

Effect of Isolated and Combined Strength and Endurance Training on Cardio Respiratory Endurance of Kho Kho Players

Tungala Venkata Nagaraju

Research Scholar University College of Physical Education & Sports Sciences Acharya Nagarjuna University, Guntur
Andhra Pradesh India

Dr.I.Devi Vara Prasad

Assistant Professor, Co-ordinator, B.P.Ed Course, Acharya Nagarjuna University Ongole Campus, Ongole
Andhra Pradesh India

Abstract: *The purpose of the study is to analyze the effect of isolated and combined strength and endurance training on cardio respiratory endurance of kho kho players. To achieve the purpose of this study, sixty men kho kho players studying in various colleges affiliated to Acharya Nagarjuna University, Nagarjuna Nagar, Guntur, Andhra Pradesh, India during the academic year 2014-2015 was selected as subjects. The subjects were selected in the age group of 18 to 22 years and they were randomly assigned into four equal groups of 15 each. Experimental group-I performed strength training, experimental group-II performed endurance training, experimental group-III performed combined strength and endurance training and group-IV was acted as control. The cardio respiratory endurance was selected as dependent variable. The research design of the study was random group design. The data collected from the experimental and control groups on selected dependent variable was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of experimental treatment. In order to nullify the initial mean differences the data collected from the four groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since, four groups were involved, whenever the obtained 'F' ratio value in the adjusted post test mean was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. It is concluded that due to the effect of isolated endurance training and combined strength and endurance training the cardio respiratory endurance of the subjects is significantly improved however, due to the effect of isolated strength training the cardio respiratory endurance of the subjects is not significantly improved. The result of the study also produced 3.36% of improvement due to strength training, 6.89% of improvement due to endurance training and 9.17% of improvement due to combined training.*

Keywords: *Isolated and combined strength and endurance training, cardio respiratory endurance, kho kho.*

1. INTRODUCTION

In the modern competitive sports, seriousness towards work and workouts plays important role in achieving high performance in competitions. Outstanding players have been found to be more sober, disciplined, practical, and tough-minded. Competitions now a day are so tough that only those achieve high performance who trains for long hours. Kho Kho is although game requiring high physical fitness and quick reflexes. One has to work hard and tolerate mental strain besides physical stress of training. There is no place for a tender minded person in competitive Kho Kho. Self-discipline and confidence are other qualities that are required to obtain high performance in Kho Kho. The Kho Kho players face more man-to-man combats and hence require physical and mental toughness.

Strength training is fast becoming the most popular exercise in the world today. For centuries, strength training was primarily used only for the strengthening and conditioning of certain athletes. Even in the sports world, many players and coaches did not emphasize the importance of strength training if their particular sport did not require them to have high levels of muscular strength in order to be competitive. However, in recent years the amount of information and research on strength training has exploded. Players of all types, from the professional to the weekend enthusiast now understand the potential benefits of partaking in strength training program. The amount and form of resistance used as well as the frequency of resistance exercises are determined by specific program goals.

The focus of endurance training is to progressively overload the cardio-respiratory system and not the musculoskeletal system. In response to an endurance training program, Type I and II muscle fibers have been shown to remain the same (Bell, 2000; McCarthy, 2002) increase (Nelson, 1990) and decrease in size (Kraemer, 1995). More consistent and well documented adaptations to endurance training include increases in capillary and mitochondrial densities (Crenshaw, 1991) as well as oxidative enzyme activity (Bell, 2000; Nelson, 1990) all of which contribute to the enhanced delivery, extraction, and utilization of oxygen by skeletal muscle. Depending on the intensity of training, adaptation may occur in the central heart, lungs, and circulation or peripheral within the muscle components.

Working on strength and endurance at the same time, whether be in the same session, alternative days, alternative sessions, etc. Countless numbers of recreational workout enthusiasts complete their strength and endurance training workouts during the same training session, or within hours of one another. Many people, athletes and non-athletes, take part in a combination of resistance and endurance training. These people are expecting to experience the benefits that these two different types of training have to offer. A number of studies have shown that performing these two types of training simultaneously can be detrimental to the gains that might be made in performing one type of training alone (Bell *et al.*, 2000). The researcher is felt that there is a need to confirm the beneficial effects of isolated and combined strength and endurance training on cardio-respiratory endurance of Kho Kho players. Moreover, very little research had been done on Kho Kho players, which motivated the investigator to take up the study.

2. METHODOLOGY

2.1. Subjects and Variables

To achieve the purpose of this study, sixty men Kho Kho players studying in various colleges affiliated to Acharya Nagarjuna University, Nagarjuna Nagar Guntur, and Andhra Pradesh, India during the academic year 2014-2015 was selected as subjects. The subjects were selected in the age group of 18 to 22 years and they were randomly assigned into four equal groups of 15 each. Experimental group-I performed strength training, experimental group-II performed endurance training, experimental group-III performed combined strength and endurance training and group-IV was acted as control. The cardio respiratory endurance was selected as dependent variables for the study and it was assessed by Cooper's 12 minutes run and walk test.

