.23 for 2 and 41 required for significance at 0.05 level.

The results of the study indicate that the significance difference is existed among adjusted post-test means of series, parallel and control groups on Muscular endurance. To determine the significance difference among the three-paired means, the Scheffe' S test was applied as post-hoc test and results are presented in table 2.

Table 2: scheffe's test for the difference between the adjusted post-test paired means of muscular endurance

Adjusted Post test Means			Mean differences	Confidence interval 0.05 Level
Series Group	Parallel Group	Control Group		
29.50	30.42	-	0.92*	1.06
29.50		27.88	1.62*	1.06
	30.42	27.88	2.54*	1.06

* Significant at 0.05 of confidence

The table 2 shows that the adjusted post-test mean difference on Muscular endurance between series group and control group and parallel group and control group are 1.62 and 2.54 respectively which are greater than the confidence interval value 1.06. It may concluded from the results that there is a significant difference between series group and control group and parallel group and control group on Muscular endurance. Table 2 shows that the adjusted post-test mean difference on Muscular endurance between series and parallel groups are 0.92 which is lesser than the confidence interval value 1.06. Hence, the results of the study concluded that there is significant difference exists on Muscular endurance between series group and parallel group. The adjusted post-test mean values on Muscular endurance of series group, parallel group and control groups are graphically depicted in figure-I

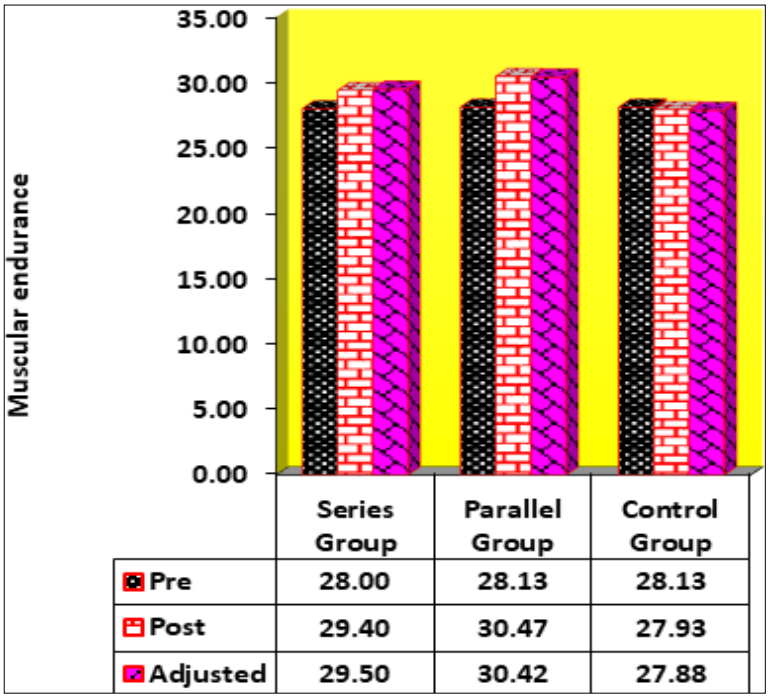

Fig 1: Bar Diagram On Muscular Endurance Of Pre, Post And Djusted Post-Test Means Of Series, Parallel And Control Groups.

Cardio Vascular Endurance

The analysis of covariance for pre-test and post-test data on Cardio Vascular Endurance (Cooper 12 minutes walk/run test) of series, parallel and control groups were analyzed and presented in table 3.

Table 3: analysis of covariance for the pre-test and post-test data on Cardio vascular endurance of series, parallel And Control Groups

Test		Series group	Parallel group	Control group	Source of variance	df	Sum of square	Mean square	Obtained 'F' ratio
Pre -test	X	1895.47	1895.67	1897.60	B	2	16	8	0.001
	σ	109.22	72.99	81.34	W	42	334208	7957.334	
Post -test	X	2061.27	2306.67	1890.20	B	2	1314656	657328	25.689*
	σ	175.01	195.99	87.88	W	42	1074672	25587.428	
Adjusted Post–test	X	2061.41	2306.55	1890.17	B	2	1313977.500	656988.750	52.500*
					W	41	513075.750	12514.043	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 level with df 2 and 42 and 2 and 41 are 3.22 and 3.23 respectively

Table 3 shows that the pre–test means of series, parallel and control groups are 1895.47, 1895.67 and 1897.60 metres respectively. The obtained 'F' ratio of 0.001 for pre-test means is less than the table value of 3.22 for df 2 and 42 required for significance at 0.05 level. The post-test means of series, parallel and control groups are 2061.27, 2306.67 and 1890.20 metres respectively. The obtained 'F' ratio of 25.689 for post-test mean is much greater than the table value of 3.22 for df 2 and 42 required for significance at 0.05 level.

