ISSN: 2349 - 4891

International
Journal of Recent Research and Applied Studies
(Multidisciplinary Open Access Refereed e-Journal)

Effect of Isolated and Combined Strength and Endurance Training on Strength Endurance of Kabaddi Players

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Received 9th July 2015, Accepted 5th October 2015

Abstract

The purpose of the study is to examine the effect of isolated and combined strength and endurance training on strength endurance of kabaddi players. To achieve the purpose of this study, sixty men kabaddi players studying in various colleges affiliated to Sri Krishnadevaraya University, Ananthapur district, 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-V was acted as control. The strength 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. The result of the study reveals that due to the effect of isolated and combined strength and endurance training the strength endurance of the subjects is significantly improved. The result of the study also produced 11.91% of improvement due to strength training, 20.76% of improvement due to endurance training and 25.79% of improvement due to combined training.

Keywords: Isolated and Combined Strength and Endurance Training, Strength Endurance, Kabaddi.

Introduction

Performance in any sports activity depends to a large extent on physical fitness. Sports trainers concentrate on improving the physical fitness and psycho-motor abilities of a player. Improving the physical fitness of a player is also called conditioning. A sound conditioning programme forms the most important part of training any sports person. Conditioning or physical fitness is categorized into general and specific fitness. General fitness refers to the common qualities required for any sports person irrespective of the sport i.e., motor qualities such as strength, endurance, flexibility and coordination ability. Every sport demands motor abilities at various levels above the average. Specific fitness is achieved when a player acquires the required motor ability at the intensified level for the particular sport. The changing nature of the game Kabaddi, demands the right type of physical, physiological and psycho-motor abilities on the part of a player. The increasing trend of professionalism and the converging demand for competitive sports have changed the complexion of the games which had been initially intended as a recreational activity of the villagers. Today with the adventure of modern scientific equipments for training and selection of the players, it has been now made possible to measure the fundamental performance characteristics which contribute to a player's success.

Strength training has been reported to cause muscle fibre hypertrophy, associated with an increase in contractile protein, which contributes to an increase in maximal contractile force (Sale et al., 1990). Strength training also reduces mitochondrial density and suppresses oxidative enzymes activity which can cause impede endurance capacity, but has minimal impact on capillary density or in the conversion of muscle fibre types from fast twitch (type-II fibres) to slow twitch (type-I fibres) (Nelson et al., 1990; Sale et al., 1990). In

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contrast, endurance training usually causes little or no muscle fibre hypertrophy, but it does induce increases in mitochondria content, citric acid enzymes, oxidative capacity and the possibility of muscle fibre conversion from fast twitch to slow twitch (Bell 1991, Nelson et al., 1990).

Overall, the literature on endurance and strength programmes suggests that the nature of the adaptive responses to training is specific to the training stimulus. McCarthy et al., (1995) also concluded that strength and endurance programs may be antagonistic when combined together (concurrent training) due to these opposing adaptations acquired from each mode in isolation. Still there is a lot of controversy associated with combined strength and endurance training. This may be due to the variations in regimens and experimental designs (Bell *et al*., 1991). However, by considering factors such as modality and duration, session sequencing, timing, volume, intensity and training frequency, as well as the training status of the individual client, trainers can develop an effective model for concurrent training (Chtara *et al*., 2005; McCarthy *et al*., 1995). All previous studies in this area have utilised only one form of resistance training, heavy training, and explosive training, or training for muscular endurance throughout the intervention program. Because, strength athletes have to perform endurance exercise in order to maintain an optimal body weight or to reduce body fat levels. Aerobic endurance exercises are an effective and efficient method of reducing body fat. Combined strength and endurance training tries to develop all important qualities at the same time. The biggest advantage of the combined training is the parallel development of all qualities, without risking or overtraining athletes.

Combined strength and endurance training in endurance athletes produced improvements in explosive force associated with rapid activation of leg muscles. The training also led to more economical sport-specific performance. The combined strength and endurance training improved anaerobic and selective neuromuscular performance characteristics in young distance runners without decreases in aerobic capacity, although almost 20% of the total training volume was replaced by explosive strength training for eight weeks, (Rick, 2006). Since, the researcher is felt that there is a need to confirm the beneficial effects of isolated and combined strength and endurance training on strength endurance of kabaddi players. Moreover, very little research had been done on kabaddi players, which motivated the investigator to take up the study.