2.2. Training Protocol

Training programme will be administered to the Kho Kho players for twelve weeks with three training units per week. The experimental group-I performed strength training, group-II performed endurance training, and group-III performed combined strength and endurance training. The strength training program was a total body workout consisting of 3 sets of 6-10 repetitions on 5 exercises that trained all the major muscle groups. A percentage of each subject's one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity and number of repetitions performed for each exercise was progressively increased. The endurance training consists of 20-40 minutes running with 65- 80% HRR. The running intensity was determined by a percentage of heart rate reserve (HRR). The intensity was increased as training progressed. Combined strength and endurance training group performed strength training during every odd numbered week and endurance training during every even numbered week.

2.3. Collection of the Data

The data on the selected bio motor and psychomotor variables were collected prior to the commencement of experiment (pre test) and after twelve weeks of training period (post test). Both the pre and post tests were administered under identical conditions, with same apparatus, testing personal and testing procedures.

2.4. Statistical Technique

The data collected from the experimental and control groups on selected dependent variables was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of experimental treatment. In order to nullify the initial mean differences the data collected from the four groups prior to and post experimentation on selected

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dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since, four groups were involved, whenever the obtained 'F' ratio value in the adjusted post test mean was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. The level of confidence is fixed at 0.05 for significance.

3. RESULT

The descriptive analysis of the data showing mean and standard deviation, range, mean differences, 't' ratio and percentage of improvement on cardio respiratory endurance of experimental groups are presented in table-I.

Table1. Descriptive Analysis of the Pre and Post Test Data and 'T' Ratio on Cardio Respiratory Endurance of Experimental Groups

Group	Test	Mean	Standard Deviation	Range	Mean Differences	't' ratio	Percentage of Changes
Strength Training	Pre test	2066.00	148.60	460.00	69.33	10.10*	3.36
	Post test	2135.30	137.21	440.00			
Endurance Training	Pre test	2108.70	111.86	360.00	145.30	10.81*	6.89
	Post test	2254.00	99.12	310.00			
Combined Training	Pre test	2122.00	118.76	380.00	194.60	14.83*	9.17
	Post test	3216.70	89.34	260.00			
Control Group	Pre test	2067.30	187.22	600.00	24.70	0.97	1.19
	Post test	2092.00	214.42	650.00			

Table t-ratio at 0.05 level of confidence for 14 (df) =2.15

*Significant

Table-1 shows that the mean, standard deviation, range and mean difference values of the pre and post test data collected from the experimental group on cardio respiratory endurance. Further, the collected data was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post data. The obtained 't' values of strength training, endurance training and combined training groups are 10.10, 10.81 and 14.83 respectively which are greater than the required table value of 2.15 for significance at 0.05 level for 14 degrees of freedom. It revealed that significant differences existed between the pre and post test means of experimental groups on cardio respiratory endurance. However, the obtained 't' values of control groups is 0.97 which is lesser than the required table value of 2.15 for significance at 0.05 level for 14 degrees of freedom. It revealed that no significant differences existed between the pre and post test means of control group on cardio respiratory endurance.

The pre and post test data collected from the experimental and control groups on cardio respiratory endurance is statistically analyzed by using analysis of covariance and the results are presented in table-2.

Table2. Analysis of Covariance on Cardio Respiratory Endurance of Experimental and Control Groups

	Strength Training Group	Endurance Training Group	Combined Training Group	Control Group	S oV	Sumof Squares	df	Mean squares	'F' ratio
Pre test Mean	2066.00	2108.70	2122.00	2067.30	B	36873.33	3	12291.11	0.59
SD	148.60	111.86	118.76	187.22	W	1172466.67	56	20936.91	
Post test Mean	2135.30	2254.00	2316.70	2092.00	B	485578.33	3	161859.44	7.84*
SD	137.21	99.12	89.34	214.42	W	1156506.68	56	20651.91	
Adjusted Post test Mean	2158.00	2238.00	2289.00	2113.00	B	271657.19	3	90552.40	23.81*
					W	209219.14	55	3803.98	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 55 is 2.77 and degree of freedom 3 and 56 is 2.77)

*Significant at .05 level of confidence

Table-2 shows that the adjusted post-test means on cardio respiratory endurance of strength training, endurance training, and combined training and control groups are 2158.00, 2238.00, 2289.00 and 2113.00 respectively. The obtained 'F' value of 23.81 on cardio respiratory endurance is greater than the required table value of 2.77 of 3, 55 df at 0.05 level of confidence. Hence, it is concluded that significant differences exist between the adjusted post test means of strength training, endurance training, and combined training and control groups on cardio respiratory endurance.

