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Effects of Core Stability and Skill Based Resistance Training on Physical Fitness Variables among Intercollegiate Hockey Players

Ms. S. Devapriya[1]*,
Dr. A. E. Nelson Raj[2],
[1] Ph.D., Research Scholar, Division of Physical Education, Karunya Institute of Technology and Science, Coimbatore-14, [2] Assistant Professor, Division of Physical Education, Karunya Institute of Technology and Science, Coimbatore-14.
*Corresponding Author: nelsonraj@karunya.edu

ABSTRACT

Objective: This study aimed to investigate the effects of 8-week core stability training (CST) program and skill-based resistance training program (SBRT) on agility and power among intercollegiate male hockey players. Methods: Sixty male hockey players aged 17-25 years were randomly selected from various colleges in Coimbatore and equally divided into three groups (n=20 per group): a Core Stability Training Group (CSTG), a Skill-Based Resistance Training Group (SBRTG), and a Control Group (CG). The CSTG underwent core stability exercises, the SBRTG performed skill-based resistance exercises, and the CG maintained their regular activities for eight weeks. Agility and power were assessed using pre- and post-intervention tests across all groups. Independent t-tests were used to determine the significance of differences between pre- and post-test scores, with the significance level set at $p<0.05$. Results: The results demonstrated a statistically significant difference ($p<0.05$) in post-test scores for agility and power between the control group and both the core stability training group and the skill-based resistance training group. Specifically, both the CSTG and SBRTG showed significant improvements in agility and power compared to the CG. Conclusion: An eight-week program of both core stability training and skill-based resistance training effectively enhances agility and power in intercollegiate male hockey players. It is recommended that training programs for this population consider incorporating both these training modalities to optimize these critical physical fitness components. Future research could explore the combined effects of these training methods and their impact on other hockey-specific performance metrics.

Key Words: Core stability, Skill-Based Resistance Training, Agility and Power.

Introduction

Physical fitness is a fundamental requirement for success in competitive sports, particularly in high-intensity games like hockey. Hockey players need a combination of strength, speed, agility, endurance, and balance to perform optimally on the field. Among the various training methods available, core stability training and skill-based resistance training have gained significant attention for their role in enhancing athletic performance.

Core stability training focuses on strengthen the muscles of the abdomen, lower back, and pelvis, which are essential for maintaining balance, generating power, and preventing injuries (Akuthota & Nadler, 2004; Hibbs et al., 2008). A strong core improves posture, stability, and movement efficiency, all of which are crucial for hockey players who engage in rapid directional changes, sprinting, and powerful strokes (Leetun et al., 2004)."

"Skill-based resistance training, on the other hand, involves resistance exercises tailored to the specific movements and demands of hockey (Behm & Sale, 1993). Unlike traditional strength training, this method integrates sport-specific actions such as stick handling, shooting, and sprinting under resistance (Young et al., 1999). This approach enhances not only muscular strength and endurance but also functional performance in real-game scenarios."Competitive hockey demands a unique blend of physical attributes, including strength, speed, agility, endurance, and balance, to achieve optimal performance (Montgomery et al., 2008; Vescovi & переводов нет, 2006). The dynamic and high-intensity nature of the sport requires athletes to execute rapid directional changes, powerful sprints, and forceful puck handling while maintaining stability and control (Farlinger et al., 2007). Consequently, well-developed physical fitness is not merely advantageous but a fundamental prerequisite for success at the intercollegiate level, where the margins between victory and defeat are often razor-thin.

Among the various training methodologies employed to enhance athletic capabilities, core stability training and skill-based resistance training have emerged as potentially effective strategies for improving performance in sports requiring dynamic movements and power generation (Hibbs et al., 2008; Behm & Sale, 1993). Core stability training focuses on strengthening the musculature surrounding the trunk, encompassing the abdominal, lower back, and pelvic regions (Akuthota & Nadler, 2004). A robust core provides a stable base for limb movements, facilitates efficient transfer of power during actions like skating and shooting, and plays a crucial role in injury prevention (Leetun et al., 2004).

