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Effect Of Soccer-Specific Training With And Without Interval Training On Anaerobic Power And Vo2max Among Women Soccer Players

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Abstract

This study aimed to examine the This study aims to improve the effect of soccer specific training With and without of interval training on an aerobic power and VO2 max woman soccer players. Total 45 female soccer players from Annamalai University in Chidambaram, Cuddalore District, Tamilnadu, who were between the ages of 18 and 23, participated in the study for this reason. Anaerobic power and VO2max, the chosen dependent variable, was evaluated before and after the training program using a running-based anaerobic power test and cooper test. Randomly chosen subjects were divided into 3 groups: two experimental groups and a control group. Group one underwent soccer-specific training and two underwent soccer- specific training with interval training, three served as the control group. The soccer-specific training comprised skills-based activities and specific movements like short sprints, jumps, agility drills etc. The interval training comprised 30,50,100,150,300,500 meters run with different intensities. The initial intensity was set at 75% before being raised by 5% every two weeks. The subjects ran these distances at their most relaxed speed and with the designated intensity. Analysis of covariance (ANCOVA) was employed as a statistical approach to ascertain whether there was, in fact, a significant difference between the data from the chosen dependent variable's pretest and post-test. The paired mean differences were determined using Scheffe's post hoc test whenever the adjusted post-test 'F' ratio value was found to be significant. The accepted level of significance was P≥ 0.05. The results revealed significant improvements happened because of both training. SSTG group had 1.44 & 2.31 and CTG showed 2.31 &3.54 percentage improvement happened on anaerobic power and vo2max respectively. The obtained f ratio was 7.91 and 28.38 of anaerobic power and vo2max respectively.

Keywords: *soccer-specific training, interval training, bio-motor fitness parameters, youth girls.*

INTRODUCTION

Background of the Study

Soccer is a physically demanding sport requiring players to demonstrate a blend of technical skills, tactical awareness, and exceptional physical fitness. Among the key physical attributes for optimal soccer performance are anaerobic power and aerobic capacity, commonly measured by VO2max. Anaerobic power is crucial for executing short bursts of high-intensity actions such as sprints, tackles, and jumps, while aerobic capacity determines a player's ability to sustain effort and recover quickly during prolonged matches.

Women's soccer has gained immense popularity globally, leading to increased scientific interest in optimizing training protocols specific to female athletes. Despite this progress, there remains a gap in understanding how distinct training regimens influence the physiological adaptations critical to female soccer players' performance. This study aims to contribute to the growing body of knowledge by investigating the combined and independent effects of soccer-specific training and interval training on anaerobic power and VO2max.

Research Rationale

The rationale for this study lies in the growing recognition that tailored training regimens can enhance performance in soccer. Soccer-specific training emphasizes drills and exercises that mimic match scenarios, improving players' technical and tactical abilities while simultaneously engaging the energy systems vital for the sport. Interval training, on the other hand, targets cardiovascular fitness and anaerobic capacity through structured bouts of high-intensity activity followed by rest or low-intensity recovery periods. While both methods have proven benefits, their comparative and combined effects on anaerobic power and VO2max in women soccer players remain underexplored.

Women athletes exhibit distinct physiological and hormonal characteristics compared to their male counterparts, which may influence their responses to training stimuli. Therefore, understanding how soccer-specific and interval training affect these key performance indicators in women soccer players can inform coaches and trainers about optimal training strategies tailored to their needs.

Soccer-Specific Training

Soccer-specific training refers to a targeted regimen that incorporates drills and exercises closely aligned with the physical and technical demands of soccer. This training typically includes activities such as dribbling, passing, shooting, and agility drills, as well as small-sided games that replicate match scenarios. The primary goal of soccer-specific training is to enhance players' technical skills, tactical awareness, and game-specific fitness. Soccer-specific training is characterized by its focus on simulating real-game conditions. Drills such as dribbling in tight spaces, one-touch passing, and shooting under pressure are designed to improve technical precision and decision-making. Tactical exercises, including positional play and attacking or defensive transitions, enhance a player's spatial awareness and understanding of team dynamics. Additionally, incorporating fitness components like endurance running or plyometric exercises ensures that players are physically prepared for the rigors of a 90-minute match. This type of training not only improves individual skills but also fosters better team coordination and performance.

