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T V Bala Krishna Reddy
Research Scholar,
University College of Physical Education & Sports Sciences, Acharya Nagarjuna University, Guntur- 522 510, Andhra Pradesh, India.

I. Devi Vara Prasad
Co-ordinator, B.P.Ed., Course Acharya Nagarjuna University Ongole Campus, Ongole- 523 001, Andhra Pradesh, India.

K.Rama Subba Reddy
Asst. Director, Co-ordinator, Department of Physical Education & Sports Sciences, Yogi Vemana University, Kadapa YSR Dist-516 003, Andhra Pradesh, India.

Correspondence
T V Bala Krishna Reddy
Research Scholar,
University College of Physical Education & Sports Sciences, Acharya Nagarjuna University, Guntur- 522 510, Andhra Pradesh, India.

Effect of Resistance Training and Endurance Training in Series on Heart Rate at Rest and Resting Respiratory Rate

T V Bala Krishna Reddy, I. Devi Vara Prasad, K.Rama Subba Reddy

Abstract
The aim of this study was to determine the Effect of Resistance training and Endurance training in series on Heart rate at rest and Resting respiratory rate. To achieve this purpose, thirty (N=30) Degree College women students were randomly selected as subjects from K.V.R.College, Nandigama, Krishna Dist, Andhra Pradesh, India. They were divide into two equal groups of fifteen (n=15) each. Group-I underwent resistance training and endurance training in series and Group-II control group. For both the groups, Heart rate at rest and resting respiratory rate were measured by using of Bio monitor and Manual method. The training group underwent 12-week resistance training and endurance training in series (12week) and no specific training was given to the control group. Prior to and after training, researcher has concluded that Heart rate at rest and resting respiratory rate are significantly improved among healthy untrained women.

Keywords: Resistance Training, Endurance Training, Series, Heart rate at rest and Resting respiratory rate.

Introduction
According to Steven .J. Fleck & Williams. J (1997) [3] training is specific. The body attempts to adapt to the imposed demands. The understanding of the exercise training compatibility has focused on endurance training. H. Clarke (1976) 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.
Hardayal Singh (1991) [2] points out the positive effect of endurance activity on various physiological systems that is cardio respiratory, digestion and metabolism. He also states that these activities have a preventive and curative effect on a number of health problems. Resisting heart rate, resting respiratory rate and cardiovascular endurance are certain parameters or external signs of human health and physical fitness.
Heart rate at rest refers to the number of times a heart contracts in one minute (beats per minute or BPM) while at complete rest. The normal heart rate depends upon age, gender and health and can vary greatly for both athletes and non-athletes. In general, a person's resting heart rate indicates their basic fitness level. The stronger the heart, the more blood it can pump during each contraction and the less frequently it needs to beat to get adequate blood flow (circulation) and oxygen to the body tissues. A well trained athlete can have a very low resting heart rate and pump more blood than an unconditioned individual.
A great deal of information exists regarding the effects and prescription of endurance exercise. The ability to prescribe aerobic exercise is necessary to address the cardiovascular endurance requirements of a conditioning program. Such aerobic endurance programs can be either continuous or intermittent. According to Willmore. J.H. *et al.*, (1996) [4] the heart rate can decrease markedly by as a result of training. In sedentary individuals the resting heart rate would be 80 beats per minute, resting heart rate decreased by approximately 1 beat per minute each week for the first ten weeks of training. So after 10 weeks of moderate endurance training resting heart rate could drop from 80 to 70 beats per minute.

Methodology
To achieve these purpose 30 (N=30) women of 15 each students from K.V.R.College, Nandigama, Krishna District, Andhra Pradesh , India were randomly selected as subjects and their age ranged from 19 to 21 years. They did not participate in any systematic fitness training previously. 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 two groups and each group contained fifteen (n=15) subjects. Group I underwent Resistance training and Endurance training in series (for 12 week), group II 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. A written informed consent has been taken from the subjects.