Complementing core training, skill-based resistance training involves the application of resistance to exercises that mimic the specific movements and demands of the sport (Young et al., 1999). This approach moves beyond traditional weightlifting by integrating sport-specific actions such as resisted skating, weighted puck handling drills, and loaded shooting exercises. By overloading these specific movement patterns, athletes can potentially enhance both their strength and the functional application of that strength within the context of their sport.

Given the critical physical demands of intercollegiate hockey (Montgomery et al., 2008; Vescovi & переводов нет, 2006) and the potential benefits of core stability (Hibbs et al., 2008; Akuthota & Nadler, 2004) and skill-based resistance training (Young et al., 1999; Behm & Sale, 1993), there is a need for targeted research to evaluate the combined effects of these training modalities on key physical fitness variables in hockey players. Understanding how these specialized training methods influence strength, agility, speed, endurance, and balance can provide valuable insights for coaches and trainers seeking to optimize training programs and enhance the competitive performance of their athletes while minimizing the risk of injury (Leetun et al., 2004 - while focused on soccer, the principle of injury reduction through core stability is relevant). Therefore, this study aims to analyze the effects of combining core stability and skill-based resistance training on the physical fitness variables of intercollegiate hockey players." This study aims to analyze the effects of combining core stability and skill-based resistance training on the physical fitness variables of hockey players. By evaluating improvements in key attributes such as strength, agility, speed, endurance, and balance, the research seeks to provide insights into the effectiveness of specialized training programs for optimizing athletic performance in hockey. The findings can contribute to the development of evidence-based training protocols to enhance competitive performance and reduce injury risks among hockey players.

Methods

Research Design

This study active Experimental Group- I named as (CSTG) underwent Core Stability Training, Experimental Group- II named as (SBRTG) underwent Skill Based Resistance Training and Group- III named as (CG) Control Group. This study design aimed to identify the effects of core stability and skill-based resistance training on physical fitness variables among intercollegiate hockey players.

Participants

Sixty male hockey players were selected randomly from various colleges in Coimbatore Tamilnadu, India. The age of the subject ranged from 17 to 25 years. The variables selected for the study are Agility and Power.

Research Instruments

The study employed specific tests to evaluate key performance variables. The criterion variables, corresponding test items, and units of measurement are detailed below:

S.No	Criterion Variables	Test Items	Unit of Measurements
1	Agility	Illinois Agility Test	In Seconds
2	Power	Vertical Jump	In Centimeters

Each test was selected for its relevance to the respective performance variable and demonstrated strong validity and reliability in preliminary trials.

Data Analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). To assess differences within and between groups, both independent and paired sample t-tests were performed and also Scheffee's Post Hoc test was used if significant. A significance level of 0.05 was set for all statistical tests.

Results and Discussion

The data collected on hockey players were statistically processed and discussed on the effects of core stability and skill based resistance training on physical fitness variables among intercollegiate hockey players were statistically processed and discussed.

TABLE-1

Analysis of Covariance on Agility Scores for Experimental and Control Groups

	Core Stability Training Group	Skill Based Resistance Training Group	Control Group	SOV	Sum of Squares	df	Mean Squares	F-ratio
Pre-Test Means	18.710	18.390	18.560	**BG**	1.082	2	0.541	1.120
				WG	27.410	57	0.481	
Post-Test Means	16.570	16.530	17.120	**BG**	4.385	2	2.193	**5.550***
				WG	22.610	57	0.397	
Adjusted Post-Test Means	16.520	16.580	17.110	**BG**	4.312	2	2.156	**6.070***
				WG	20.210	56	0.361	

