

# Effect of Soccer Training on Body Composition and Physiological Variables among Footballers

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## Abstract

The aim of this study was to examine the effects of soccer training on selected body composition and physiological variables among footballers. Forty male football players of various institutions in Pondicherry (Age  $20.03 \pm 0.99$ ; Height  $167.55 \pm 6.67$ ; Weight  $70.15 \pm 6.42$ ; BMI  $24.93 \pm 0.56$ ) were randomly assigned into either Experimental group (Exp:N=20: Age  $19.85 \pm 0.99$ ; Height  $165.85 \pm 6.17$ ; Weight  $68.30 \pm 6.31$ ; BMI  $24.77 \pm 0.59$ ) or Control group (Con:N=20: Age  $20.20 \pm 1.01$ ; Height  $169.25 \pm 6.87$ ; Weight  $72.00 \pm 6.12$ ; BMI  $25.09 \pm 0.49$ ). The experimental group participated in the soccer Training program for 12 weeks (three sessions a week) whereas the control group maintained their regular routine activities. All the subjects were evaluated before (pre) and after (post) the training period on the selected variables namely Body Weight, BMI, Resting Pulse Rate, Maximum heart Rate, Recovery Pulse Rate and  $VO_2$  max. The obtained data were statistically analyzed using ANCOVA to find out significant difference if any. The results show a significant improvement in Body Weight, BMI, Maximum Heart Rate, Recovery Pulse Rate and  $VO_2$  max with no significant change in Resting Pulse Rate. In conclusion, the soccer training program resulted in positive changes in the selected variables among footballers.

**Key Words:** Soccer training, Body composition & Physiological variables

## Introduction

The health benefits of engaging in regular physical activity are widely known and it is well documented that physical activity enhances cardio respiratory fitness, increased muscular strength and endurance, and favorable cholesterol and other profiles. Most scientific knowledge, whether from experience or research, aims to understand and improve the effects of exercise on the body. Exercise is now the focus of sport science. Research from several sciences enriches the theory and methodology of training, which has become a branch of science and the player is the subject of the science of training. Theoretically, training induced muscle adaptations are divergent and can even be antagonistic to improvements in

strength<sup>1,2,3</sup> or endurance<sup>4,5</sup>. Soccer popularly known as football in some parts of the world including India is a common language among peoples of diverse backgrounds and heritages, a bridge that spans economic, political, cultural and religious barriers. Soccer performance has dramatically progressed over the past few years. Performance levels which are unimaginable before are now common and the number of athletes capable of producing outstanding results is increasing due to modern training. Football is fast, quick, aggressive and attractive. There are four physical abilities, which are relevant to mastering the football skills. They are speed, strength, endurance and mobility. The greater or lesser degree of proficiency is possible within each one of them. There is a close relationship between each of them. It has been found that male elite soccer players cover 8–12 km during a game, depending on team role,<sup>5-7</sup> nutritional status,<sup>9,10</sup> and aerobic capacity.<sup>11,12</sup> Within this aerobic context a sprint bout occurs about every 90 seconds, each lasting an average of two to four seconds.<sup>6,7,13</sup> During a typical game, soccer players travel from 9000-11000 metres, which includes 4000 metres of jogging, 2000 metres of running at a high but not maximal speed, 800-1000 metres of sprinting, 2500 metres of walking, and 600 metres of moving backwards. Soccer player's heart rates are above 150 beats per minute for most of a game, and blood lactate levels often rise to 6-10 millimoles per liter, comparable to the concentrations commonly observed during 5000 metres and 10000 metres running competitions. Although it has been suggested that these abilities are concerned with the quantities of work done in soccer, they can affect all other levels of skill response. Each level may determine the degree of proficiency shown at other levels. They can therefore affect the quality of movement both above and below the level of skill. With the modern game becoming more and more physical and fast, never has the need for a player to have good all-round ability and acceptable technique been greater. Training involves periodic assessment of the athlete's status and progress and it usually varies depending on the difficulty of task performance. Most kind of training needs regular repeated and collective repetition of some of the original movement and anthropometric and physiological criteria do have a role as part of a holistic monitoring of talented young players<sup>14</sup>. Understanding the training methods and the effectiveness of the training methods to suit a particular game and game situations is a challenging task for any coach or player. This helps coaches and athletes to prevent injury and overtraining while trying to maximize their performance variables, and analyze the strengths and weaknesses related to their specific training programs. If one failed to establish correct training patterns for young athletes, unfortunately, goes way back. Heart beat of an individual shows the level of physical fitness he is possessing and Maximum heart rate is often used as an yardstick to fix load for training. Most leading epidemiologic studies have demonstrated that the resting heart rate is a

