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INFLUENCE OF SERIES AND PARALLEL TYPES OF AEROBIC AND ANAEROBIC TRAINING ON CARDIOPULMONARY FITNESS AMONG FOOTBALL PLAYERS.

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Abstract: *The aim of this study is to find out the influence of series and parallel types of aerobic and anaerobic training on cardiopulmonary fitness among football players. 45 male football players studying B.P.Ed in the Department of Physical Education and Sports Science, Pragathi College Of Physical Education (PCPE) Vizianagaram, Andhra Pradesh. were divided into three groups, namely, series (continuous) aerobic and anaerobic training group (STG) and parallel (alternate) aerobic and anaerobic training group (PTG) and control group. The STG group was given aerobic training continuously for first 8 weeks and anaerobic training for next 8 weeks. The PTG group was experimented with aerobic training and anaerobic training alternately for 16 weeks. Aerobic training for both the groups was running at 50 to 60% of maximum heart rate for 40 minutes. Anaerobic training consisted of short sprint (running at 90 to 100% heart rate duration 3 minutes) and eight weight training exercises. The ANCOVA results showed that STG and PTG significantly improved VO_2 max and vital capacity post hoc analysis proved that PTG was better than STG and the differences were significant at 0.05 level ($P<0.05$). Though STG and PTG improved vital capacity comparing to control group, comparisons between the treatment groups proved that there was no significant difference between STG and PTG. It was concluded that parallel aerobic and anaerobic training are better than series training in improving cardiopulmonary fitness variables, VO_2 max and vital capacity of football players.*

Key Words: *Series, Parallel, Aerobic and Anerobic Training, VO_2 max, Vital Capacity.*

1. INTRODUCTION:

Undertaking a focused, structured, individualized training program can increase an athletes VO2max by 15 to 30% over a 3 month period and up to 50% over 2 years. However this benefit is limited to someone new to the sport. A world champion cannot be expected to increase their VO2max by 50%. Focused training also leads to metabolic adaptations, include changes in lactic acid removal, which contribute to the ability to perform at a higher level of VO2max for longer periods of time. Changes are also made to lipid metabolism which enable extra energy Calories to be provided from fat. These Calories supplement those from glycogen and glucose, at specific VO2max levels, supporting longer durations of exercise to fatigue. (Mc Ardle et.al. 1991)

Although the exact optimum for training intensity is unknown, and obviously varies between individuals, it is generally accepted that maximum aerobic improvement occurs at 85% VO2max (approximately 90% of one's max. heart rate). Lower levels of exercise, 60% maximum heart rate for 45 minutes, will at least maintain general cardiovascular conditioning. The "long slow distance" approach to endurance training where one's maximum heart rate is always limited to 60 to 80% VO2max will not optimize the personal performance for high level aerobic events. A recent study assigned 15 women to either a low intensity (132 beats per minute) or high intensity (163 bpm) group, exercising for 45 minutes, 4 times a week. There was an increase in VO2max for members of the high intensity group, but not the low intensity one. (Donatelle, Rebecca, 2005)

Aerobic training at less than 90% maximum heart rate makes the most sense to look at the duration of the planned event, and to train at the same level of anticipated performance for a duration equal to that of the event plus, possibly, an additional 10%. Studies on maintaining the benefits of aerobic training revealed that a 66% reduction in training frequency, going from 6 days a week to 2 days a week but keeping the same intensity for each individual workout, maintained gains previously made. Thus, training needs to be structured for the intensity and duration of the planned sporting event. Anaerobic (oxygen independent) exercise is generally less than 60 seconds in duration and is fueled by the anaerobic, ATP Creatine Phosphate (CP) energy pathways. The classic anaerobic sport is weightlifting. Sprint activities also use anaerobic pathways. If the sprint lasts more than 5 or 10 seconds, lactic acid clearance becomes an issue because of the negative effects of lactic acid on muscle performance. Training focused on anaerobic activities will enhance the ATP and CP energy transfer pathways as well as improving the tolerance for, and

clearance of, lactic acid. Aerobic training on the other hand provides its benefits by improving the cardiovascular and oxygen delivery systems to the muscle cell. These include improvements in both cardiac output, the amount of blood pumped by the heart per minute, and at the muscle fiber level there is an increase in the extraction of oxygen from the blood cells in the capillaries. In addition, there is an improvement in the efficiency of the cellular metabolic pathways which convert glucose into ATP. (Janssen P, 2001)

As the level of exertion increases, there is a slow transition towards anaerobic metabolism in the muscle. There are always areas of relatively lesser perfusion within the muscle that are functioning anaerobically. So even at 50 to 60% VO2max some anaerobic conditioning is occurring. At 85% VO2max, the "anaerobic threshold" for most individuals, there is an abrupt increase in anaerobic metabolism throughout the entire muscle. Even though some cross training of the anaerobic systems takes place during exercise at 60 to 80% VO2max, a sprint performance training program needs to include exercise sessions above 85% VO2max. (Perna F et.al. 1999) Thus, there exists a need for further research to determine a training that could be beneficial for cardiopulmonary fitness.

Hence, in this research paper, the investigator studied the influence of series and parallel types of aerobic and anaerobic training on cardiopulmonary fitness among football players.

