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## Optimizing performance by improving core strength and stability of fencing players

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### Abstract

The endeavor of this study was to improve the performance of core strength and stability of Fencing Players. Thirty, University level male Fencers of Guru Nanak Dev University, Amritsar between the age group of 18-28 years (Mean  $\pm$  SD: age 21.166 $\pm$ 2.260 yrs, body height 167.946  $\pm$  4.759 cm, body weight 63.593 $\pm$ 3.318 kg) volunteered to participate in the study. The Central Plank Test and Side Plank Test were used to measure the Core Strength and Stability. Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 16.0 software (SPSS Inc., Chicago, IL). Data is expressed as the mean  $\pm$  SD. Paired sample t-test was utilized to compare the means of the Pre-Test and the Post-Test. The level of significance was set at 0.05. Significant differences were found in Central Plank Test in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group. Significant differences were found in Side Plank Test- Right in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group. Significant differences were found in Side Plank Test- Left in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group.

**Keywords:** Performance, core strength and stability, fencing

### Introduction

In terms of youth strength training, substantial research has been conducted regarding feasibility, safety, and effectiveness [1]. When the factors affecting the performance are reviewed, it is seen that the power of muscles is a major contributing factor [2]. The physiological effects of exercises on athletes have been subject matter for many studies [3]. Resistance-training exercises that focus on core musculature are widely used to improve overall balance, flexibility, and strength; they are also used to rehabilitate musculoskeletal injuries, increase spinal stabilization, and decrease the occurrence of lower back pain [4]. Modern fencing emerged as a competitive sport in Europe and is now a well-recognized Olympic sport, with over 150 member federations [5]. Both the sport and the culture of fencing have progressed significantly over the past decades, with an estimated 22,000 participants in the United States in 2006 [6] and 25,000 in Germany in 2008 [7]. The dressing culture and fighting traditions until the 19th century are likely to have contributed to the promotion of this combat sport [8]. Understanding the biomechanics and demands of a sport provides a pathway to injury prevention and safety promotion [9].

### Material and Methods

#### Subjects

Thirty, University level male Fencers of Guru Nanak Dev University, Amritsar between the age group of 18-28 years (Mean  $\pm$  SD: age 21.166 $\pm$ 2.260 yrs, body height 167.946  $\pm$  4.759 cm, body mass 63.593 $\pm$ 3.318 kg) volunteered to participate in the study. The subjects were purposively divided into three groups:

- Group-I: Control (N<sub>1</sub>=15)
- Group-II: Experimental (N<sub>2</sub>=15)

Distribution and demographics of subjects are brought forth in Table-1.

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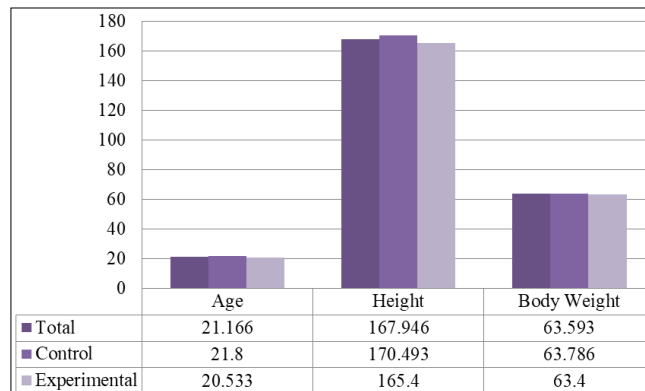
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**Table 1:** Distribution and Demographics of Subjects (N=30) (i.e., Control Group (N<sub>1</sub>=15) and Experimental Group (N<sub>2</sub>=15))

Variable(s)	Sample Size		
	Total (N=30)	Control Group (15)	Experimental Group (15)
Age (yrs)	21.166±2.260	21.8±2.455	20.533±1.922
Height (cm)	167.946 ± 4.759	170.493±3.280	165.4±4.717
Body Weight (kg)	63.593±3.318	63.786±2.832	63.4±3.834

\*N; sample size, yrs; years, cm; centimeters, kg; kilograms.



**Fig 1:** Distribution and Demographics of Subjects (N=30) (i.e., Control Group (N<sub>1</sub>=15) and Experimental Group (N<sub>2</sub>=15))

**Variable**

**Core Strength and Stability**

- Central Plank Test and Side Plank Test were used to measure the Core Strength and Stability.