Methodology

Subjects and Variables

To achieve the purpose of this study, sixty men kabaddi players studying in various colleges affiliated to Sri Krishnadevaraya University, Ananthapur district, 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-V was acted as control. The strength endurance was selected as dependent variables for the study and it was assessed by bent knee sit-ups test.

Training Protocol

Training programme was administered to the kabaddi 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

Collection of the Data

The data on the strength endurance was 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.

Statistical Technique

The data collected from the experimental and control groups on strength endurance 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 strength endurance 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. The level of confidence is fixed at 0.05 for significance.

Result

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

Table I. Descriptive Analysis of the Pre and Post Test Data and 'T' Ratio on Strength Endurance of Experimental Groups

Group	Test	Mean	Standard Deviation	Range	Mean Differences	't' ratio	Percentage of Changes
Strength Training	Pre test	30.07	1.67	6.00	3.60	13.21*	11.97
	Post test	33.67	2.02	8.00			
Endurance Training	Pre test	28.27	3.33	11.00	5.87	15.09*	20.76
	Post test	34.13	3.66	12.00			
Combined Training	Pre test	29.47	2.83	10.00	7.60	15.64*	25.79
	Post test	37.07	2.37	9.00			
Control Group	Pre test	29.60	2.82	9.00	0.20	0.43	0.68
	Post test	29.40	2.03	8.00			

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

Table-I shows that the mean, standard deviation, range and mean difference values of the pre and post test data collected from the experimental group on strength 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 13.21, 15.09 and 15.64 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 strength endurance. However, the obtained 't' values of control groups is 0.43 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 strength endurance. The result of the study also produced 11.91% of improvement due to strength training, 20.76% of improvement due to endurance training and 25.79% of improvement due to combined training on strength endurance. The pre and post test data collected from the experimental and control groups on strength endurance is statistically analyzed by using analysis of covariance and the results are presented in table–II.

Table II. Analysis of Covariance on Strength Endurance of Experimental and Control Groups

	Strength Training Group	Endurance Training Group	Combined Training Group	Control Group	S o V	Sum of Squares	df	Mean squares	'F' ratio
Pre test Mean	30.07	28.27	29.47	29.60	B	26.45	3	8.82	0.32
SD	1.67	3.33	2.83	2.82	W	417.20	56	7.45	
Post test Mean	33.67	34.13	37.07	29.40	B	449.13	3	149.71	21.97*
SD	2.02	3.66	2.37	2.03	W	381.60	56	6.81	
Adjusted Post test Mean	33.10	34.98	36.98	29.20	B	489.83	3	163.28	72.34*
					W	124.15	55	2.26	

(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-II shows that the pre-test means and standard deviation on strength endurance of strength training, endurance training, combined training and control groups are 30.07 ± 1.67, 28.27 ± 3.33, 29.47 ± 2.83 and 29.60 ± 2.82 respectively. The obtained 'F' value 0.32 of strength endurance is lesser than the required table value of 2.8277 at 3, 56 df at 0.05 level of confidence, which proved that the random assignment of the subjects were successful and their scores on strength endurance before the training were equal and there was no significant differences. The post-test means and standard deviation on strength endurance of strength training, endurance training, combined training and control groups are 33.67 ± 2.02, 34.13 ± 3.66, 37.07 ± 2.37 and 29.40± 2.03 respectively. The obtained 'F' value of 21.97 on strength endurance is greater than the required table value of 2.77 at 3, 56 df at 0.05 level of confidence. It implied that significant differences exist between the four groups during the post test on strength endurance. The adjusted post-test means on strength endurance of strength training, endurance training, combined training and control groups are 33.10, 34.98, 36.98 and 29.20 respectively. The obtained 'F' value of 72.34 on strength 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, combined training and control groups on strength 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-III.

