ANALYSIS OF PHYSIOLOGICAL ALTERATIONS IN RESPONSE TO STATIC AND DYNAMIC CORE STRENGTH TRAINING WITH SOCCER SPECIFIC TRAINING AMONG WOMEN SOCCER PLAYERS

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ABSTRACT

The purpose of this investigation was to analysis of physiological alterations in response to static and dynamic core strength training with soccer specific training among women soccer players. To attain these objectives, 45 college women soccer players in the age of 18-25 years from Lilong Haoreibi College, Lilong Manipur, India during the academic year 2023-2024 were preferred. The chosen subjects (N=45) were classified into three equivalent groups of fifteen participants each (n=15) at random. Group-I was assigned static core strength training in combination with soccer specific training, group-II was assigned dynamic core strength training in combination with soccer specific training and group-III was control. They did these 2 trainings for 12 weeks. All 3 groups were measured before and immediately after 12weeks of training period on anaerobic power and Vo_2max by using standardized test items. The data obtained were analyzed by paired 't' test to know the differences if any between the two testing periods. Additionally, magnitude of variation was also calculated. In addition, ANCOVA was also applied. When the adjusted 'F' was greater, Scheffe's test was applied. To test the obtained results the significance level 0.05 was chosen. As a result of static core strength training with soccer specific training and dynamic core strength training with soccer specific training the anaerobic power and Vo_2max of soccer players was significantly altered.

Key words: *Static and dynamic core strength training, soccer specific training, anaerobic power, Vo2max, women soccer players*

INTRODUCTION

Soccer is a highly dynamic and physically demanding sport that requires a combination of speed, agility, and power. To excel in soccer, athletes must develop and maintain a high level of physical fitness, especially in terms of strength. Strength training is an essential component of any comprehensive football conditioning program, as it helps players improve their performance, prevent injuries, and enhance their overall athleticism. A soccer -specific strength and conditioning program can optimize a player's performance on the court. Whether athletes are still developing or competing at the highest level, spending time in the weight room building a strength foundation can be the difference between winning and losing a game.

Core strength training is a term that denotes building the strength of the muscles of the body in such a manner that the entire body is fully balanced and supported. The core is the center of gravity in the body surrounding the center of the abdomen. One cannot expect to have a lean and graceful body without this as this is the focal point of balance and movement. The sedentary lifestyle that many people are accustomed to has made core weight training very popular. Because of white collar jobs and luxurious lifestyle, our body is kept more relaxed instead of being active and that is the reason for out of shape. This can be observed in the complaints of back pain, sagging abdominal muscles and tell tale signs of poor posture. When the core muscles are in proper shape, then the entire body carries different look.

In the recent years, various programs in connection with strength training are evolved. They are organized to stress the importance of strengthening core muscles. These are the muscles of the trunk and pelvis in addition to the muscles of the legs, arms and shoulders. Core training specific to athletes are very much needed. Thus, for a given individual, particular muscle groups in the core become very important. Athletes have to strengthen the trunk and pelvic muscles and this is very much required for them. Exercising the lower back and abdominal muscles together is the unique feature of most of the core training programs. A huge emphasis is there to provide training for multi-plane, dynamic and multi-directional movements and it is achieved by core strength training. Significant improvement will be there in these movements if core strength training and related exercises are utilized properly.

Soccer is characterized as an intermittent sport with repeated bouts of high-intensity activity. Therefore, for training to suit the physical demands of the game, emphasis should be placed on the ability to repeatedly execute high-intensity activities with short rest periods. High-intensity training has been reported to induce greater improvements in both aerobic and anaerobic capacity compared with continuous training involving the same mechanical work and duration. In addition to this, high-intensity training modalities require approximately half the time of traditional continuous methods and are more likely to enhance player motivation and adherence and increase the time for technical and tactical practices. It is evident that aerobic and anaerobic capacities are determinants of successful soccer performance. The best method for improving these qualities is through static and

dynamic core strength training in combination with soccer specific training. The purpose of this study was to find out the effect of static and dynamic core strength training with soccer specific training on selected physiological variables among college women soccer players.

METHODOLOGY

Subjects and Variables

To attain these objectives, 45 college women soccer players in the age of 18-25 years from Lilong Haoreibi College, Lilong Manipur, India during the academic year 2023-2024 were preferred. The chosen subjects (N=45) were classified into three equivalent groups of fifteen participants each (n=15) at random. Group-I was assigned static core strength training in combination with soccer specific training, group-II was assigned dynamic core strength training in combination with soccer specific training and group-III was control. All 3 groups were assessed before and immediately after 12 weeks of training period on anaerobic power and Vo_2max by RAST test and Cooper's 12minutes R/W test respectively.