For women soccer players, soccer-specific training can help bridge gaps in technical proficiency and tactical understanding, which are often overlooked in generalized training programs. By engaging in drills that replicate match scenarios, female athletes can improve their reaction times, adaptability, and ability to handle pressure. This training also aids in building confidence, as players become more familiar with game-like situations. Furthermore, it helps reduce the risk of injuries by improving balance, coordination, and joint stability.

Interval Training

Interval training involves structured periods of high-intensity exercise interspersed with recovery intervals of low-intensity activity or rest. This training modality is widely recognized for its ability to improve both aerobic and anaerobic fitness. In the context of soccer, interval training often includes sprints, shuttle runs, and other high-intensity activities performed over specified distances or durations, followed by recovery periods. This approach helps players adapt to the intermittent nature of soccer matches, where bursts of intense effort are required throughout the game. Interval training is versatile and can be tailored to target various fitness components. High-intensity intervals can range from short sprints lasting 10-20 seconds to longer runs of 2-3 minutes, depending on the desired outcome. Recovery periods may involve walking, light jogging, or complete rest to ensure proper energy replenishment. Incorporating interval training into soccer regimens helps develop explosive power, speed endurance, and the ability to sustain high-intensity efforts during matches. Variations such as high-intensity interval training (HIIT) and repeated sprint training (RST) further enhance its applicability to soccer.

Interval training offers numerous physiological and performance benefits for women soccer players. It significantly improves cardiovascular fitness, enabling players to recover more quickly between high-intensity actions. Enhanced aerobic and anaerobic capacities allow athletes to maintain optimal performance levels throughout the game. Interval training also aids in fat loss and muscle tone, contributing to better body composition and overall athleticism. Furthermore, by mimicking the stop-and-go nature of soccer, interval training prepares players for the physical demands of competitive matches and reduces fatigue during critical moments.

Objectives of the Study

This study seeks to examine the effect of soccer-specific training with and without interval training on anaerobic power and VO2max among women soccer players. By comparing the outcomes of these two training protocols, the research aims to identify effective strategies for enhancing the physical performance of women athletes in soccer.

Significance of the Study

The findings of this study will provide evidence-based insights into the design of training programs for women soccer players, potentially leading to improved performance on the field. Furthermore, the research will contribute to the scientific understanding of how different training modalities impact key physiological metrics, helping to bridge the knowledge gap in women's sports science.

Additionally, this study has the potential to influence the development of gender-specific training guidelines in soccer, fostering an environment where women athletes can achieve peak performance.

By addressing the physiological and technical demands unique to women soccer players, the study aims to promote equality in sports science research and ensure that female athletes receive training interventions that are both effective and scientifically validated.

MATERIALS AND METHODS

Subjects and Variables

The goal of the current study was to examine the effect of soccer-specific training with and without interval training on anerobic power and vo2max among women soccer players. 45 female soccer players from Annamalai University in Chidambaram, Cuddalore District, Tamilnadu, who were between the ages of 18 and 23, participated in the study for this reason. Anaerobic power and VO2max, the chosen dependent variable, was evaluated before and after the training program using a running-based anaerobic power test and cooper test.

Training protocol

The randomly chosen subjects were divided into 3 groups: two experimental groups and a control group. Group one underwent soccer-specific training and two underwent soccer- specific training and interval training, three served as the control group. The soccer-specific training comprised skills-based activities and specific movements like short sprints, jumps, agility drills etc. The interval training comprised 30,50,100,150,300,500 meters run with different intensities. The initial intensity was set at 75% before being raised by 5% every two weeks. The subjects ran these distances at their most relaxed speed and with the designated intensity.