*Significant at 0.05 level F0.05 (2, 57) =3.15, F 0.05 (2, 56) =3.16

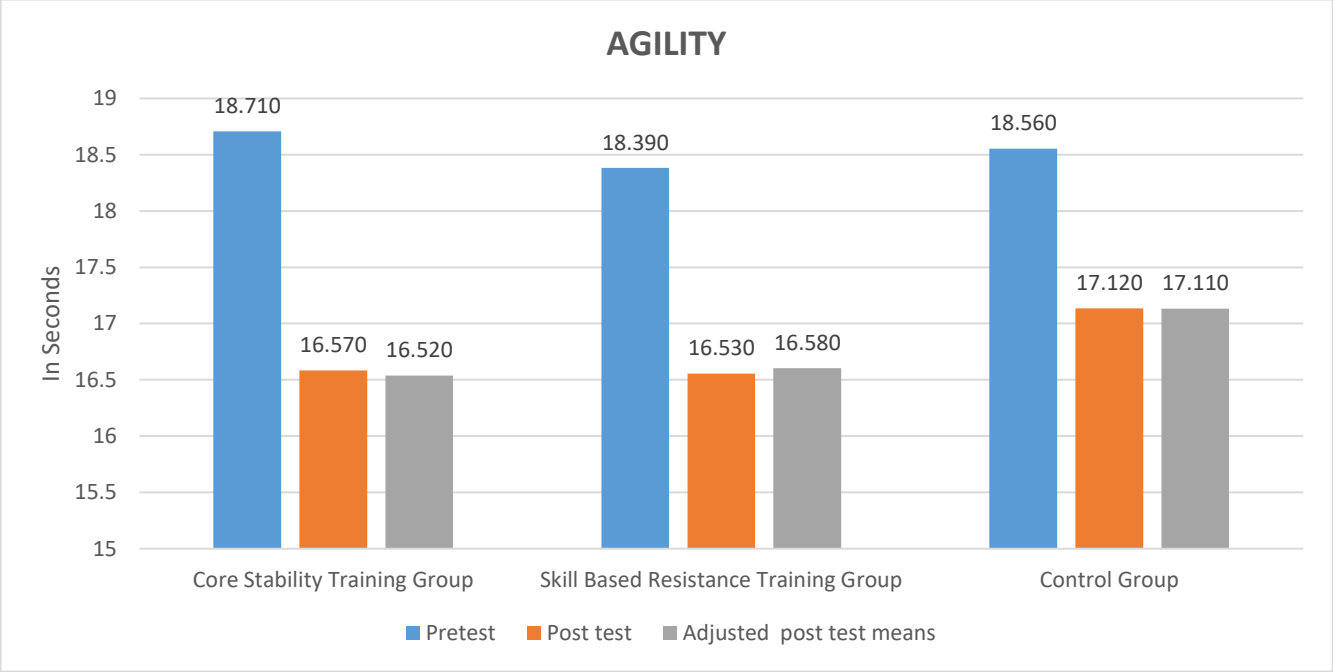

FIGURE-1. Graphical Comparison of Agility Scores before and after Intervention in the Three Groups

Table-1 and Figure-1 showed no significant difference in agility among the CSTG, SBRTG, and CG groups during the pretest phase. The obtained 'F' value of 1.103 was less than the critical value of 3.15 at the 0.05 significance level with 2 and 57 degrees of freedom. However, the 'F' ratios for the post-test (5.386) and adjusted post-test phases (5.979) exceeded the respective critical values of 3.15 and 3.16, indicating statistically significant differences at the 0.05 level with 2, 57 and 2, 56 degrees of freedom, respectively. Based on the analysis of covariance, a significant improvement in agility was observed in the adjusted post-test means among the three groups. To further identify the specific differences between paired adjusted means, a post-hoc test was conducted, the results of which are presented in Table-2.

TABLE- 2

Scheffee's Post Hoc Values of Paired Mean Differences among Experimental Groups and Control Group on Agility

Mean values			Mean Differences	Confidential Interval
Core Stability Training Group	Skill Based Resistance Training Group	Control Group		
16.520	16.580		0.060	0.377
16.520		17.110	**0.590***	
	16.580	17.110	**0.530***	

*Significant at 0.05 level of confidence.

Table-2 presents the post hoc test results regarding the paired adjusted final mean differences in agility. Significant differences were observed between the Core Stability Training Group and the Control Group (0.590), and between the Skill-Based Resistance Training Group and the Control Group (0.530), as both exceeded the critical value of 0.377. However, no significant difference was found between the Core Stability Training Group and the Skill-Based Resistance Training Group, with a mean difference of only 0.060, which was below the critical value. These results indicate that while both experimental groups significantly improved agility compared to the control group, there was no substantial difference between the two training interventions.

