

Influence of Weight Training Endurance Training and their Combination on Selected Physical Fitness Variables among Women Players of Different Games

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Abstract— The purpose of the study was to find out the effect of weight training, endurance training and combination training on selected physical fitness variables. Sixty women players of different games were divided into four equal groups (n = 15), in which group - I underwent weight training, group - II underwent endurance training and group - III underwent the combination training for 3 days per week for 12 weeks, and group IV acted as control which did not participate any special training. The subjects were tested on selected criterion variables such as back strength, muscular endurance and cardio-respiratory endurance at prior to and immediately after the training. For testing the back strength, the dynamometer was used, bent knee sit-up test was administered to test muscular endurance and for cardio-respiratory endurance the Cooper's 12 minutes run/walk test was administered. The analysis of covariance (ANCOVA) was used as statistical tool and since four groups were involved in the present study, the Scheffé S test used as post-hoc test. The selected criterion variables were improved significantly for all the training groups when compared with the control group and the back and muscular endurance were improved significantly for weight training group and the endurance training group has improved their cardio-respiratory endurance significantly.

Index Terms: Weight training, endurance training, combined training, physical fitness, back strength, muscular endurance and cardio-respiratory endurance.

INTRODUCTION

Training is for developing the physical ability which focuses on mechanistic goals. The complete muscle groups and some skill for specific games or sports will enhance within particular time of period through physical training. The fitness of physical or health related will be increased by most of the physical

training programme.¹ Dale S. Beach² defines training as an 'planned procedure by which athlete learn knowledge and/or skill for a definite purpose'. It is a process of teaching the particular skill to some human or animal and the aim is to improve the capacity, performance capacity or productivity of an individual.³

The physical activity with low level of intensity in young adult have been linked to the improvement of cardiovascular disease, obesity and low level psychological health.⁴ The CDC (Center for Disease Control and Prevention) of various countries have advised the young adults to participate in vigor physical activity at least 150 min of moderate of 75 min/week.⁵ Various studies are proved that this level of physical activity can prevent obesity, a sum of chronic conditions, such as lower the risk of diabetes (type 2), cardiovascular diseases, colon and breast cancers, improvement in sleep quality and reduction in depression,⁷ and an increase in cognitive capacity.^{8,9,10} The physical activities aim is to improve the maximum level of physiological potential and biomotor abilities of an athlete.⁶ The physical activity which adding the motor behavior such as leisure and daily routine activities also determined to consider the lifestyle for general health status.¹¹

The training are given to the athlete on the basis of scientific principles and which, through systematic development of mental and physical efficiency, capacity and motivation, which help the athlete to produce outstanding and record breaking performances.¹² An organized training at the time of specific period, which includes an increase in the routine of training programme improves the performance is called as periodization,¹³ and the

competitor achieved the maximum adaptation prior an important competition. Month after month, instead of practicing regular routine workouts, athlete should change his or her session with uniform periods or interval periods of work which is harder with sufficient rest.¹⁴ A study was conducted at Human Performance Laboratory, Ball State University shown that there was a significant difference was found in favour of periodized weight training programme than the non-periodized program.¹⁵

Weight training also cites as a type of physical exercise, uses of weight/resistance which improves the muscular contraction which contributes the strength, increase the size of skeletal muscle and anaerobic endurance. It helps to improve overall health and well-being of human being, including the size of muscle, tendon, strengthen and improves the toughness of ligament and joint function, reduced for injury,¹⁶ increased the bone density, fitness, metabolism and cardiac function.^{17,18}

Training with aerobic system is called as endurance or aerobic training which is antonyms of anaerobic training, which is divided into two categories, general and specific endurance.¹⁹ Aerobic fitness which sustain the necessary activity level for a specific competitive sport, which includes both cardiovascular and muscular endurance required for the sport.²⁰ In physiological aspect, it requires the circulatory and respiratory systems to supply energy to the working muscles to support sustained physical activity. Endurance requires the circulatory and respiratory systems to supply energy to the working muscles in order to support sustained physical activity.²¹ Indeed, high levels of muscular strength and aerobic endurance are key determinants of success in many sports.^{22,23}

MATERIAL AND METHODS

In this study it was aimed to find out the effect of weight training, endurance training and their combination on back strength, muscular endurance and cardio-respiratory endurance. To achieve the purpose, sixty women players of different games (twelve players from basketball, volleyball, football, kho-kho and kabaddi game) from various faculties of Annamalai University, Annamalainagar, Tamilnadu were selected as subjects at random. They were

divided into four equal groups of fifteen each and further divided as three experimental groups and one control group, in which the group - I underwent weight training, group - II underwent endurance training and group - III underwent the combination of weight and endurance training for three days (alternative days) per week for twelve weeks, and group - IV acted as control which did not participate in any special training apart from the regular sports activities.