Training program

To achieve the purpose of this study, the experimental group underwent resistance training and endurance training program for 4/12 week in addition to their regular physical activities. Group I underwent resistance training and endurance training in series for 12 weeks on both Heart rate at rest and Resting respiratory rate. Every training session workout lasted for about 45-60 minutes including warm-up and limbering down exercise. Group II (control group) did not participate in any specific training. However, they performed regular physical 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

Heart rate at rest

To measure Heart rate at rest used **"**Non-invasive Automatic blood pressure monitor". Uses the oscilometric method of heart rate at rest measurement. 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 resting heart rate and blood pressure systolic/diastolic are displayed. To measure the resting respiratory rate used Manual method. Resting respiratory rate of each of the subjects was recorded between 6.00 am and 7.00 am consistently. Before recording the resting respiratory rate the subjects were asked to remain lying on the bed. The tester then recorded the rate of respiration by counting the movements of the subject abdomen. Number of the respiratory rate per minute was recorded for each subject

Statistical analysis

The data were collected from the two groups prior to and after the experiment period. Heart rate at rest and resting respiratory rate was statistically examined by employing analysis of covariance (ANCOVA). To find out significant difference level of confidence was fixed at 0.01.

Results & discussion

The mean and standard deviation on Resistance training and Endurance training in series on Heart rate at rest and resting respiratory rate are presented in Table-I and Table-II. The 'F' value of adjusted post-test was numerically higher than table 'F' value. Hence, there exists a significant difference between resistance training and endurance training in series on Heart rate at rest and Resting respiratory rate group and control group.

Adjusted post-test means indicates that the resistance training and endurance training in series on Heart rate at rest and resting respiratory rate has significantly improved when compared with the control group. It has shown clearly in table -I and table-II.

Table 1: ANCOVA for the pre and post-test data on heart rate at rest

Test		Series group	Control group	Source of variance	df	Sum of square	Means square	Obtained 'F' ratio
Pre-test	**X**	74.31	74.98	B	2	2.58	1.29	3.07
	σ	0.55	0.48	W	42	17.85	0.42	
Post -test	**X**	66.21	73.01	B	2	225.82	112.91	104.55*
	σ	0.68	0.50	W	42	45.36	1.08	
Adjusted Post–test	**X**	66.53	72.85	B	2	47.12	223.56	120.19*
				W	41	76.26	1.86	

* Significant at 0.05 level of confidence.

The table value for significant at 0.01 level with df 2 and 27 and 2 and 26 are 3.35 and 3.37 respectively.

Table -I shows that the pre–test means of series and control groups are 74.31 and 74.98 bpm respectively. The obtained 'F' ratio of 3.07 for pre-test means is less than the table value of 3.35 for df 2 and 27 required for significance at 0.05 level. The post-test means of series and control groups are 66.21 and 73.01 bpm respectively. The obtained 'F' ratio of 104.55 for post-test means is greater than the table value of 3.35 for df 2 and 27 required for significance at 0.05 level. The adjusted post-test means of series and control groups are 66.53 and 72.85 bpm respectively. The obtained 'F' ratio of 120.19 is greater than the table value of 3.37 for 2 and 26 required for significance at 0.05 level.

The results of the study indicate that there is significance among adjusted post-test means of series training group and control groups on Heart rate at rest.

The adjusted post-test mean values on Heart rate at rest of series training group and control groups are graphically depicted in figure-I.