powerful risk factor for cardiovascular and total mortality, irrespective of age.<sup>15-16</sup> Literature available on the effect of soccer training on heart rate related variables and  $VO_2$  max on Indian population is limited, hence the investigator was interested to find out the effects of soccer training on selected body composition and physiological variables among football players.

## Methods

Forty male students of various institutions in Pondicherry (mean (SD) were randomly assigned into either Experimental group (Exp:N=20) or Control group (Con:N=20) . The baseline characteristics of the subjects were as follows: mean (SD) age 20.03 (0.99) years; height 197.55 (6.67) cm; body weight 70.15 (6.42) kg and body mass index 24.93 (0.56) kg/m<sup>2</sup>. They were all beginners in football and they did not do any physical activity outside of their studies. All subjects gave written consent after having being informed about the study protocol, without being informed of the goal of the study. The Experimental group participated in the soccer Training program for 12 weeks (three sessions a week) whereas the control group maintained their regular routine activities. The criterion variables selected for this study were Body Weight, BMI, Maximum heart rate, Recovery heart rate, Resting pulse rate and  $VO_2$  max. The subjects of both the groups were tested on selected variables 24 hours before and after the training period. The selected variables were measured before (Pre) and after(Post) for both the groups using standard tests and procedures. The experimental group trained three non-alternative days in a week for 12 weeks. The training includes a combination of general and specific conditioning, plyometrics, drills with and without ball etc. The duration of the sessions was 60 min which includes 5 min each for warm-up and warm down. Excluding this 10 min the active training duration was 50 min.

The data collected from experimental and control groups prior to and after completion of the training period on selected variables were statistically examined for significant differences if any, by applying analysis of covariance (ANCOVA). The pre test and post test means of experimental and control groups were tested for significance by applying ANOVA. As both the groups (EXP and CON) were selected from the same population and no attempt was made to equate the groups on the selected dependent variables or any other common variables, initial differences may exist, and there is a possibility of affecting the post test mean. For eliminating any possible influence of pre test means the adjusted post test means of experimental and control group were tested for significance by using ANCOVA. All the data were analyzed using SPSS statistical package. The level of confidence was fixed at 0.05 level of significance as the number of subjects was limited and also as the selected variables and the possible influence of various extraneous factors.

**Discussion**

**Results**

**Table-I**  
**Analysis of Covariance for the Selected Variables among Experimental and Control Groups With Percentage of Gain**

