Effects of Core Strength Training on Agility and Maximal Oxygen Uptake (VO_2 Max) of Soccer Players

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Abstract

The aim of this study was to explore the effects of Core Strength Training on Agility and Maximal Oxygen Uptake (VO_2 Max) of Soccer Players. Sixty, University level male Soccer Players of Guru Nanak Dev University, Amritsar between the age group of 18-28 years (Mean ± SD: age 21.533±2.003 yrs, body height 166.516±6.040 cm, body mass 62.783±3.517kg) volunteered to participate in the study. The core training for stable and unstable surface was given thrice a week. Prior to core training the subjects should warm up for at least 10 minutes. Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 10.0 software (SPSS Inc., Chicago, IL). Data is expressed as the mean ± SD. The results of Analysis of Covariance (ANCOVA) among two experimental groups and control group with regard to the variable of Agility as measured by Illinois Agility Run Test were found statistically significant. The results of Analysis of Covariance (ANCOVA) among two experimental groups and control group with regard to the variable of Maximal Oxygen Uptake (VO_2 Max) as measured by Queens College step test were found statistically significant.

KEYWORDS: Core Strength Training, Agility, Maximal Oxygen Uptake (VO_2), Soccer Players

INTRODUCTION

In this modern era, most of our youth are having sedentary life-style due to excessive exposure to television, computer, internet etc. Our students have physical inactivity due to stressful academics and busy schedule in schools, colleges, classes leading to poor health. The people are more aware of health as compared to us. Regular exercise and sports is very important in young people in their busy life. Sports maintain physical as well as mental fitness and introduce values such as dedication, discipline and responsibility in us.

Core stability and core strength have been subject to research since the early 1980s. (Stanton R, Reaburn PR, Humphries B.; 2004, Fig G.; (2005). Faries and Greenwood provide clearer definitions as to the difference between core stability and core strength for the rehabilitation sector by suggesting that core stability refers to the ability to stabilize the spine as a result of muscle activity, with core strength referring to the ability of the musculature to then produce force through con-tactile forces and intra-abdominal pressure. (Faries MD, Greenwood M; 2007). Core training programmes include processes that target muscular strengthening and motor control of the core musculature (Nadler SF, Malanga GA, Bartoli LA, et al.; 2002).The rationale for the approach of a high focus on core training often relates to the assumption that specific core muscles such as the

transversus abdominis muscle and the multifidus play a key role in stabilising the spine and therefore play a key role in enhancing sport performance (Barr K. P, Griggs M and Cadby T.; 2005.

Speed and agility in team sports represent complex psychomotor skills (Verkhoshansky, Y.V.; 1996). Agility is most often defined as the ability to change direction rapidly (Altug, Z., Altug, T., & Altug, A.; 1987).Moreover, if they are connected with the performance of sport specific skill, inter-correlation decreases even more (Young et al., 2001a). This can be caused also by the fact that training methods of their development are specific for each of the types of speed abilities, thus minimum transfer of qualities between them occurs (Young et al., 2001).

Physiologically VO_2 max is the intensity of an individual to increase metabolic processes with the requirements of increased physical efforts (Laskowski, Ewa Ziemann, Tomasz Grzywacz; 2009).VO_2 max is the measure of aerobic capacity and determined as international standard of physical capacity (John F. Moxens, Kjell Hausken; 2012, Steven A. Hawkins R.A. Wiswell; 2003).

MATERIALS AND METHODS

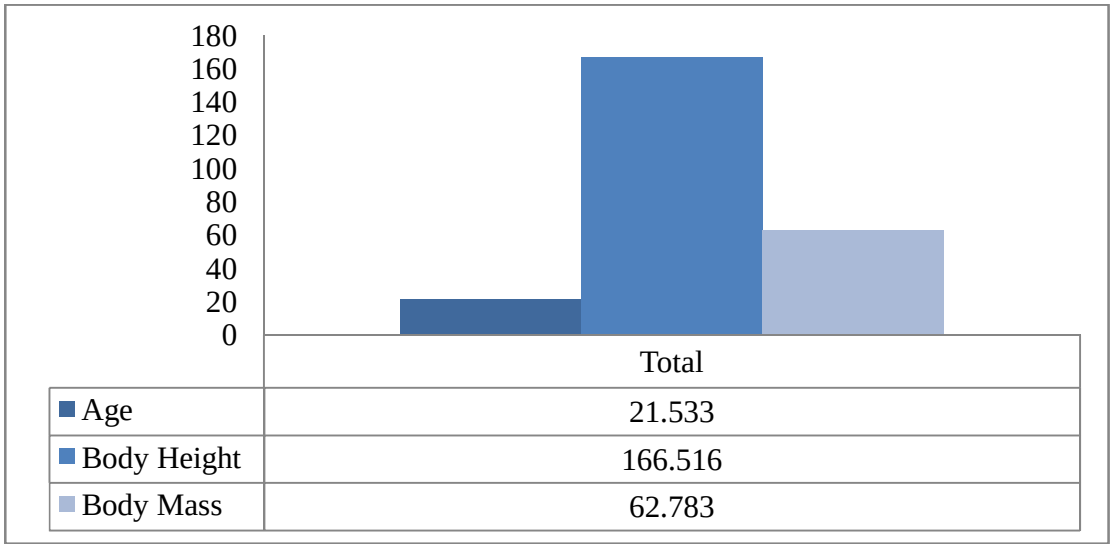
Sixty, University level male Soccer Players of Guru Nanak Dev University, Amritsar between the age group of 18-28 years (Mean ± SD: age 21.533±2.003 yrs, body height 166.516±6.040 cm, body mass 62.783±3.517 kg) volunteered to participate in the study. The subjects were purposively divided into three groups:

- Group-I: Control (N_1=20)
- Group-II: Experimental-A (N_2=20)
- Group-III: Experimental-B (N_3=20)

Table 1. Distribution and Demographics of Subjects (N=60) (i.e., Control (N_1=20), Experimental Group-A (N_2=20) and Experimental Group-B (N_3=20)).

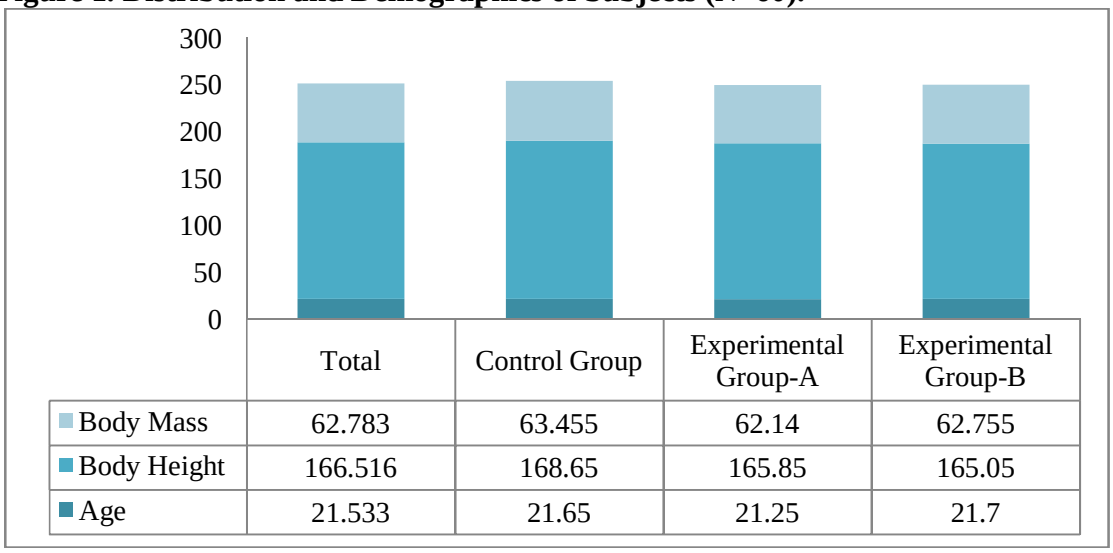
Variable (s)	**Sample Size (N=60)**			
	Total (N=60)	***Control Group (N_1=20)***	***Experimental Group-A (N_2=20)***	***Experimental Group-B (N_3=20)***
Age (yrs)	21.533±2.003	21.65±2.158	21.25±2.022	21.7±1.894
Body Height (cm)	166.516±6.040	168.65±5.193	165.85±6.123	165.05±6.427
Body Mass (kg)	62.783±3.517	63.455±3.567	62.14±3.565	62.755±3.473

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



	Total
Age	21.533
Body Height	166.516
Body Mass	62.783

Figure 1. Distribution and Demographics of Subjects (N=60).



	Total	Control Group	Experimental Group-A	Experimental Group-B
Body Mass	62.783	63.455	62.14	62.755
Body Height	166.516	168.65	165.85	165.05
Age	21.533	21.65	21.25	21.7

Figure 2. Distribution and Demographics of Subjects (N=60) (i.e., Control (N_1=20), Experimental Group-A (N_2=20) and Experimental Group-B (N_3=20)).

PROCEDURE

Agility
The Illinois Agility Run Test: (Miller, et al., 2005)

The length of the course is 10 meters and the width (distance between the start and finish points) is 5 meters. On the track you could use 5 lanes. 4 cones can be used to mark the start, finish and the two turning points. Each cone in the center is spaced 3.3 meters apart.