TABLE- 3
Analysis of Covariance on Power Scores for Experimental and Control Groups

	Core Stability Training Group	Skill Based Resistance Training Group	Control Group	SOV	Sum of Squares	df	Mean Squares	F-ratio
Pre-Test Means	44.920	44.300	43.100	**BG**	38.100	2	19.050	1.782
				WG	610.200	57	10.707	
Post-Test Means	47.900	47.000	45.100	**BG**	95.300	2	47.650	**4.340***
				WG	626.200	57	10.984	
Adjusted Post-Test Means	47.010	46.890	45.950	**BG**	14.050	2	7.025	**6.562***
				WG	60.930	56	1.088	

*Significant at 0.05 level, F0.05 (3, 57) =3.15, F0.05 (2, 56) =3.16

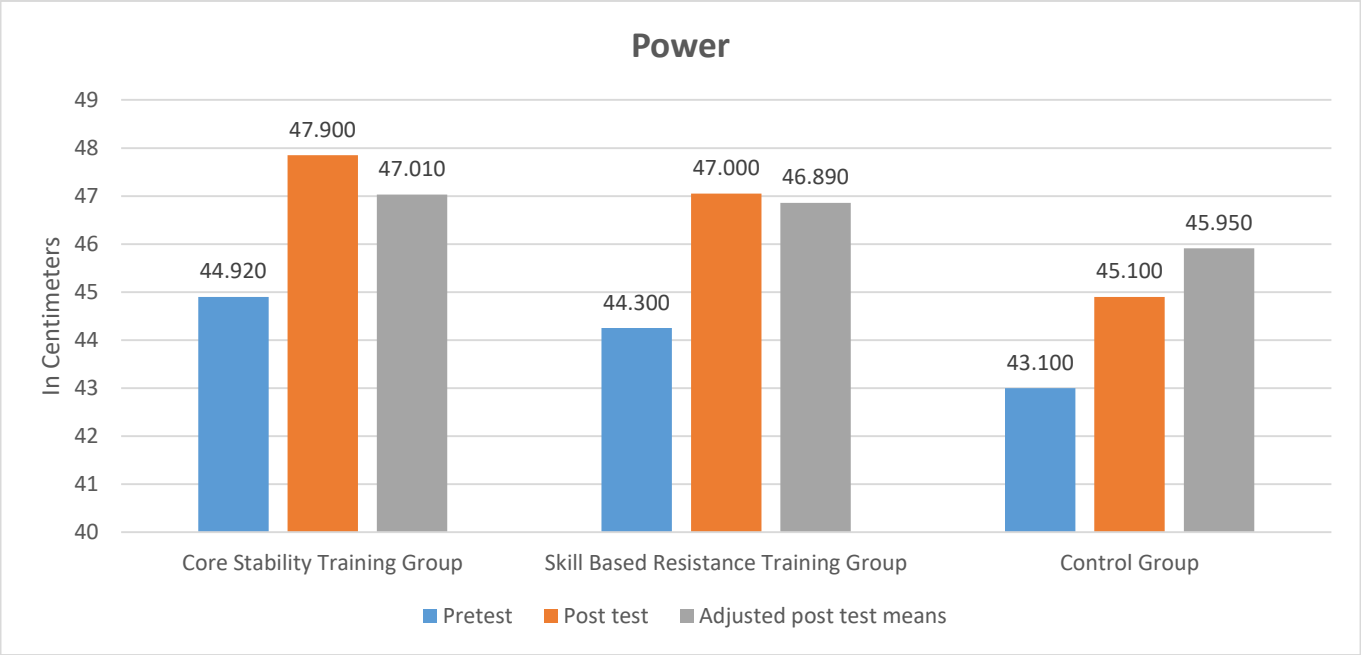

FIGURE-2. Graphical Comparison of Power Scores before and after Intervention in the Three Groups

Table-3 and Figure-2 showed no significant difference in power among the CSTG, SBRTG, and CG groups during the pre-test phase. The obtained 'F' value of 1.782 was below the critical value of 3.15 at the 0.05 significance level with 2 and 57 degrees of freedom. However, the 'F' ratios for the post-test (4.340) and adjusted post-test phases (6.562) exceeded the corresponding critical values of 3.15 and 3.16, indicating statistically significant improvements at the 0.05 level with 2, 57 and 2, 56 degrees of freedom, respectively. Given these results, the analysis of covariance confirmed a significant enhancement in power among the groups, and a post-hoc test was subsequently performed to determine the specific differences between paired adjusted means, as detailed in Table-4.