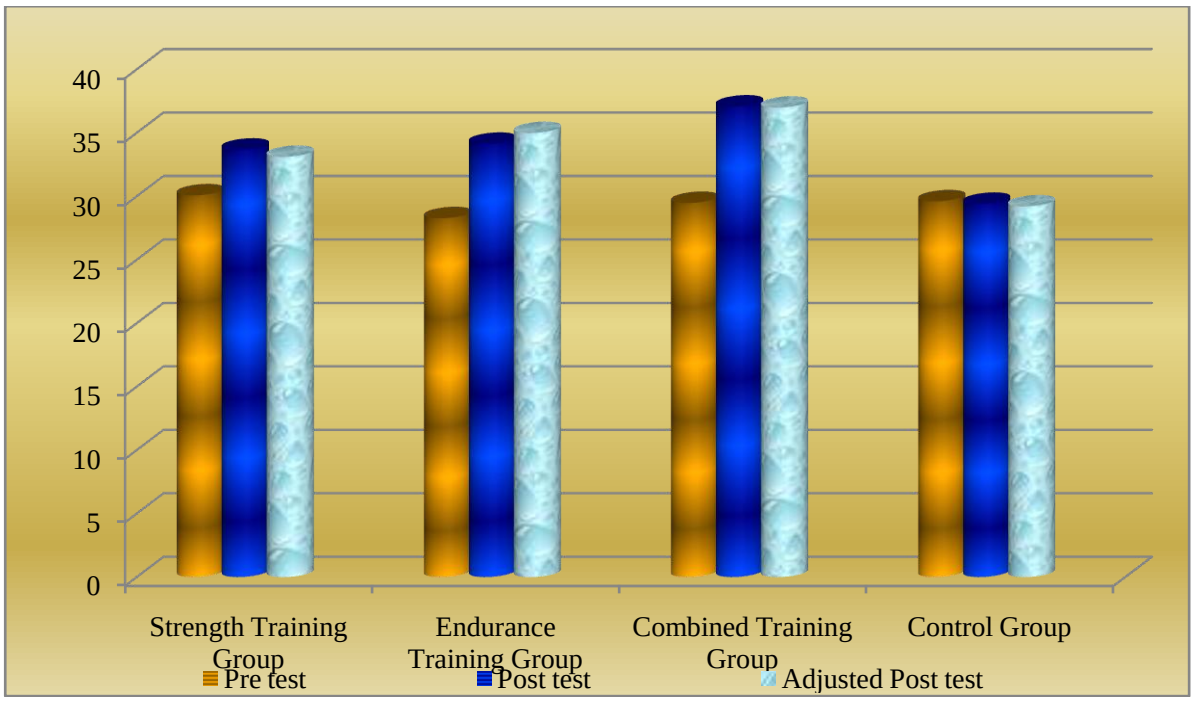
Table III. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Strength Endurance

Strength Training Group	Endurance Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval
33.10	34.98			1.88*	1.58
33.10		36.98		3.88*	1.58
33.10			29.20	3.90*	1.58
	34.98	36.98		2.00*	1.58
	34.98		29.20	5.78*	1.58
		36.98	29.20	7.78*	1.58

**Significant at .05 level*

As shown in table-III the Scheffe's post hoc analysis proved that significant mean differences existed between strength and endurance training groups, strength and combined training groups, strength training and control groups, endurance and combined training groups, endurance training and control groups, combined training and control groups on strength endurance since, the mean differences 1.88, 3.88, 3.90, 2.00, 5.78 and 7.78 are higher than the confident interval value of 1.58 at 0.05 level of significance. Hence, it is concluded that due to the effect of isolated and combined strength and endurance training the strength endurance of the subjects is significantly improved. It is also concluded that combined training is better than isolated endurance and strength training whereas isolated endurance training is better than isolated strength training in improving strength endurance of the kabaddi players. The pre, post and adjusted post test mean values of strength endurance of strength training, endurance training, combined training and control groups on strength endurance is graphically represented in figure-I.