The adjusted post-test means of series, parallel and control groups are 2061.41, 2306.55 and 1890.17 metres respectively. The obtained 'F' ratio of 52.500 is also much greater than the table value of 3.23 for 2 and 41 required for significance at 0.05 level. The results of the study indicate that there is a significance among adjusted post-test means of series, parallel and control groups on cardio vascular endurance. To determine the significance difference among the three-paired means, the Scheffe'S test was applied as post-hoc test and results are presented in table 4.

Table 4: Scheffe's test for the difference between the adjusted post-

test paired means of cardio vascular endurance

Adjusted Post test Means			Mean differences	Confidence interval 0.05 Level
Series Group	Parallel Group	Control Group		
2061.41	2306.55	-	245.10*	130.20
2061.41	-	1890.17	171.24*	130.20
-	2306.55	1890.17	416.38*	130.20

* Significant at 0.05 of confidence

The table 4 shows that the adjusted post-test mean difference on cardio vascular endurance between series group and control group and parallel group and control group are 171.24 and 416.38 respectively which are greater than the confidence interval value 130.20.

It may concluded from the results that there is a significant difference between Series and Parallel group, series group and control group and parallel group and control group on cardio vascular endurance. Hence, the results of the study concluded that there is significant difference exists on cardio vascular endurance between series group, parallel group and control group. The adjusted post-test mean values on cardio vascular endurance of series group, parallel group and control groups are graphically depicted in figure-2.

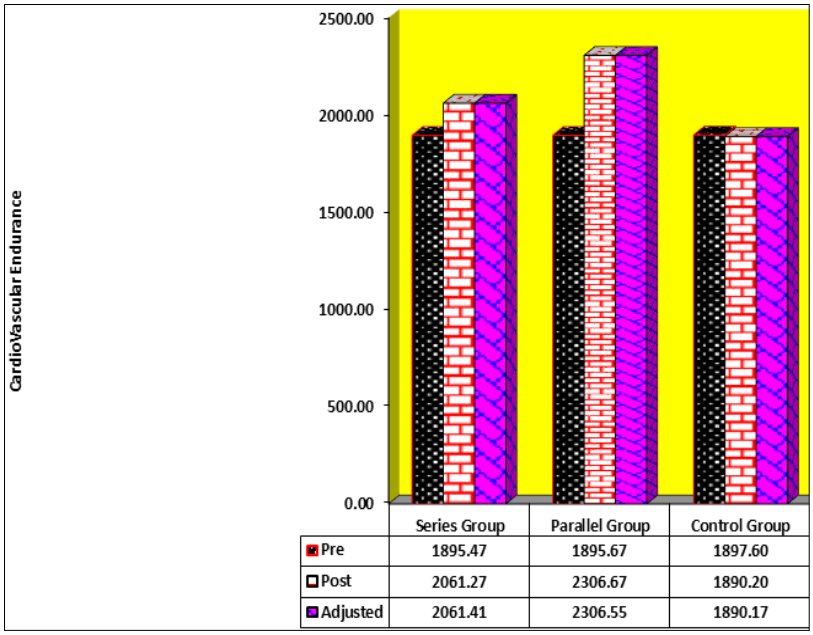

Fig 2: bar diagram on cardio vascular endurance of pre, post and adjusted post-test means of series, parallel and control groups.

Stroke Volume At Rest

The analysis of covariance for pre, post and adjusted post-test data on Stroke volume at rest of series, parallel and control groups were analyzed and presented in table-5.

Table 5: Analysis of covariance for the pre, post and adjusted post-test data on stroke volume at rest of series, parallel and control groups

Test		Series group	Parallel group	Control group	Source of variance	df	Sum of square	Means square	Obtainedm 'F' ratio
Pre-test	X	74.53	74.60	74.60	B	2	0.047	0.023	0.002
	σ	3.96	3.44	2.82	W	42	496.938	11.832	
Post -test	X	76.80	79.09	74.60	B	2	149.625	74.813	4.287*
	σ	4.06	5.18	3.02	W	42	732.938	17.451	
Adjusted Post–test	X	76.85	79.04	73.58	B	2	149.578	74.789	17.966*
					W	41	170.671	4.163	

* Significant at 0.05 level of confidence.

The table value for significance at 0.05 level with df 2 and 42 and 2 and 41 are 3.22 and 3.23 respectively.

Table -III shows that the pre–test means of series, parallel and control groups are 74.53, 74.60 and 74.60 ml respectively. The obtained 'F' ratio of 0.002 for pre-test means is less than the table value of 3.22 for df 2 and 42 required for significance at 0.05 level. The post-test means of series, parallel and control groups are 76.80, 79.09 and 74.60 ml respectively. The obtained 'F' ratio of 4.287 for post-test means is greater than the table value of 3.22 for df 2 and 42 required for significant at 0.05 level.