Criterion measures and selection of tests

VARIABLE	*TEST*	*UNIT*

Anaerobic power	*RAST*	*Watts*
VO2max	*Cooper test formula*	*Ml/Kg/Min*

Anaerobic power - RAST Test

purpose: To test anaerobic power during running.

Equipment: Scales, stopwatches, optional timing gates, measuring tape, marking cones, and a 50-meter track are all necessary.

Procedure: Before the exam, weight each participant for calculation reasons, and warm up. Place cones at both ends of a 35-meter running track. Two testers may be required, since one person must time each 35-meter run while the other time the 10-second rest interval. The participant places himself at one end of the 35-meter track and begins a maximal sprint when the 'go' signal is given. Ensure that the subject moves at the fastest possible rate through the queue each time. Following a 10-second rest, the ensuing sprint begins from the opposite end of the 35-meter track. Continue the process until six sprints have been performed.

Scoring: Document the duration of each sprint to the nearest tenth of a second (using timing gates improves precision). Sprint times and body weight may be used to calculate peak, minimum, and average power outputs, as well as a fatigue index.

Computations: Use the formula below to determine the power for each sprint. These statistics facilitate the computation of maximum and minimum power, average power, relative power, and fatigue index.

Power =Weight×Distance^2÷Time^3

Peak Power = the highest power measurement **Relative Peak Power** = peak power ÷ Weight **Average Power** = the sum of all six power values ÷ 6

Fatigue Index = (maximum power – minimum power) ÷ total time for the 6 sprints

Vo2max

Purpose: to calculate vo2 max.

Formula : Meters: VO2 max = (distance in meters – 504.9) / 44.73

Statistical Analysis and Experimental Design

Thirty volunteers were included in the random group design experiment employed for this study. Analysis of covariance (ANCOVA) was employed as a statistical approach to ascertain whether there was, in fact, a significant difference between the data from the chosen dependent variable's pretest and post-test. The paired mean differences were determined using Scheffe's post hoc test whenever the adjusted post-test 'F' ratio value was found to be significant. The accepted level of significance was P 0.05.

RESULT OF THE STUDY

Paired 't' test and % of changes on soccer player's Anaerobic power of SSTG, CTTG&CG

Groups Name	Assessment Periods	Subjects	Mean Value s	SD Values	MD	DM	't' Value	Percentage
SSTG	pre-test	15	618.3	8.85	8.93	.77	11.58	1.44
	post-test		627.2	9.54				
CTG	pre-test	15	619.3	8.85	14.33	.67	21.27	2.31
	post-test		633.3	9.89				
CG	pre-test	15	620.3	8.85	1.53	4.00	0.383	0.24
	post-test		621.8	9.84				

df 14 =2.15 (table value) (*significant)

The assessed pre and post-test anaerobic power values of three training (SSTG, CTG&CG) groups differ noticeably since the 't' values of SSTG (21.27), as well as CTG (11.58) groups were greater than the table value (df14=2.15). following 8 weeks of SST, CT treatment, soccer player's anaerobic power(SSTG=1.44%, and CG =2.31%), enhanced greatly.

computation of analysis of covariance of pre-test post- test and adjusted post- test on Anaerobic power for experimental groups and control group