Figure – I. Diagram Showing the Mean Values on Strength Endurance of Experimental and Control Groups



Discussion

The results of this study suggest that twelve weeks of isolated and combined strength and endurance training have a detrimental effect on strength endurance of kabaddi players. The above findings can be substantiated by observations made by following renowned experts. It is well known that strength training increases muscle mass and strength. These findings agree with those of DeLorme (1945) who reported that a small number of repetitions with high resistance produced strength, whereas a large number of repetitions against low resistance increased endurance. These two principles are the basis of isotonic strength training. Combined training produced improvements in aerobic capacity and endurance performance, especially when endurance training preceded strength training in the same session (Chtara *et al*., 2005). Millett et al., (2002) concluded that the addition of heavy weight training to an endurance training program did not affect VO_2 kinetics in well-trained athletes. The researchers found that a greater number of fast-twitch motor units were recruited to compensate for the decrease in power output caused by the fatigued muscle. Recent research has shown that concurrent strength and endurance training may be beneficial for untrained males (McCarthy *et al*., 1995).

Performing exercises that involve a low number of repetitions on a load that is of high resistance effectively increases strength (Dudley *et al*., 1985; Sale *et al*., 1990). It is of importance that athletes have high levels of not only strength but also endurance. For this reason many athletes' training programs involve simultaneous strength and endurance training. Nelson et al., (1990) conducted a study on previously untrained subjects in which one group performed strength training 4 days/wk for 20 weeks while another group performed the same routine but also performed endurance on the same days. The results indicated that although both groups showed increases in force production, yet the strength-training group showed greater improvements. The same results were also found by (Kraemer et al., 1995).

Conclusion

The result of the study revealed that it is concluded that due to the effect of isolated and combined strength and endurance training the strength endurance of the subjects is significantly improved. It is also concluded that combined training is better than isolated endurance and strength training whereas isolated endurance training is better than isolated strength training in improving strength endurance of the kabaddi players. The result of the study also produced 11.91% of improvement due to strength training, 20.76% of improvement due to endurance training and 25.79% of improvement due to combined training. Hence, training for strength endurance generally emphasizes participation in long-duration low or moderate intensity exercise during the base or preparation phase of the season, with the inclusion of shorter-duration high-intensity efforts as the competitive phase approaches.

References

1. Bell, G.J. et al. (1991). Physiological adaptations to concurrent endurance training and low velocity resistance training. *International Journal of Sports Medicine. 12* (4): p. 384–90.
2. Chtara, M., Chamari, K., Chaouachi, M., Chaouachi, A., Koubaa, D., Feki, Y., Millet, G. P.,

Amri, M., (2005). Effects of intra-session concurrent endurance and strength training sequence on aerobic performance and capacity: *British Journal of Sports Medicine.* 39 (8):p. 555-60.

3. Delorme, TL. (1945). Restoration of muscle power by heavy - resistance trained exercises. *J. Bone Joint Surq.* 27:645-667.
4. Dudley, G. A., and Djamil, R., (1985). Incompatibility of endurance- and strength-training modes of exercise. *J Appl Physiol. 59: p. 1446-1451.*
5. Kraemer, W. J., Patton, J. F., Gordon, S. E., Harman, E. A., Deschenes, M. R., Reynolds, K., Newton, R. U., Triplett, N. T., & Dziados, J. E., (1995). Compatibility of high-intensity strength and endurance training on hormonal and skeletal muscle adaptations. *Journal of Applied Physiology*. 78(3): p. 976-989.
6. McCarthy, J. P., Agre, J. C., Graf, B. K., Pozniak, M. A., and Vaicas, A. C., (1995). Compatibility of adaptive responses with combining strength and endurance training. *Med. Sci. Sports Exercise.* 27 (3): P. 429-436.
7. Millet, G. P., Jaouen, B., Borrani, F., & Candau, R., (2002). Effects of concurrent endurance and strength training on running economy and VO_2 kinetics. *Medicine and Science in Sports and Exercise. 34*(8): p. 1351-1359.
8. Nelson, A. G., Arnall, D. A., Loy, S. F., Silvester, L. J., and Conlee, R. K., (1990). Consequences of combining strength and endurance training regimens. *Physical Therapy.* 70: p. 287-294.
9. Rick Morris., (2006). Effect of high intensity resistance training of performance of competitive distance runners. *International J Sports Physiol. Perform*. 1 (1): p. 40-9.
10. Sale, D. G., MacDougall, J. D., Jacobs, I., Garner, S., (1990). Interaction between concurrent strength and endurance training. *Journal of Applied Physiology*. 68 (1): P. 260-270.