**Training**

Week's	Training
Week-1	<ol style="list-style-type: none"> <li>Traansversusabdominus (10 repetitions with 15 seconds hold).                             <ul style="list-style-type: none"> <li>Abdominal bracing.</li> <li>Bracing with heel slides</li> <li>Bracing with leg lifts</li> <li>Bracing with bridging</li> <li>Bracing in standing row</li> <li>Bracing with walking</li> <li>Bracing with quadruped position</li> </ul> </li> </ol>
Week-2	<ol style="list-style-type: none"> <li>Parspinal/ multifidi (10 repetitions with 15 seconds hold).                             <ul style="list-style-type: none"> <li>Quadruped arm lifts with bracing.</li> <li>Quadruped leg lifts with bracing.</li> <li>Quadruped alternate arms and leg lifts with bracing.</li> </ul> </li> <li>Central plank (8 repetitions with 30 seconds hold).</li> <li>Abdominal bridging (10 repetitions with 15 seconds hold).</li> </ol>
Week-3	<ol style="list-style-type: none"> <li>Quadratuslumborum and obliques (6 repetitions with 30 seconds hold).                             <ul style="list-style-type: none"> <li>Side plank with knees flexed.</li> <li>Side plank with knees extended.</li> </ul> </li> <li>Planks with variation of arm and leg(6 repetitions, 3-3 on each side with 30 seconds hold)                             <ul style="list-style-type: none"> <li>Plank with 1 arm raise.</li> <li>Plank with 1 leg raise.</li> </ul> </li> <li>Trunk Curl (2 sets, 30 repetitions).</li> <li>Abdominal bridging with leg raise (10 repetitions with 15 seconds hold).</li> </ol>
Week-4	<ol style="list-style-type: none"> <li>Central planks with variations(6 repetitions with 30 seconds hold)</li> <li>Sit-ups (2 sets of 30 repetitions).</li> <li>Cross crunches (2 sets of 30 repetitions).</li> <li>Leg raises (2 sets of 15 repetitions by descending the legs slowly).</li> </ol>
Week-5	<ol style="list-style-type: none"> <li>Central planks with variations (8 repetitions with 30 seconds hold).</li> <li>Scissors (2 sets of 30 repetitions).</li> <li>Cycling crunches (2 sets of 30 repetitions).</li> <li>Flutter kicks (2 sets of 30 repetitions).</li> </ol>
Week-6	<ol style="list-style-type: none"> <li>Leg circles (30 repetitions).</li> <li>Reverse crunches (2 sets of 30 repetitions).</li> <li>Sitting twist (2 sets of 30 repetitions).</li> <li>V-sit (10 repetitions with 10 seconds hold) (Akuthota, V., <i>et al.</i>, 2008)</li> </ol>

**Statistical Procedure Used**

Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 16.0 software (SPSS Inc., Chicago, IL). Data is expressed as the

mean ± SD. Paired sample t-test was utilized to compare the means of the Pre-Test and the Post-Test. The level of significance was set at 0.05.

## Results

**Table 2:** Descriptive statistics (Mean & Standard Deviation) and paired sample t-test of Subjects (N=30) (i.e., Control Group (N<sub>1</sub>=15) and Experimental Group (N<sub>2</sub>=15) for Core Strength and Stability

Central Plank						
Group	Number	Mean	Standard Deviation	Variance	t-value	p-value
Experimental (Pre-Test)	15	223.626	35.529	1262.342	7.029	
Experimental (Post-Test)	15	227.226	35.915	1289.936		
Control (Pre-Test)	15	227.093	26.941	725.853	1.051	
Control (Post-Test)	15	228.02	27.006	729.328		
Side Plank - Right						
Experimental (Pre-Test)	15	112.933	16.934	286.781	7.641	
Experimental (Post-Test)	15	130.666	17.086	291.952		
Control (Pre-Test)	15	105.866	15.122	228.695	0.684	
Control (Post-Test)	15	106.333	15.384	236.666		
Side Plank - Left						
Experimental (Pre-Test)	15	93.733	15.144	229.352	6.118	
Experimental (Post-Test)	15	112.666	14.709	216.381		
Control (Pre-Test)	15	91.533	15.569	242.409	0.370	
Control (Post-Test)	15	91.8	15.048	226.457		

### Central Plank Test

#### Experimental Group

- The means of Group 1 and Group 2 are significantly different at  $p < 0.05$ .
- The absolute value of the calculated t exceeds the critical value ( $7.0294 > 2.145$ ), so the means are significantly different.

#### Control Group

- The means of Group 1 and Group 2 are not significantly different at  $p < 0.05$ .
- The absolute value of the calculated t is smaller than critical value ( $1.0517 < 2.145$ ), so the means are not significantly different.

### Side Plank Test- Right

#### Experimental Group

- The means of Group 1 and Group 2 are significantly different at  $p < 0.05$ .
- The absolute value of the calculated t exceeds the critical value ( $7.641 > 2.145$ ), so the means are significantly different.

#### Control Group

- The means of Group 1 and Group 2 are not significantly different at  $p < 0.05$ .
- The absolute value of the calculated t is smaller than critical value ( $0.684 < 2.145$ ), so the means are not significantly different.

### Central Plank Test- Left

#### Experimental Group

- The means of Group 1 and Group 2 are significantly different at  $p < 0.05$ .
- The absolute value of the calculated t exceeds the critical value ( $6.118 > 2.145$ ), so the means are significantly different.

#### Control Group

- The means of Group 1 and Group 2 are not significantly different at  $p < 0.05$ .
- The absolute value of the calculated t is smaller than critical value ( $0.370 < 2.145$ ), so the means are not significantly different.

### Conclusion

Significant differences were found in Central Plank Test in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group.

Significant differences were found in Side Plank Test- Right in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group.

Significant differences were found in Central Plank Test- Left in the experimental group subjected to 6-week training. However, no significant changes over that 6-week period were noted in the control group.

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