Body Weight	ConGroup	Exp Group	SOV	SOS	df	MS	F-Ratio	
Body Weight	PRE TEST	72.00(6.12)	68.30(6.30)	B	136.90	1	136.90	3.54
				W	1468.20	38	38.64	
	POST TEST	71.90(6.17)	66.30(6.03)	B	313.60	1	313.60	8.43*
				W	1414.00	38	37.21	
	AD PO TEST	69.19	71.11	B	30.31	1	30.31	26.85*
				W	41.77	37	1.13	
	GAIN	0.10↓	2.00↓					(P < 0.05)
				W	11.09	38	0.292	
	POST TEST	25.09(0.55)	24.05(0.09)	B	10.18	1	10.18	25.10*
				W	11.21	38	0.292	
	AD PO TEST	24.75	25.11	B	0.812	1	0.812	7.462*
				W	4.09	37	0.11	
	GAIN	0.00↑	0.77↓					(P < 0.05)
	% OF GAIN	0.00%↑	2.91%↓					
Restingpulerate	PRE TEST	72.05(1.50)	73.10(2.40)	B	11.03	1	11.03	2.74
				W	152.75	38	4.02	
	POST TEST	72.15(1.86)	72.45(1.86)	B	3.60	1	3.60	1.34
				W	102.30	38	2.69	
	AD PO TEST	72.31	72.84	B	2.73	1	2.73	1.32
				W	76.45	37	2.07	
GAIN	0.1↑	0.65↓						
% OF GAIN	0.14%↑	0.89%↓						
VO <sub>2</sub> Max	PRE TEST	36.10(3.11)	36.60(3.10)	B	2.50	1	2.50	0.26
				W	366.60	38	9.65	
	POST TEST	36.50(3.05)	56.60(3.10)	B	4040.10	1	4040.10	426.69*
				W	359.80	38	9.47	
	AD PO TEST	11.00	20.00	B	123.42	1	123.42	3.37
				W	123.42	37	3.37	
GAIN	0.40↑	20.00↑					(P < 0.05)	
% OF GAIN	1.11%↑	55.16%↑						
Maximum heartRate	PRE TEST	197.70(2.16)	198.35(1.57)	B	4.26	1	4.26	1.19
				W	134.75	38	3.55	
	POST TEST	198.05(1.82)	196.50(1.47)	B	24.03	1	24.03	8.78*
				W	103.95	38	2.74	
	AD PO TEST	170.06	190.14	B	33.09	1	33.09	0.89
				W	33.09	37	0.89	
GAIN	0.35↑	1.85↓					(P < 0.05)	
% OF GAIN	0.18%↑	0.93%↓						
Recovery heartRate	PRE TEST	179.40(2.16)	180.80(2.40)	B	19.60	1	19.60	3.76
				W	198.00	38	5.21	
	POST TEST	180.50(2.24)	160.70(2.16)	B	3920.40	1	3920.40	813.18*
				W	183.20	38	4.82	
	AD PO TEST	170.06	190.14	B	179.93	1	179.93	190.16*
				W	35.01	37	0.95	
GAIN	1.10↑	20.10↓					(P < 0.05)	

Table.1 shows the body Weight, BMI, Maximum heart rate, Recovery heart rate, Resting pulse rate,  $VO_2$  max among the experimental and control group before (Pre) and after (post) the soccer training period. There was a significant change in body Weight, BMI, Maximum heart rate, Recovery heart rate and  $VO_2$  max ( $P < 0.05$ ) whereas there was no significant change in Resting pulse rate. The pre test means of all the variables does not show any significant difference. After the training the experimental group ( $68.30 \pm 6.30$  vs  $66.30 \pm 6.03$ kg) showed a decrease of 2.00 Kg (2.93%) in body weight. In the case of BMI, Experimental group ( $24.77 \pm 0.59$  vs  $24.05 \pm 0.09$ kg/m<sup>2</sup>) shows a decrease of 0.77 (2.91%). Resting pulse rate for the experimental group ( $73.10 \pm 2.40$  vs  $72.45 \pm 1.86$  bt/min) shows a decrease of 0.65 (0.89%) which was not significant, whereas in the case of  $VO_2$  max for the experimental group ( $36.60 \pm 3.10$  vs  $56.60 \pm 3.08$  ml/kg/min) shows a significant increase of 20.00 (55.16%). Maximum heart rate for the experimental group ( $198.35 \pm 1.57$  vs  $196.50 \pm 1.47$  bt/min) shows a decrease of 1.85 (0.93%) and recovery heart rate ( $180.80 \pm 2.40$  vs  $160.70 \pm 2.16$  bt/min) shows a decrease of 20.10 (11.12%) whereas the control group shows no significant difference in all the above-mentioned variables.

## Conclusions

On the basis of the findings it was concluded that Soccer training program produces favorable changes in Body weight, BMI, Maximum heart Rate, Recovery Pulse Rate and  $VO_2$  max with no significant change in Resting Pulse Rate. The Soccer training is viewed as providing stimuli that promote specific and varied adaptations depending on the type, intensity and duration of exercise performed. In general the Soccer training produces increased aerobic capacity which might have caused the reduction in body weight and BMI and this may be attributed to an certain extent to the increase in lean body mass, the decrease in maximum heart rate and recovery heart rate shows improved physiological efficiency like proper oxygen- $CO_2$  transportation and increased stroke volume. Even though it has been suggested that the total work load (training volume and duration of participation) is the key factor that determines the effect of exercise training on performance there is a need for more information. Further studies are needed to clarify the effects of different types of training with variations in duration and intensity on performance related variables among different games in general and football in particular.

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