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Effects of aerobic training and resistance training in series and parallel on speed, muscular endurance and heart rate at rest

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Abstract
The aim of this study was to determine the Effects of Aerobic Training and Resistance training in series and parallel on Speed, Muscular Endurance and Heart rate 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, speed, muscular endurance and heart rate at rest

Introduction

Sports training are a conscious human activity. Also, it is a goal oriented activity. Hence, sports training gives high weight age for studying the nature and genesis of sports performance in training and competition, similarly a large portion of sports training is devoted to the study of performance capacity which further comprises of physical condition, technique, coordinative abilities tactics, physique and psychic factors Haradayal Singh (1991) [3]. The efficiency of an individual in performing physical activities depends basically on his/her cardio respiratory efficiency. Through training the efficiency of the circulatory and respiratory systems are improved H. Clarke (1976) [4].

According to Boucher.C (1993) [1] to enhance physiological improvement effectively and to bring about a change, specific exercise and overload must be followed. By undergoing a systematic training at a level above normal, a variety of physiological adaptations take place in the body that makes it function more effectively. Numerous training procedures are in practice to improve each and every physical and motor fitness quality at various levels. The best training program is that which increase the desired quality at a higher rate without causing unwanted effects.

Dudley.G.A (1985) [2] reveals that combined resistance and aerobic 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.

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 Rayala Seema 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) [3], 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 Resistance training only for six weeks and Aerobic 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

Speed

To calculate speed, after a short warm-up the subject takes a position behind the starting line. Best results are obtained when two subjects runs at the same time for competitions. The starter used the command, on your mark and 'Go'. The latter accompanied by a downward sweep of the arm as a signal to the timer. The subjects run across the finish line. One trail is permitted. By using the stopwatch time was taken to the nearest one tenth of a second Harrison Clarke.H (1987) [4].

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.

Heart Rate at Rest

Heart rate at rest of each subject was recorded in the morning time between 6.00 am and 7.00am. Ten minutes before taking the heart rate the subject was asked to sit and rest himself comfortably on a chair. The investigator wraps the cuff around the arm by placing arm on a table so that the cuff will be at the level of the heart. Just pres start/stop button and the cuff will start to inflate automatically. When the measurement is complete the arm cuff automatically deflates and the heart rate at rest and blood pressure systolic/diastolic are displayed.

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

Speed

The analysis of covariance for pre, post and adjusted post-test data on speed of series, parallel and control groups were analyzed and presented in table I.

Table 1: analysis of covariance for the pre, post and adjusted post-test on speed 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	7.79	7.81	7.80	B	2	0.002	0.001	0.003
	σ	0.65	0.64	0.65	W	42	17.587	0.419	
Post -test	X	7.69	7.10	7.81	B	2	4.365	2.182	6.64*
	σ	0.67	0.37	0.64	W	42	13.805	0.329	
Adjusted post–test	X	7.69	7.09	7.81	B	2	4.453	2.226	20.956*
					W	41	4.356	0.106	

* 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 7.79, 7.81 and 7.80 seconds respectively. The obtained 'F' ratio of 0.003 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 7.69, 7.10 and 7.81 seconds respectively. The obtained 'F' ratio of 6.64 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 7.69, 7.09 and 7.81 seconds respectively. The obtained 'F' ratio of 20.956 is 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 speed. 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: Schaffer's Test for the Difference between the Adjusted Post-Test Paired Means of Speed

Adjusted Post-test Means			Mean differences	Confidence interval 0.05 Level
Series Group	Parallel Group	Control Group		
7.52	7.09	-	0.43*	0.37
7.52	-	7.89	0.37*	0.37
-	7.09	7.89	0.80*	0.37

* Significant at 0.05 of confidence

The table I-A shows that the adjusted post-test mean difference on speed between series and parallel, series and control and parallel and control group are 0.43, 0.37 and 0.80 respectively which are greater than the confidence interval value 0.37. From the results shows that there is a significant

difference between experimental groups series and control group and parallel and control groups on speed. The adjusted post-test mean values on speed of series, parallel and control groups were graphically depicted in figure-I.

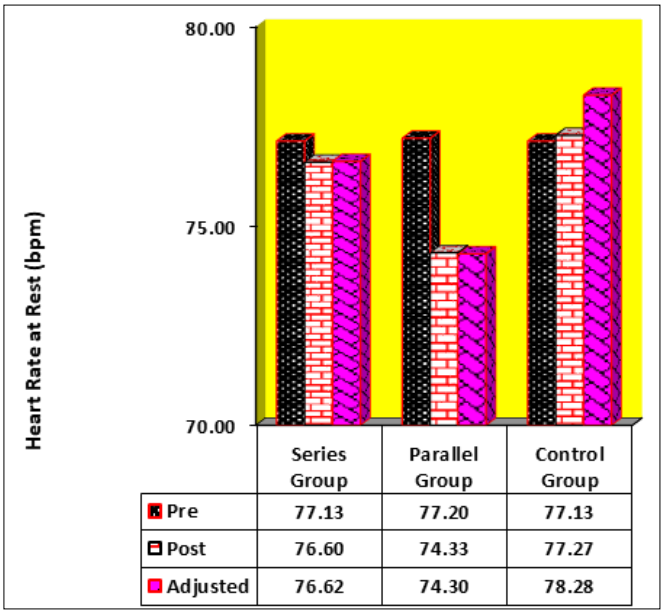

Fig 1: Bar Diagram on Speed of Pre, Post and Adjusted Post- Test means of series, parallel and control groups

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 3.