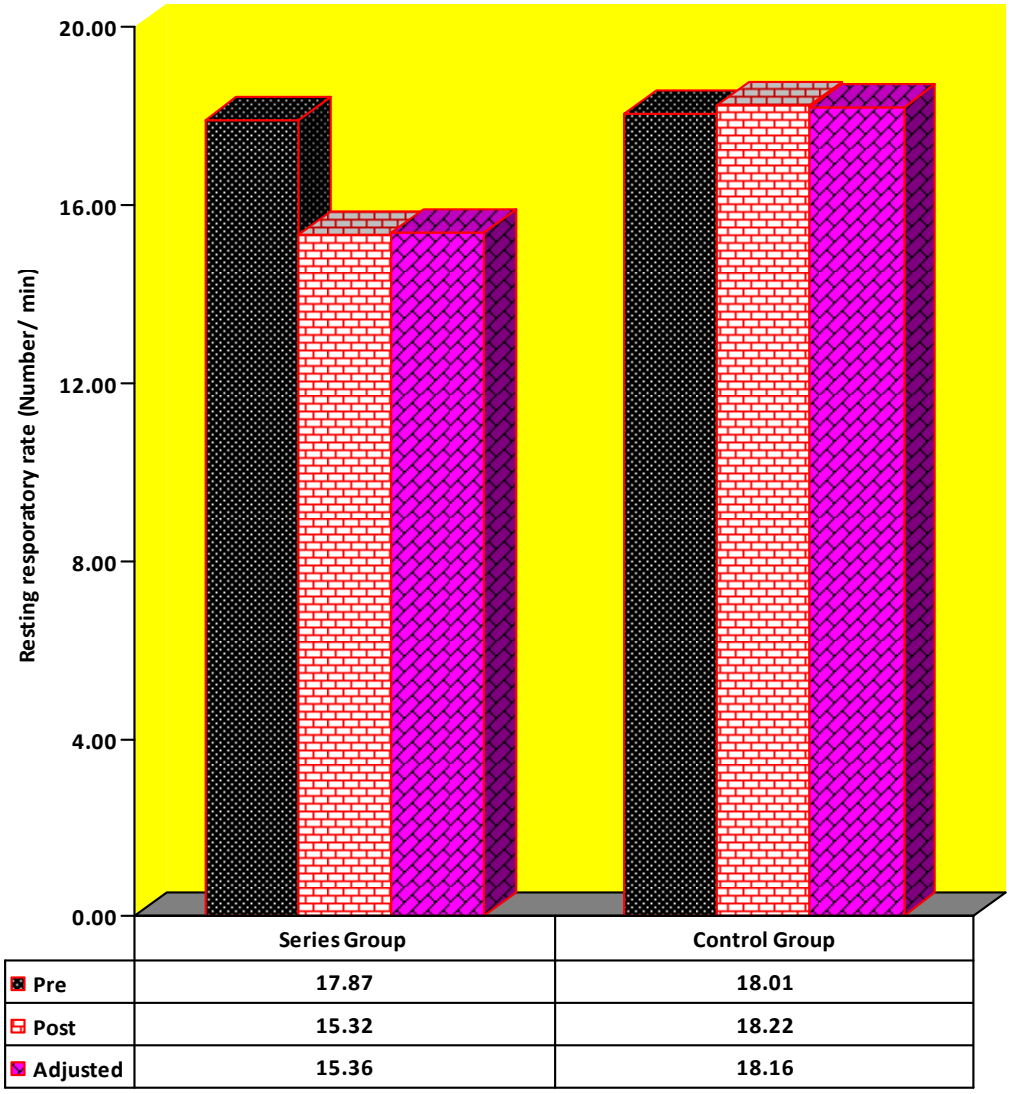


Fig 1: bar diagram on heart rate at rest of pre, post and adjusted post-test means of series and control groups.