2. METHOD & MATERIALS:

To achieve the purpose of this study, 45 male football players studying B.P.Ed in the Department of Physical Education and Sports Science, Pragathi College Of Physical Education (PCPE) Vizianagaram, Andhra Pradesh. were selected randomly as the subjects and their age ranged between 21 to 25 years. The selected subjects were divided into three groups, namely, series (continuous) aerobic and anaerobic training group (STG) and parallel (alternate) aerobic and anaerobic training group (PTG) and control group consisting of 15 football players in each group. The experimental period was 12 weeks. The STG group was given aerobic training continuously for first 6 weeks and anaerobic training for next 6 weeks. The PTG group was experimented with aerobic training and anaerobic training alternately for 12 weeks. Aerobic training for both the groups was running at 50 to 60% of maximum heart rate for 40 minutes. Anaerobic training consisted of short sprint (running at 90 to 100% heart rate duration 3 minutes) and eight weight training exercises. The control group was not exposed to any treatments and was strictly under control. The selected cardiopulmonary fitness variables, VO_2 max and vital capacity of the subjects of all the three groups were measured through standard tests prior to the experimental period and after the experimental period. The difference between the initial and final means on selected variables was the influence of series and parallel type of aerobic and anaerobic training on selected cardiopulmonary fitness variables. The obtained data were subjected to statistical treatment using ANCOVA. In all cases 0.05 level was fixed to test the hypothesis of this study

3. DISCUSSION& FINDINGS:

The results indicated that there was a significant increase in VO2max and Vital capacity values after series and parallel aerobic and anaerobic exercise program. Though there was significant difference between the treatment groups, in favour of PTG on VO_2 max, there was no significant difference between the two groups after training in vital capacity . Carsten et al (2004) agreed with this result as they explain the significant increase in VO2max is related to the effect of exercise either aerobic or anaerobic improve the respiratory function as vital capacity, inspiratory reserve volume and expiratory reserve volume of the lungs, also the stroke volume of the heart increase by regular exercise. These respiratory adaptations facilitate oxygen supply to tissues and add further evidence to the improvement of the respiratory fitness. Also Tomohiro et al. (2003) confirmed this results as he reported that moderate intensity exercise have a significant increase in VO2max as well as participating in bouts of high intensity anaerobic exercise

4. ANALYSIS & RESULT:

Tab 1: Results on Calculation of Analysis of Covariance on Selected Cardiopulmonary Fitness Variables Among Experimental and Control Groups

Calculation of Analysis of Covariance on VO_2 max								
	Series Training Group	Parallel Training Group	Control Group	Source of Variance	Sum of Squares	Df	Mean Squares	Obtained F
Pre Test Mean	41.87	40.29	40.94	Between	19.0	2	9.52	
Std Dev	4.73	3.82	4.52	Within	803.3	42	19.13	0.50
Post Test Mean	44.75	46.16	41.16	Between	198.8	2	99.40	
Std Dev	4.06	4.25	3.82	Within	687.7	42	16.37	6.07*
	44.12	46.71	41.23	Between	224.5	2	112.23	

Adjusted Post Test Mean				Within	244.2	41	5.96	18.84*
Mean Diff	2.87	5.87	0.22					
Calculation of Analysis of Covariance on Vital Capacity								
Pre Test Mean	2118.67	2046.00	2126.00	Between	58671.1	2	29335.56	
Std Dev	264.46	218.92	155.37	Within	1988093.3	42	47335.56	0.62
Post Test Mean	2278.00	2296.00	2144.00	Between	206920.0	2	103460.00	
Std Dev	278.16	218.92	149.03	Within	2065160.0	42	49170.48	2.10
Adjusted Post Test Mean	2258.12	2342.45	2117.43	Between	379981.1	2	189990.56	
				Within	408621.1	41	9966.37	19.06*
Mean Diff	159.33	250.00	18.00					

Required $F_{(0.05, 2,42)} = 3.22$ *Significant

Tab 2: Scheffe's Post Hoc Analysis Results

Post Hoc Analysis for VO_2 Max				
Series Training Group	Parallel Training Group	Control Group	Mean Difference	Reqd. C.I
44.12	46.71		2.59*	2.27
44.12		41.23	2.89*	2.27
	46.71	41.23	5.48*	2.27
Post Hoc Analysis for Vital Capacity				
2258.12	2342.45		84.33	92.51
2258.12		2117.43	140.69*	92.51
	2342.45	2117.43	225.03*	92.51

*Significant

The obtained results proved that sixteen weeks series aerobic and anaerobic training (STG) and parallel aerobic and anaerobic training (PTG) have been significantly improved cardiopulmonary fitness, VO_2 max ($P<0.05$) as the obtained values were greater than the required F value of 3.22 required to be significant at 0.05 level. The post hoc analysis proved that the paired differences of means between STG and control group, PTG and control group were significant. It was also found that PTG was significantly better than STG in improving VO_2 max..

The obtained results on cardiopulmonary fitness variable, vital capacity proved that sixteen weeks series aerobic and anaerobic training (STG) and parallel aerobic and anaerobic training (PTG) have been significantly improved cardiopulmonary fitness, vital capacity ($P<0.05$) as the obtained F value 19.05 on adjusted post test mean values were greater than the required F value of 3.22 required to be significant at 0.05 level. The post hoc analysis proved that the paired differences of means between STG and control group, PTG and control group were significant.

5. CONCLUSION:

In conclusion, series and parallel aerobic exercise improves cardiopulmonary fitness in football players while anaerobic exercise increases cardiac work. Football players require aerobic power and strength, which can be gained from parallel aerobic and anaerobic training. Hence, parallel aerobic and anaerobic training may be used best to improve cardiopulmonary fitness of football players.

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