The subjects those who are under medical treatment for various injuries were excluded from the present study after using a self-answered questionnaire. This study was approved by the Rajah Muthiah Medical College and Hospital, Annamalai University, Annamalainagar in which it was performed and compiled with the ethical committee. All participants provided their written informed consent to participate in this study prior to enrollment. The physical and anthropometric characteristics in Table – 1.

Table – 1 MEAN VALUES OF GENERAL CHARACTERS OF THE PARTICIPANTS

	Experime ntal Group - I	Experimen tal Group – II	Experimen tal Group – III	Control Group (n=15)
Age (year)	20.3±0.5	20.9±0.7	21.7±0.4	21.2±0.6
Height (cm)	153.1±1.8 0	152.5±1.40	153.5±1.10	151.3±1. 30
Weight (kg)	51.4±1.50	52.4±1.10	53.1±1.30	50.3±1.2 0
Blood Pressure				
Systolic (mmHg)	123.26±1 0.20	123.45±9.4 0	124.30±10. 5	122.15±9 .3
Diastolic (mmHg)	81.8±1.60	82.50±1.50	81.3±1.90	82.20±2. 05

For every training programme there would be a change in various structure and systems in human body. So, the researchers consulted with the experts and then selected the following variables as criterion variables: 1. Back strength, 2. Muscular endurance and 3. Cardio-respiratory endurance. The back strength was assessed by BID – 2000 dynamometer,²⁴ muscular endurance was assessed by simple sit-ups test (crunches),²⁵ and cardio-respiratory endurance was measured by administering Cooper’s 12 minutes run/walk test.²⁶

ANALYSIS OF THE DATA

Analysis of covariance was used to determine the differences, if any, among the adjusted post test means on selected criterion variables separately. Whenever the ‘F’ ratio for adjusted post test mean was found to be significant, the Scheffé S test was

applied as post-hoc test. The level of significance was fixed at .05 level of confidence to test the ‘F’ ratio obtained by analysis of covariance.

Table – 2 Analysis of Covariance and ‘F’ ratio for Back strength, Muscular endurance and Cardio-respiratory Endurance of Weight training Group, Endurance Training Group, Combined Training Group and Control Group

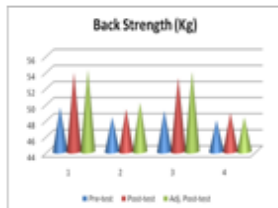
Variable Names	Group Name	Weight Training Group	Endurance Training Group	Combined Training Group	Control Group	‘F’ Ratio
Back strength (in Kgs.)	Pre-test Mean ±S.D.	49.52 ± 1.86	48.31 ± 1.50	49.11 ± 1.34	47.91 ± 1.49	0.45
	Post-test Mean±S.D.	53.86 ± 1.12	49.31 ± 1.09	53.22 ± 1.37	48.83 ± 1.27	18.37*
	Adj. Post-test Mean	64.20	60.11	63.96	58.28	48.39*
Muscular Endurance (in Nos/min)	Pre-test Mean±S.D.	22.27 ± 0.81	22.81 ± 0.13	23.34 ± 0.63	23.19 ± 0.59	0.863
	Post-test Mean±S.D.	26.86 ± 0.29	24.39 ± 0.72	25.63 ± 0.61	22.89 ± 0.29	14.96*
	Adj. Post-test Mean	27.11	24.63	26.33	22.65	85.39*
Cardio-respiratory Endurance (in Meters)	Pre-test Mean±S.D.	1086.31 ± 122	1067.51 ± 236	1079.86 ± 183	1081.36 ± 154	1.371
	Post-test Mean±S.D.	1209.73 ± 145	1408.33 ± 171	1413.45 ± 201	1033.51 ± 122	12.33*
	Adj. Post-test Mean	1210.22	1433.86	1406.87	1054.23	38.63*

* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 3 and 56 and 3 and 55 were 2.77 and 2.78 respectively).

Table – 2 show that pre and post test means ‘f’ ratio of weight training group, endurance training group, combined training group and control group on back strength was 0.45, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean ‘f’ ratio value of experimental groups and control group was 18.37 and 48.39 which was significant at 0.05 level of confidence. The pre test means ‘f’ ratio of weight training group, endurance training group, combined training group and control group on muscular endurance was 0.863, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean ‘f’ ratio value of experimental groups and control group was 14.96 and 85.39, which was

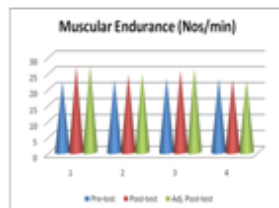
significant at 0.05 level of confidence. The pre test means ‘f’ ratio of weight training group, endurance training group, combined training group and control group on cardio-respiratory endurance were 1.371 which is insignificant at 0.05 level of confidence. The post test and adjusted post test mean ‘f’ ratio value of experimental groups and control group were 12.33 and 38.63, which was significant at 0.05 level of confidence. The overall study shows that there was a significant increase in back strength, muscular strength and cardio-respiratory endurance. Further, to find out which of the paired mean significantly differ, the Scheffé S test was applied and presented below