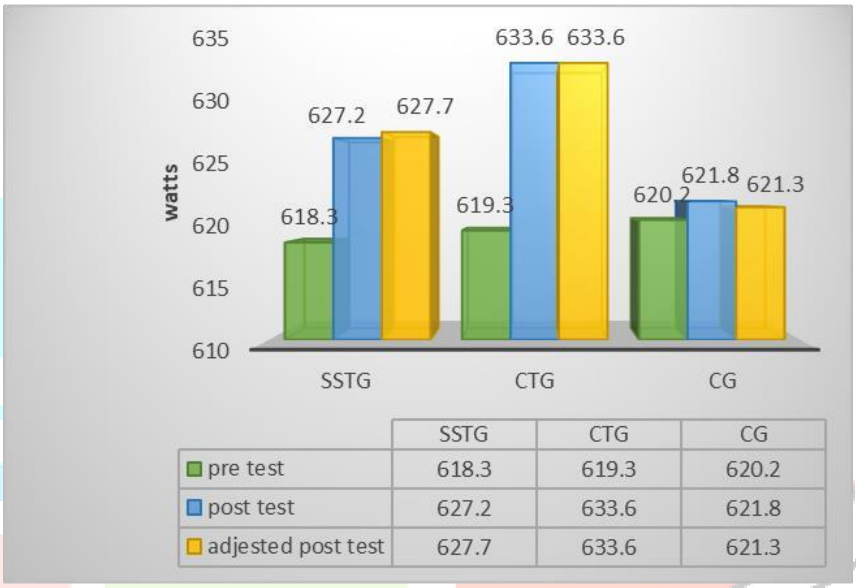
	SSTG	CTG	CG	SOV	SS	df	MS	F
pre-test	618.3	619.7	620.7	B	30	2	15	1.91
SD	8.85	8.6	8.6	W	3296.8	42	78.5	
post-test	627.2	633.6	621.8	B	1046.8	2	523.4	5.48
SD	9.89	9.85	9.54	W	4006.6	42	95.4	
Adjusted post-test	627.7	633.6	621.2	B	1144.6	2	572.3	7.91
				W	2963.1	41	72.3	

Required F (0.05), (df 2 and 42) = 3.22, (df 2 and 41) = 3.23 at 0.05, significance. BG - Between Groups, WG - Within Groups, df – Degrees of Freedom

The means of the adjusted post-test of the training groups of soccer specific, soccer specific training with interval training and control groups were 627.7,633.3 and 621.2respectively. The F ratio 7.91 obtained, and it was greater than 3.23 of table value for degree of 2 and 41 necessary for significance level at 0.05.

The analysis mentioned above shows that the means of the adjusted post-test measures of the four chosen groups differed significantly. For post hoc test Scheffe's test was used in order to identify which specific group had the significant difference and showed significance of difference and the results of the analysis are shown in the table.

SSTG	CTG	CG	MD	CI
627.7	633.6		5.9	7.88
627.7		621.3	6.4	
	633.6	621.3	12.3*	



Paired 't' test and % of changes on soccer player's Vo2max of SSTG, CTG&CG

Groups Name	Assessment Periods	Subjects	Mean Values	SD Values	MD	DM	't' Value	Percentage
SSTG	pre-test	15	41.21	1.17	.96	.165	5.87	2.31
	post-test		42.17	.74				
CTG	pre-test	15	41.14	.41	1.46	.106	13.8	3.54
	post-test		42.61	.47				
CG	pre-test	15	40.9	.41	.264	.185	1.42	1.42
	post-test		40.63	.78				

df 14 =2.15 (table value) (*significant)

The assessed pre and post-test anaerobic power values of three training (SSTG, CTG&CG) groups differ noticeably since the 't' values of SSTG (5.87), as well as CTG (13.8) groups were greater than the table value (df14=2.15). following 8 weeks of SST, CT treatment, soccer player's Vo2 max (SSTG=2.31%, and CG =3.54%), enhanced greatly.