Table 3: 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 2 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 4.

Table 4: 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 4 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 II -A 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-2

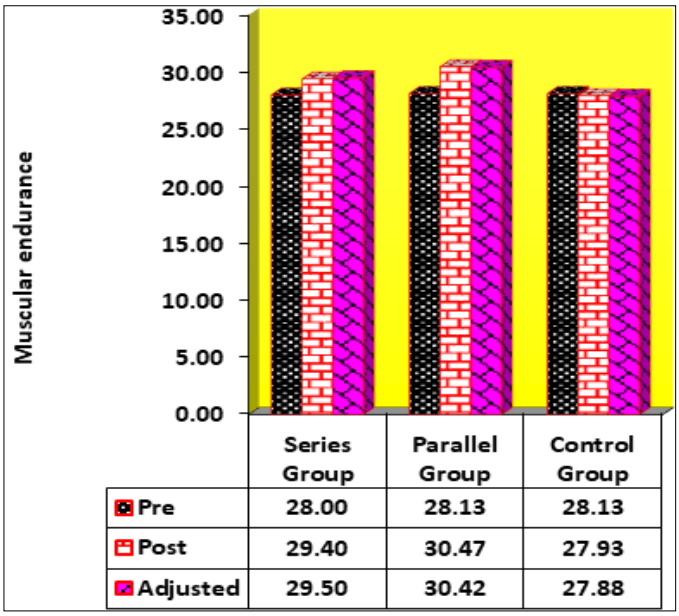

Fig 2: bar diagram on muscular endurance of pre, post and djusted post-test means of series, parallel and control groups.

Heart rate at rest

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

Table 5: analysis of covariance for the pre-test and post-test data on heart rate at rest of series, parallel and control groups

Test		Series group	Parallel group	Control group	Source of variance	df	Sum of square	Means square	Obtained 'F' ratio
Pre-test	X	77.13	77.20	77.13	B	2	0.031	0.016	0.004
	σ	2.10	1.86	1.73	W	42	151.875	3.616	
Post -test	X	76.60	74.33	77.27	B	2	70.938	35.469	11.651*
	σ	1.86	2.03	1.35	W	42	127.859	3.044	
Adjusted Post–test	X	76.62	74.30	78.88	B	2	73.708	36.854	46.351*
					W	41	32.600	0.795	

* 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 -5 shows that the pre–test means of series, parallel and control groups are 77.13, 77.20 and 77.13 bpm respectively. The obtained 'F' ratio of 0.004 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 76.60, 74.33 and 77.27 78.88 respectively. The obtained 'F' ratio of 11.651 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 76.62, 74.30 and 77.28 respectively. The obtained 'F' ratio of 46.351 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 there is a significance among adjusted post-test means of series, parallel and control groups on Heart rate 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: a.scheffe's test for the difference between the adjusted Post-test paired means of heart rate at rest

Adjusted Post-test Means			Mean differences	Confidence interval 0.05 Level
Serie Group	Parallel Group	Control Group		
76.62	74.30	-	2.32*	1.01
76.62	-	78.88	1.66*	1.01
-	74.30	78.88	2.98*	1.01

* Significant at 0.05 of confidence

The table 6. shows that the adjusted post-test mean difference on Heart rate at rest between series group and parallel group, series group and control group and parallel group and control group are 2.32, 1.66 and 2.98 respectively which are greater than the confidence interval value 1.01.It may concluded from the results that the significant difference exists between series group and parallel group, parallel group and control group and parallel group and control group on Heart rate at rest. The adjusted post-test mean values on Heart rate at rest of series group, parallel group and control groups are graphically depicted in figure-3

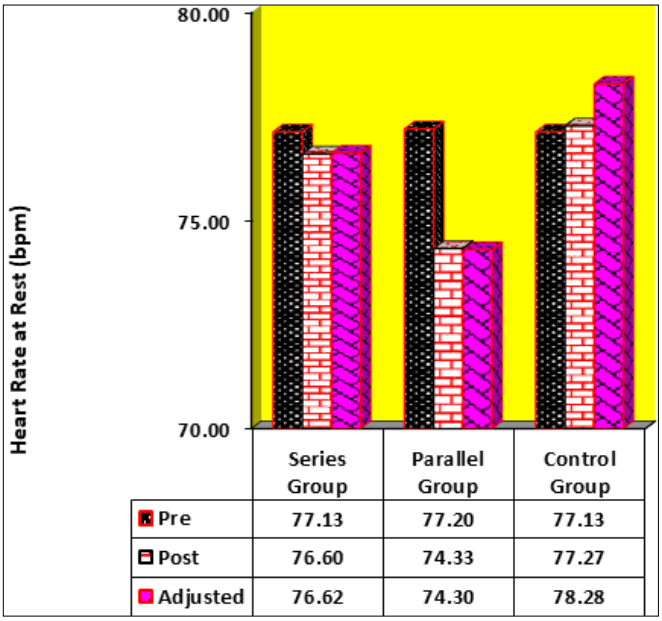

Fig 3: bar diagram on heart rate at rest of pre, post and adjusted post-test means of series, parallel and control groups.

Conclusions

- Speed is significantly increased by series and parallel training
- There is significance difference between series and parallel training on speed
- Muscular Endurance is significantly increased by series and parallel training.
- There is significant difference between series and parallel training on Muscular Endurance.
- There is significant difference exists between training groups on Heart rate at rest.

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