Training Protocol

A sufficient warm up was performed by the subjects before undergoing core strength and game specific training sessions. Warm down activities were completed after the completion of every sessions. Group-I was assigned static core strength training in combination with soccer specific training, group-II was assigned dynamic core strength training in combination with soccer specific training and group-III was control. The two experimental groups were trained at the similar time during the morning, weekly 3- days, throughout the study. The static and dynamic core strength training in combination with soccer specific training group subjects took part in a 12-week training program performing a variety of exercises designed. Following a series of familiarization sessions, all participants completed a battery of standardized physical fitness tests and laboratory tests in the same order for the subsequent analyses of generic training adaptations on anaerobic power and Vo_2max. The testing procedures were repeated at the conclusion of the 12 weeks intervention period.

Collection of the Data

The data on the selected physiological variables were 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 selected dependent variables were 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. Further, the data collected from the three 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, three 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 on anaerobic power and Vo_2max of experimental and control groups are presented in table-I.

Table – I: **Descriptive Analysis of the Data on Anaerobic Power and Vo_2max of Experimental and Control Groups**

Variable	Group	Test	Mean	SD	MD	't' ratio	Improvement
Anaerobic Power	Static Core Strength with Soccer Specific Training	Pre	223.60	5.56	9.13	7.47*	4.08
		Post	232.73	5.77			
	Dynamic Core Strength with Soccer Specific Training	Pre	223.13	4.58	21.13	10.49*	9.47
		Post	244.26	8.48			
	Control Group	Pre	224.00	5.55	0.20	0.10	0.08
		Post	224.20	4.90			
Vo_2max	Static Core Strength with Soccer Specific Training	Pre	24.26	1.18	0.48	5.42*	2.01
		Post	24.75	0.90			
	Dynamic Core Strength with Soccer Specific Training	Pre	24.06	1.17	1.56	5.72*	6.52
		Post	25.63	1.28			
	Control Group	Pre	24.10	1.35	0.20	0.90	0.80
		Post	24.30	1.23			

*Table value for df 14 is 2.15(*Significant)*
**Significant*

The collected pre and post test anaeropbic power (AP) values of two treatment (static and dynamic core strength training with soccer specific training) groups vary obviously as

the found 't' values of static core strength training with soccer specific training (7.47) as well as dynamic core strength training with soccer specific training (10.49) groups were more than table value (df14=2.15). Performing static core strength training with soccer specific training leads to 4.08% of improvement in anaerobic power (AP) whereas performing dynamic core strength training with soccer specific training leads to 9.47% of improvement in aerobic power (AP) of football players.

The collected pre and post test VO_2 Max values of two treatment (static and dynamic core strength training with soccer specific training) groups vary obviously as the found 't' values of static core strength training with soccer specific training (5.42) as well as dynamic core strength training with soccer specific training (5.72) groups were more than table value (df14=2.15). Performing static core strength training with soccer specific training leads to 2.01% of improvement in VO_2 Max whereas performing dynamic core strength training with soccer specific training leads to 6.52% of improvement in VO_2 Max of football players.

The pre and post test data collected from the experimental and control groups on anaerobic power and Vo_2max was statistically analyzed by using Analysis of Covariance and the results are presented in table–II.

Table – II: **Analysis of Covariance on Anaerobic Power and Vo_2max of Experimental and Control Groups**

Variable	Static Core Strength with Soccer Specific Training	Dynamic Core Strength with Soccer Specific	Control Group	S o V	Sum of Squares	df	Mean squares	'F' ratio
Anaerobic Power	232.72	244.45	224.02	B	3138.47	2	1569.23	41.06*
				W	1604.96	42	38.21	
Vo_2max	24.71	25.73	24.14	B	14.03	2	7.01	24.17*
				W	12.46	42	0.29	

*(Table value for df 2 & 41 is 3.23)*Significant (.05 level)*

Table-II shows that the obtained adjusted post-test 'F' value of 41.06 and 24.17 on anaerobic power and Vo_2max of static and dynamic core strength training with soccer specific training groups and control groups are greater than the required table value of 3.23 for df 2 and 41 at 0.05 level of confidence. Hence, it is concluded that significant differences

exist between the adjusted post test means of static and dynamic core strength training with soccer specific training groups and control groups on anaerobic power and Vo_2max.

Since, the obtained 'F' value in the adjusted post test means was found to be significant, the Scheffe's test was 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 Anaerobic Power and Vo_2max**