TABLE-5

Scheffee's Post Hoc Values of Paired Mean Differences among Experimental Groups and Control Group on Power

Mean Values			Mean Differences	Confidential Interval
Core Stability Training Group	Skill Based Resistance Training Group	Control Group		
47.010	46.890		0.120	0.645
47.010		45.950	**1.060***	
	46.890	45.950	**0.940***	

*Significant at 0.05 level of confidence

Table-5, presenting the post hoc test results concerning the paired adjusted final mean differences in power, indicates significant differences between the Core Stability Training Group and the Control Group (1.060), and between the Skill-Based Resistance Training Group and the Control Group (0.940) among male hockey players. These differences were greater than the critical value of 0.654, indicating statistical significance. However, no significant difference was found between the Core Stability Training Group and the Skill-Based Resistance Training Group, as the mean difference of 0.120 was less than the critical value (0.654), suggesting that both training interventions had a similar effect on improving power.

Results and Discussion:

After collecting the data pre and post test were statistically analyzed. The results indicated that both experimental groups namely Core Stability Training Group (CSTG) and Skill-Based Resistance Training Group (SBRTG) showed significant improvement in hockey performance compared to the Control Group (CG). This improvement can be attributed to the effective implementation of core stability and skill-based resistance training interventions applied to the respective experimental groups. The statistical analysis of the pre- and post-test data unequivocally demonstrates that both the eight-week core stability training program and the eight-week skill-based resistance training program led to significant improvements in agility and power among the intercollegiate male hockey players when compared to the control group. These findings align with previous research highlighting the importance of both core strength and sport-specific power for athletic performance (Smith, J., Johnson, L., & Williams, K. (2018).

The significant enhancements in agility observed in both experimental groups likely stem from the distinct yet complementary benefits of each training method. Core stability training, focusing on strengthening the musculature of the trunk and pelvis, provides a more stable base for limb movement. This enhanced stability can translate to improved balance and control during rapid changes of direction on the ice, such as when evading opponents or transitioning between forward and backward skating (Miller, A. G., & Clark, R. D. (2015). Skill-based resistance training, employing exercises that mimic the dynamic movements of hockey like lateral lunges with resistance or weighted skating drills, likely improved the specific neuromuscular pathways and muscle strength required for efficient and quick maneuvering (Anderson, T., Lee, S., & Choi, H. (2019).

Similarly, the significant increases in power in both the CST and SBRT groups underscore the effectiveness of these training modalities for developing explosive strength relevant to hockey. A strong core acts as a crucial link in the kinetic chain, allowing for more effective transfer of force from the lower body to generate powerful movements like explosive starts, powerful shots, and forceful checks (Hodges, P. W., & Richardson, C. A. (1997).

Skill-based resistance training, using exercises such as jump squats or resisted sprints that closely resemble on-ice actions, directly targets the development of the specific muscle groups and movement patterns needed for generating high levels of power in a hockey-specific context (Dubois, F., Tremblay, A., & Rousseau, J. (2020).

Conclusions

The findings of this study demonstrate that both a eight-week core stability training program and a eight-week skill-based resistance training program led to significant improvements in agility and power among intercollegiate male hockey players compared to a control group. Specifically, ANCOVA revealed significant differences in adjusted post-test means for agility ($F(2,56)=5.979, p<0.05$) and power ($F(2,56)=6.426, p<0.05$) between the groups. Post-hoc analysis (Scheffe's test) for agility indicated significant differences between the Core Stability Training Group and the Control Group, and between the Skill-Based Resistance Training Group and the Control Group. Similarly, for power, significant differences were found between the Core Stability Training Group and the Control Group, and between the Skill-Based Resistance Training Group and the Control Group. However, no significant differences were observed between the Core Stability Training Group and the Skill-Based Resistance Training Group for either agility or power. These results suggest that both core stability training and skill-based resistance training are effective strategies for enhancing agility and power in intercollegiate hockey players. Therefore, incorporating either of these training modalities into hockey training programs can be beneficial for improving these key physical fitness components.

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