computation of analysis of covariance of pre-test post- test and adjusted post- test on VO2 Max for

experimental groups and control group

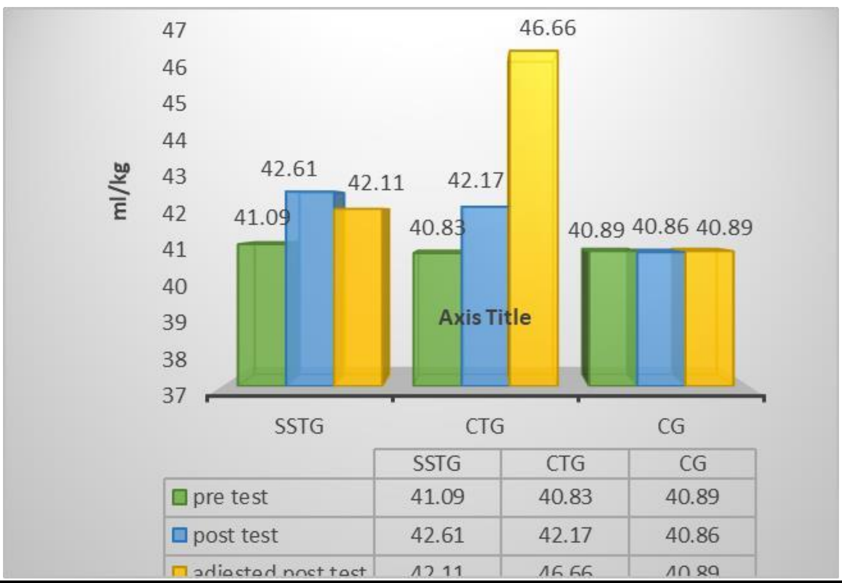
	SSTG	CTG	CG	SOV	SS	df	MS	F
pre-test	41.09	40.83	40.89	B	.559	2	.279	.267
SD	1.1	.93	1.03	W	44.03	42	1.04	
post-test	42.61	42.17	40.86	B	24.75	2	12.38	20.0
SD	.742	.681	.916	W	25.99	42	.62	
Adjusted post-test	42.11	46.66	40.89	B	24.65	2	12.32	28.4
				W	17.80	41	.43	

Required F (0.05), (df 2 and 42) = 3.22, (df 2 and 41) = 3.23 at 0.05, significance. BG - Between Groups, WG - Within Groups, df – Degrees of Freedom

The means of the adjusted post-test of the training groups of soccer specific, soccer specific training with interval training and control groups were 42.11,46.66 and 40.89 respectively. The F ratio 7.91 obtained, and it was greater than 3.23 of table value for degree of 2 and 41 necessary for significance level at 0.05.

The analysis mentioned above shows that the means of the adjusted post-test measures of the four chosen groups differed significantly. For post hoc test Scheffe's test was used in order to identify which specific group had the significant difference and showed significance of difference and the results of the analysis are shown in the table.

SSTG	CTG	CG	MD	CI
42.11	46.66		4.55*	
42.11		40.89	1.22*	.6
	46.66	40.89	5.77*	



Discussion on results

This study aims to improve the effect of soccer specific training With and without of interval training on an aerobic power and VO2 max woman soccer players. Analysing this variables are very important in the soccer performance. The researcher tried compare old studies to his result and discussing the significance of the study.

The statistical outputs elucidate that due to 8 weeks of Soccer Specific training with interval training (CTG) improved significantly better than soccer specific training (SSTG) and the control group (CG) among women football players. Further, the post hoc analysis proved that the Soccer Specific training with interval training was better than the Soccer Specific training and Soccer Specific training was better than control group on improving the anaerobic power.

The statistical outputs elucidate that due to 8 weeks of soccer specific training (SSTG), Soccer Specific training with interval training (CTG) improved significantly better than the control group (CG) among women football players. Further, the post hoc analysis proved that the Soccer Specific training with interval training was better than the Soccer Specific training and Soccer Specific training was better than control group on improving the Vo2max.

Interval training itself is a training system interspersed with intervals in the form of rest periods (Trisaptono & Sumintarsih, 2020); (Christiansen et al., 2021). The interval training method has characteristics, namely consistency in the effort made and the rest period between repetitions taking place consistently (Haugen et al., 2019). The implementation of the interval training method is divided into extensive interval training and intensive interval training. Intense interval training is a training method that can be used to increase an athlete's VO2Max. Intensive interval training is a training method in which distance, travel time, the number of repetitions and recovery time have been determined (Yamin & Gusril, 2020).