Table 2: ANCOVA for the pre and post-test data on resting respiratory rate

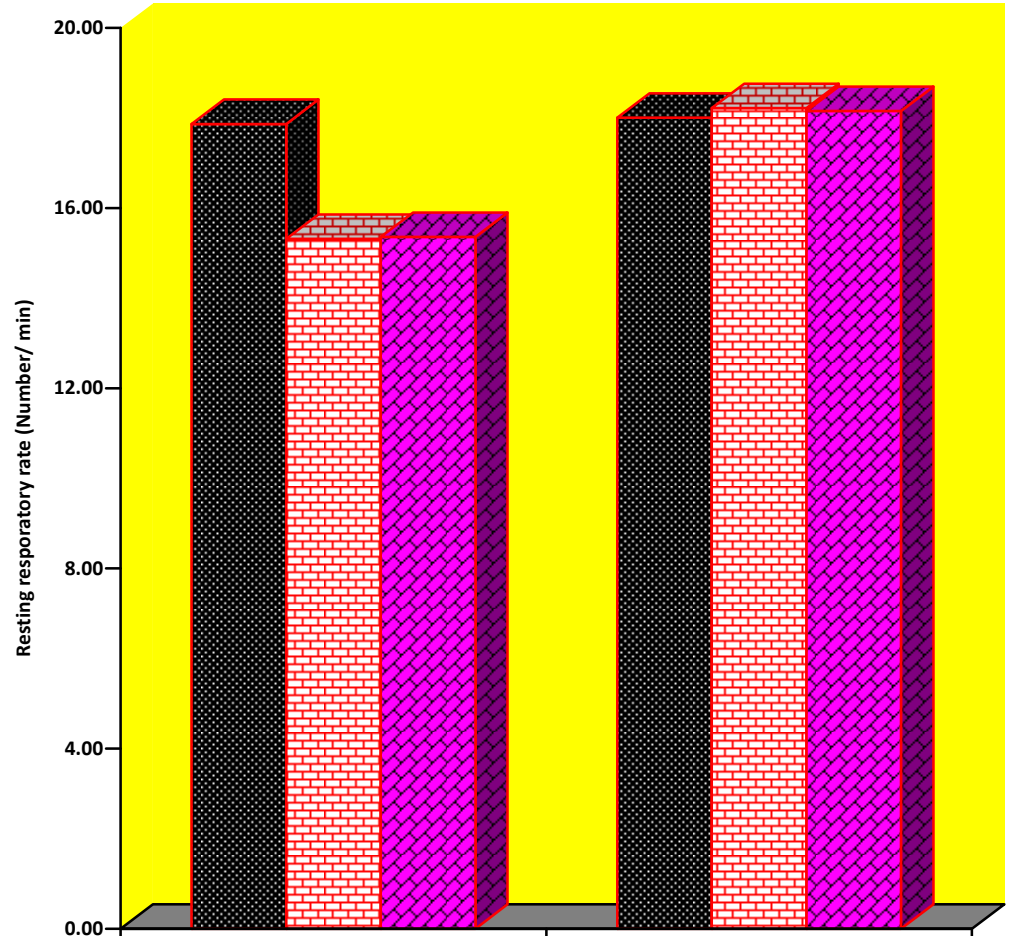
Test		Series group	Control group	Source of variance	df	Sum of square	Means square	Obtained 'F' ratio
Pre-test	**X**	17.87	18.01	B	2	0.148	0.074	1.85
	σ	0.18	0.27	W	27	1.68	0.040	
Post -test	**X**	15.32	18.22	B	2	86.813	43.406	943.60*
	σ	0.18	0.31	W	27	1.932	0.046	
Adjusted Post–test	**X**	15.36	18.16	B	2	781.83	890.915	1172.26*
				W	26	31.16	0.76	

* Significant at 0.05 level of confidence.
The table value for significant at 0.01 level with df 2 and 27 and 2 and 26 are 3.35 and 3.37 respectively.

Table-II shows that the pre–test means of series and control groups are 17.87 and 18.01 number respectively. The obtained 'F' ratio of 1.85 for pre-test means is less than the table value of 3.35 for df 2 and 27 required for significance at 0.05 level. The post-test means of series and control groups are 15.32 and 18.22 number respectively. The obtained 'F' ratio of 943.60 for post-test means is greater than the table value of 3.35 for df 2 and 27 required for significance at 0.05 level. The adjusted post-test means of series and control groups are 15.36 and 18.16 number respectively. The obtained 'F' ratio of 1172.26 is greater than the table value of 3.37 for 2 and 26 required for significance at 0.05 level.

The results of the study indicate that there is significance among adjusted post-test means of series training group and control groups on resting respiratory rate.

The adjusted post-test mean values on resting respiratory rate of series training group and control groups are graphically depicted in figure-II.



	Series Group	Control Group
Pre	17.87	18.01
Post	15.32	18.22
Adjusted	15.36	18.16

Fig 2: bar diagram on resting respiratory rate of pre, post and adjusted post-test means of series and control groups.

Conclusion

- Heart rate at rest is increased by Resistance training and Endurance training in series for untrained women.
- Resting respiratory rate is significantly increased by Resistance training and Endurance training in series for untrained women.

Recommendations

- Series type of Resistance training and Endurance training is recommended to improve Heart rate at rest.
- Series type of Resistance training and Endurance training is recommended to improve Resting respiratory rate.

Reference

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2 Hardayal Singh (1991), "Science of Sports Training", New Delhi, DVS Publications, 130.
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4 Willmore, J.H, Stanforth, P.R. et.al., (1996), "Endurance Exercise training has a minimal effect on Resting Heart Rate: The Heritage study", medicine and science in Sports and Exercise. 28:829-835.