Since, the obtained 'F' value in the adjusted post test means is found to be significant, the Scheffe's test is applied as post hoc test to find out the paired mean difference, and it is presented in table-3

Table3. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Cardio Respiratory Endurance

Strength Training Group	Endurance Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval
2158.00	2238.00			80.00*	64.92
2158.00		2289.00		131.00*	64.92
2158.00			2113.00	45.00	64.92
	2238.00	2289.00		51.00	64.92
	2238.00		2113.00	125.00*	64.92
		2289.00	2113.00	176.00*	64.92

*Significant at .05 level

As shown in table-3 the Scheffe's post hoc analysis proved that significant mean differences existed between strength and endurance training groups, strength and combined training groups, endurance training and control groups, combined training and control groups on cardio respiratory endurance since, the mean differences 80.00, 131.00, 125.00 and 176.00 are higher than the confident interval value of 64.92 at 0.05 level of significance. However, there was no significant difference exist between strength training and control groups, endurance and combined training groups,, since, the mean differences 45.00 and 51.00 are lesser than the confident interval value of 64.92 at 0 .05 level of significance.

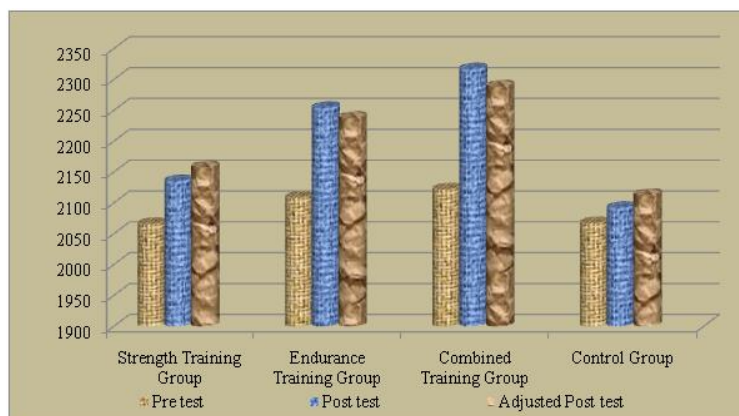


Fig1. Diagram Showing the Mean Values on Cardio Respiratory Endurance of Experimental and Control Groups

Hence, it is concluded that due to the effect of isolated endurance training and combined strength and endurance training the cardio respiratory endurance of the subjects is significantly improved however, due to the effect of isolated strength training the cardio respiratory endurance of the subjects is not significantly improved. It is also concluded that combined training and isolated endurance training are significantly better than isolated strength training in improving cardio respiratory endurance however, there is no significant differences found between combined training and isolated endurance training.

The pre, post and adjusted post test mean values of experimental and control groups on cardio respiratory endurance is graphically represented in figure 1

4. DISCUSSION

The result of the study indicates that the cardio respiratory endurance of the experimental group improved significantly by underwent the twelve weeks of isolated and combined strength and endurance training. These results are conformity with the following findings. Concurrent training

improves endurance performance, both with trained cyclists (Paton & Hopkins, 2005) and other trained athletes (Hoff *et al.*, 1999; Johnston *et al.*, 1997; Millet *et al.*, 2002; Paavolainen *et al.*, 1999). Paton and Hopkins (2005) found that 1- and 4-km time trial performance increased could have also been a result of high intensity interval training being employed in addition to resistance training. It has been well documented by Senthil *et al.*, (2011) that the effects of concurrent strength and endurance training significantly improved the Cardio-respiratory endurance when compared with control group.

According to the NSCA, including strength training in an endurance training program can improve the ability of the heart, lungs and circulatory system to perform under conditions of high pressure and force production (NSCA, 2000). Hickson, (1980) found that strength training did increase the time to exhaustion in high-intensity cycling and running. Therefore, Hickson (1980) concluded, strength training might be beneficial in endurance events where a “sprint finish” was needed.

Combined training lead to increases in aerobic capacity might be related to the increase in fat-free mass and the muscle hypertrophy elicited by strength training and potentially to the short rest periods and high intensity of the strength program. The progressions were made without changes in VO_2max , suggesting increases in muscle power and running economy. Strength training may decrease ground contact time by improving the stretch-shortening cycle, thus enhancing running economy (Paavolainen *et al.*, 1999). Improvements in endurance training can occur with some type of strength training through benefits garnered from neuromuscular characteristics, running economy or anaerobic capacity (Jung, 2003).

5. CONCLUSION

The result of the study revealed that due to the effect of isolated endurance training and combined strength and endurance training the cardio respiratory endurance of the subjects is significantly improved however, due to the effect of isolated strength training the cardio respiratory endurance of the subjects is not significantly improved. It is also concluded that combined training and isolated endurance training are significantly better than isolated strength training in improving cardio respiratory endurance however, there is no significant differences found between combined training and isolated endurance training. The result of the study also produced 3.36% of improvement due to strength training, 6.89% of improvement due to endurance training and 9.17% of improvement due to combined training. Hence, in order to maintain optimal training levels and take advantage of the potential benefits, it is suggested that combined strength and endurance training sessions not be missed by Kho Kho players.

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