This study supports the conclusions of Iaia, Ermanno, &Bangsbo, (2009) reviewed the major physiological and performance effects of aerobic high-intensity and speed-endurance training in football. This findings of the study both aerobic and speed-endurance training can be used during the season to improve high-intensity intermittent exercise performance. The type and amount of training should be game related and specific to the technical, tactical, and physical demands imposed on each player. Similar way**,** Moghaddam et al, (2023**)** conducted study on sprint interval training on stationary air bikes. The study also agreeing that because of interval training VO2 max improved greatly. The result of the research indicate that an anaerobic interval training programme significantly improve VO2max and anaerobic endurance, as well as increase enzymatic activities associated with glycolysis such as phosphofructokinase, lactate dehydrogenase, and glycogen phosphorylase (Parra, Cadefau, Rodas, Amigo, & Cusso, 2000; Bompa & Haff, 2009). Research by MacDougall et al. (1998) supports these findings showing an increase in glycolytic and oxidative muscle enzyme activity, maximum short term power output, and VO2max after 7 weeks of sprint interval training.The research findings indicate that an anaerobic interval training program significantly enhances VO2max and anaerobic endurance, as well as elevates enzymatic activities related to glycolysis, such as phosphofructokinase, lactate dehydrogenase, and glycogen phosphorylase (Parra, Cadefau, Rodas, Amigo, & Cusso, 2000; Bompa & Haff, 2009). MacDougall et al. (1998) conducted research that corroborates these findings, demonstrating an enhancement in the glycolytic and oxidative muscle enzyme activity, peak short-term output of power, and VO2max following 7 weeks of sprint interval training.

This study investigated the impact of soccer-specific training with and without interval training on anaerobic power and VO2max in women soccer players. The results indicate that both training regimens led to significant improvements in these performance metrics compared to the control group. Notably, the group that combined soccer-specific training with interval training demonstrated greater gains in both anaerobic power and VO2max than the group that underwent only soccer-specific training. These findings align with previous research highlighting the benefits of interval training for enhancing both anaerobic and aerobic capacity in athletes [1,2]. The observed improvements can be attributed to the physiological adaptations induced by interval training, such as increased mitochondrial density, improved buffering capacity, and enhanced cardiovascular function. However, the specific contribution of each training modality (soccer-specific vs. interval) to the overall improvement requires further investigation.

While this study provides valuable insights into the efficacy of different training approaches for women soccer players, certain limitations should be considered. The relatively small sample size and the specific training protocols employed may limit the generalizability of the findings to other populations and training contexts. Furthermore, the study did not examine the long-term effects of these training interventions. Future research should explore the sustained impact of combined soccer-specific and interval training programs on performance outcomes in larger and more diverse samples of female soccer players. Additionally, investigating the optimal combination of interval training parameters (e.g., work-to-rest ratios, intensity, duration) within soccer-specific training programs would provide valuable guidance for coaches and athletes seeking to maximize performance gains.

Conclusion

This study contributes to the growing body of evidence supporting the efficacy of specific training with interval training and demonstrates that incorporating interval training alongside soccer-specific training leads to significant improvements in anaerobic power and VO2max among women soccer players. While soccer-specific training alone also yielded positive results, but not that much significant. The addition of interval training amplified these benefits, suggesting a synergistic effect. These findings underscore the importance of integrating interval training into training programs for women soccer players to maximize physiological adaptations and enhance performance. Future research should explore the long-term effects and optimal implementation strategies of combined training approaches. The findings encourage further exploration of combined trainings with interval training greatly enhancing performance of athletes, especially who participating the events require aerobic and anaerobic combination

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