Figure – 1



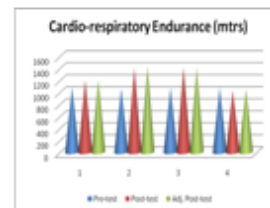
Mean values of experimental groups and control group on Back Strength

Figure – 2



Mean values of experimental groups and control group on Muscular Endurance

Figure - 3



Mean values of experimental groups and control group on Cardio-respiratory Endurance

Table – 3 Scheffë S Test for the Difference Between the Adjusted Post-Test Mean of Back strength Muscular endurance and Cardio-respiratory Endurance

Adjusted Post-test Mean for Back strength					
Weight Training Group	Endurance Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
64.20	60.11			4.09*	1.36
64.20		63.96		0.24	1.36
64.20			58.28	5.92*	1.36
	60.11	63.96		3.85*	1.36
	60.11		58.28	1.83*	1.36
		63.96	58.28	5.68*	1.36
Adjusted Post-test Mean for Muscular Endurance					
27.11	24.63			2.48*	1.13
27.11		26.33		0.78	1.13
27.11			22.65	4.46*	1.13
	24.63	26.33		1.70*	1.13
	24.63		22.65	1.98*	1.13
		26.33	22.65	3.68*	1.13
Adjusted Post-test Mean for Cardio-respiratory Endurance					
1210.22	1433.86			223.64*	28.18
1210.22		1406.87		196.65*	28.18
1210.22			1054.23	155.99*	28.18
	1433.86	1406.87		26.99	28.18
	1433.86		1054.23	379.63*	28.18
		1406.87	1054.23	352.64*	28.18

* Significant at 0.05 level of confidence

Table – 3 shows that the Scheffë S Test for the difference between adjusted post-test mean of weight training group and endurance training groups (4.09), weight training group and control group (5.92), endurance training group and combined training group (3.85), endurance training group and control group (1.83) and combined training group and control group (5.68), which were significant at 0.05 level of confidence. But there was no significant difference between endurance training group and combined training group (0.24) on back strength after the training programme.

Table – 3 also shows that the Scheffë S Test for the difference between adjusted post-test mean difference in muscular endurance between weight training group and endurance group (2.48), weight training group and control group (4.46), endurance training group and combined training groups (1.70), endurance training group and control group (1.98), combined training group and control group (3.68) were significant at 0.05 level of confidence. But there was no significant difference between weight training group and combined training group (0.78) on muscular endurance after the training programme.

Table – 3 shows that the Scheffë S Test for the difference between adjusted post-test mean difference in cardio-respiratory endurance between weight training group and endurance group (223.64), weight training group and combined training group (196.65), weight training group and control group (155.99), endurance training group and control group (379.63) combined training group and control group (352.64) were significant at 0.05 level of confidence. But there was no significant difference between endurance training group and combined training group (26.99) on cardio-respiratory endurance after the respective training programme.

DISCUSSIONS

The maximum noticeable health benefits of weight training is improving the muscle size, strength, metabolic efficiency, body composition and bone density.27,28,29,30,31,32 Moreover, it also increases the physiological, psychological and social health sphere and also positively correlate to regular weight training of women.33,34,35,36 Moreover, high levels of muscular strength and endurance are key stimulant of success in many sporting events.37,38 The concept

of specificity in training,^{39,40} the weight training increases the strength of the muscle and aerobic training enhances the cardiovascular endurance. The strength training and endurance training are interact with one another⁴¹ and it creates some less gain in muscular strength with weight training.^{42,43} A meta-analysis study shown that endurance training combined with strength training has improved a small amount of muscular strength, muscular hypertrophy and muscle power.⁴³

CONCLUSIONS

The result of the present study shows that the back strength has improved all the training groups except, endurance training group. Findings of Yiannis et al⁴⁴ and Bartholomew et al⁴⁵ supports the results of the present study. Roelants, et al⁴⁶ found that there was a significant improvement in back strength after 24 weeks whole body vibration and standard fitness training programme (strength and cardio-vascular training). Hong et al⁴⁷ reported that, an improvement was found in muscular endurance and strength after the weight training programme.

Leonardo Shigak et al⁴⁸ also found that there was a significant improvement in back strength after the combined weight and endurance training. Combined training programme has improved the cardio-respiratory endurance when compared with the control group. Spurs et al⁴⁹ has found that combination of weight and endurance training has better in 3 km running performance and running economy at running velocity above 12 km/h in 25 years of distance runners.

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