The adjusted post-test means of series, parallel and control groups are 76.85, 79.04 and 73.58 ml respectively. The obtained 'F' ratio of 17.966 is greater than the table value of 3.21 for 2 and 41 required for significance at 0.05 level. The results of the study indicate that there is a significance among adjusted post-test means of series, parallel and control groups on Stroke volume at rest.

To determine the significance difference among the three-paired means, the Scheffe'S test was applied as post-hoc test and results are presented in table 6.

Table 6: scheffe's test for the difference between the adjusted post-test paired means of stroke volume at rest

Adjusted Post- test Means			Mean differences	Confidence interval 0.05 Level
Series Group	Parallel Group	Control Group		
76.85	79.04	-	2.19*	2.36
76.85	-	73.58	3.27*	2.36
-	79.04	73.58	5.46*	2.36

* Significant at 0.05 of confidence

The table-6 shows that the adjusted post-test mean difference on Stroke volume at rest between series group and control group and parallel groups and control group are 3.27 and 5.46 respectively which are greater than the confidence interval value 2.36. It may be concluded from the results of the study that there is a significant difference between series group and control group and parallel group and control groups on Stroke volume at rest. Further, Table 6 also shows that the adjusted post-test mean difference on Stroke volume at rest between series and parallel groups are 2.19 which is lesser than the confidence interval value 2.36. Hence, the results of the study concluded that there is insignificant difference exists on Stroke volume at rest between series group and parallel group. The adjusted post-test mean values on Stroke volume at rest of series group, parallel group and control groups are graphically depicted in figure 3.

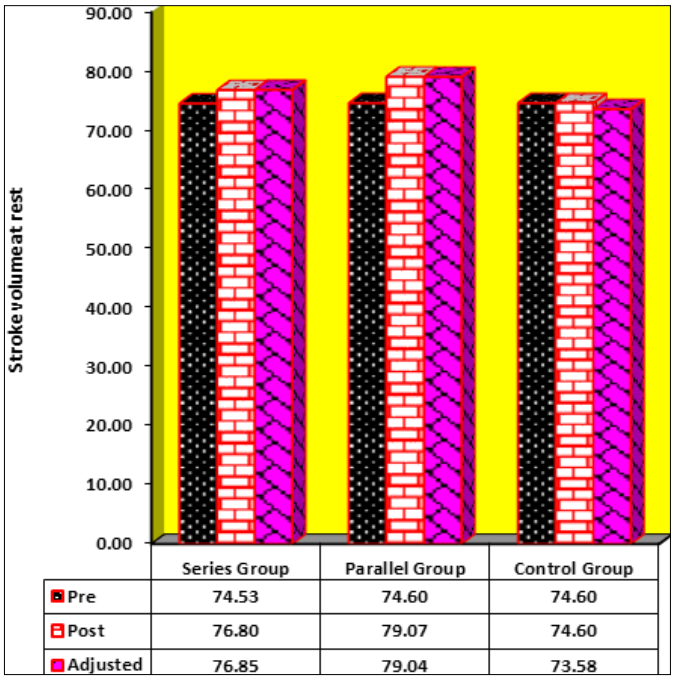

Fig 3: bar diagram on stroke volume at rest of pre, post and adjusted post-test means of series, parallel and control groups.

Conclusions

- Muscular Endurance is significantly increased by series and parallel training.
- There is significant difference between series and parallel training on Muscular Endurance.
- Cardio Vascular Endurance has increased by both series and parallel training and there is significant difference between the both training groups.
- Cardio Vascular Endurance has significantly increased by series and parallel training.
- The insignificant difference exist between both the training groups on Stroke volume at rest.
- Stroke volume at rest is significantly increased by series and parallel groups.

Reference

1. Dudley GA, Jamil RD. Incompatibility of Endurance Training and Strength Training Modes of Exercise, Journal of Applied Physiology. 1985; 59:1446-1451.
2. Gary Moran and George Mc Glynn. Dynamics of Strength Training, San Francisco: Wm. C. Publishers, 1990, 2.
3. Harrison Clarke H. Application of Measurement of Health and Physical Education, Englewood Cliffs, New Kersey: Prentice Hall Inc, 1976, 152.
4. Morgan WP, Brown DR, Raglin JS *et al*. Psychological Monitoring of Over Training and Staleness, British Journal of Sports Medicine. 1987; 21:107-114.
5. Raglan JS, Willson GS. Over Training in Athletics", in Y,L. Hanin (ed), Emotions in Sports, Champaign, Illinois: Human Kinetics. 2000, 191-207.
6. Tudor Bompa O. Periodization: theory and Methodology of training, (4th ed) Champaign, Illinois: Human Kinetics Publishers. 1999; 13-87, 230-316.