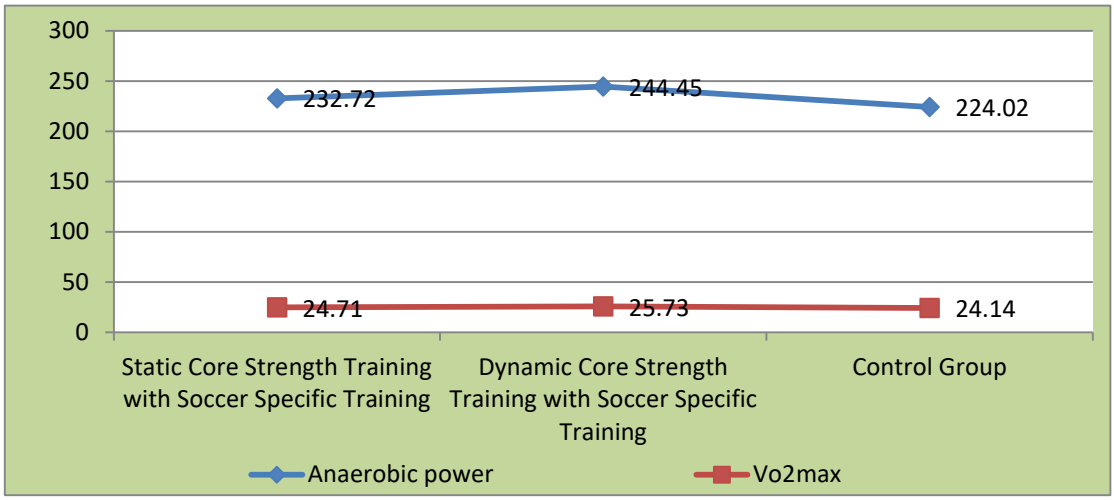
Variable	Static Core Strength with Soccer Specific Training	Dynamic Core Strength with Soccer Specific Training	Control Group	Mean Difference	Confidence Interval
Anaerobic Power	232.72	244.45		11.73*	5.80
	232.72		224.02	8.70*	5.80
		244.45	224.02	20.43*	5.80
Vo_2max	24.71	25.73		1.02*	0.49
	24.71		24.14	0.57*	0.49
		25.73	24.14	1.59*	0.49

**Significant at .05 level*

The applied Scheffe's statistics confirmed that due to static core strength training with soccer specific training (8.70), as well as dynamic core strength training with soccer specific training (20.43) the football player's anaerobic power was improved to a great extent. Though, dynamic core strength training with soccer specific training was much better than static core strength training with soccer specific training since the mean difference (11.73) is more than 5.80 (CI value).

The applied Scheffe's statistics confirmed that due to static core strength training with soccer specific training (0.57), as well as dynamic core strength training with soccer specific training (1.59) the football player's VO_2 Max was improved to a great extent. Though, dynamic core strength training with soccer specific training was much better than static core strength training with soccer specific training since the mean difference (1.02) is more than 0.49 (CI value).

Figure-I: **Diagram Showing the Mean Values on Anaerobic Power and Vo2max of Experimental and Control Groups**



DISCUSSION

Core strength plays a crucial role in enhancing athletic performance, particularly in sports like soccer that demand a combination of aerobic endurance, anaerobic power, agility, and stability. The integration of core strength training both static and dynamic with soccer-specific drills appears to significantly improve physiological performance indicators, namely anaerobic power and VO_2max**.**

Soccer is predominantly an intermittent sport requiring repeated short bursts of high-intensity activity, making anaerobic power essential. Dynamic core training, which involves movement patterns that mimic sport-specific actions (e.g., rotational throws, medicine ball slams), can enhance force production and neuromuscular coordination. These adaptations contribute to improved sprinting, jumping, and change of direction ability (Reed et al., 2012). When coupled with soccer-specific training, dynamic core exercises may optimize kinetic chain efficiency, enabling athletes to generate and transfer power more effectively during anaerobic efforts. In contrast, static core training which focuses on isometric holds such as planks promotes trunk stability and endurance of postural muscles. Although it contributes less directly to explosive movements, it enhances the foundational strength necessary for force transmission during high-intensity actions. This stability reduces energy leaks, indirectly supporting greater anaerobic output during repeated sprints or tackles (Kibler, Press, & Sciascia, 2006).

VO_2max, a key indicator of aerobic fitness, determines a player's ability to sustain high-intensity activity over time. Core strength, particularly when improved through dynamic methods, has been shown to enhance running economy and posture during prolonged activity (Sato & Mokha, 2009). A more stable core minimizes excessive movement and improves biomechanical efficiency, thereby reducing oxygen cost during submaximal exertion. When this is combined with soccer-specific endurance drills, players may experience greater improvements in cardiovascular conditioning, reflected in increased VO_2max levels (Ozmen & Aydogmus, 2016). Moreover, dynamic core training may stimulate greater systemic adaptations due to the recruitment of large muscle groups and engagement of multiple energy systems. This may lead to cardiovascular benefits, including increased stroke volume and mitochondrial density, both of which contribute to VO_2max enhancement (Behm et al., 2010).

In summary, both static and dynamic core strength training, when paired with soccer-specific activities, have distinct yet complementary effects on the physical conditioning of soccer players. While static core training fortifies foundational stability essential for energy transfer, dynamic core training more directly boosts power and efficiency in sport-specific movements. Their combined application results in significant improvements in both anaerobic power and VO_2max, suggesting a synergistic approach is most beneficial for athletic development in soccer.

CONCLUSION

Due to static core strength training with soccer specific training (4.08%), as well as dynamic core strength training with soccer specific training (9.47%) the soccer player’s anaerobic power was improved to a great extent. Though, dynamic core strength training with soccer specific training was much better than static core strength training with soccer specific training. Due to static core strength training with soccer specific training (2.01%), as well as dynamic core strength training with soccer specific training (6.52%) the soccer player’s VO_2 Max was improved to a great extent. Though, dynamic core strength training with soccer specific training was much better than static core strength training with soccer specific training.

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