- The athlete lies face down on the floor at the start point.
- On the assistant's command the athlete jumps to his/her feet and negotiates the course around the cones to the finish The assistant records the total time taken from their command to the athlete completing the course.

Maximal Oxygen Uptake (VO_2 max)
Queens College step test: (Stanton et al., 2004)

The Queens College step test is conducted as follows: Step up and down on the step for 3 minutes at the following rate: 1 Male – 24 steps per minute, Female – 22 steps per minute, Use a metronome or have someone to help you keep to the required pace, 5 seconds after finishing the test – count the heart beats for 15 seconds (PR).

The core training for stable and unstable surface was given thrice a week. Prior to core training the subjects should warm up for at least 10 minutes.

Control Group	**Experimental Group-A (Core Training on Stable surface)**	**Experimental Group-B (Core Training on Unstable surface)**
Subjects will be advised to be carry out their regular exercise program under supervision of coach but reframed from intervention.	▪ The plank was done on stable surface (ground). ▪ Left side plank without slings (3 repetitions with 15s hold) ▪ Right side plank without slings. (3 repetitions with 15s hold) ▪ Prone planks without slings. (3 repetitions with 15s hold)	▪ The plank was done with slings (TRX Slings) that provided unstable surface. ▪ Left side planks with slings (3 repetitions with 15s hold) ▪ Right side planks with slings. (3 repetitions with 15s hold) ▪ Prone planks with slings (3 repetitions with 15s hold)

STATISTICAL ANALYSES

Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 10.0 software (SPSS Inc., Chicago, IL). Data is expressed as the mean ± SD.

RESULTS

Table 2. Analysis of Covariance for Two Experimental Groups and the Control Group with Regard Agility.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	115.398	3	38.466	254.535	.000
Intercept	1.770	1	1.770	11.715	.001
Pre-Test	102.286	1	102.286	676.841	.000
Treatment-Group	1.579	2	.789	5.223	.006
Error	26.598	176	.151		
Total	53907.335	180			
Corrected Total	141.996	179			

*significant at .05 F0.05 (3,176)

It is evident from Table-2 that the results of Analysis of Covariance (ANCOVA) among two experimental groups and control group with regard to the variable of Agility as measured by Illinois Agility Run Test were found statistically significant. The P-value (Sig.) being .006 which was significant as it was less than 0.05 ($p<0.05$). As calculated F-value (5.223*) was found to be significant, hence LSD Post-hoc test was applied to analyze the direction and significance of difference between paired means among two experimental groups and control group mentioned above on the sub-variable Agility.

Table 3. Analysis of LSD Post-Hoc Test for Two Experimental Groups and the Control Group with Regard Agility.

Means		Mean Difference	Sig
Experimental Group-A 17.17	Experimental Group-B 17.27	.10	.14
	Control Group 17.40	.23	.00
Experimental Group-B 17.27	Experimental Group-A 17.17	.10	.14
	Control Group 17.40	.13	.07
Control Group 17.40	Experimental Group-A 17.17	.23	.00
	Experimental Group-B 17.27	.13	.07

Level of Significant at 0.05

1. The mean difference between Experimental Group-A and Experimental Group-B was .10 and the P-value (Sig.) being .14 proving Experimental Group-A had shown better Agility than their counterpart Experimental Group-B although not very significantly.

2. The mean difference between Experimental Group-A and Control Group was .23 and corresponding P-value (Sig.) .00 which established that Experimental Group-A showed significantly better Agility than in their counterpart Control Group.
3. The mean difference between Experimental Group-B and Control Group was .13 and the P-value (Sig.) being .07 proving Experimental Group-B had shown better Agility than their counterpart Control Group although not very significantly.

Table 4. Analysis of Covariance for Two Experimental Groups and the Control Group with Regard VO_2 Max.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2874.839	3	958.280	308.370	.000
Intercept	8.859	1	8.859	2.851	.093
Pre-Test	2793.555	1	2793.555	898.955	.000
Treatment-Group	87.442	2	43.721	14.069	.000
Error	546.930	176	3.108		
Total	430370.775	180			
Corrected Total	3421.769	179			

*significant at .05 F0.05 (3,176)

It is evident from Table-4 that the results of Analysis of Covariance (ANCOVA) among two experimental groups and control group with regard to the variable of VO_2 Max as measured by Queens College step test were found statistically significant. The P-value (Sig.) being .000 which was significant as it was less than 0.05 ($p<0.05$). As calculated F-value (14.069*) was found to be significant, hence LSD Post-hoc test was applied to analyze the direction and significance of difference between paired means among two experimental groups and control group mentioned above on the sub-variable VO_2 Max.

Table 5. Analysis of LSD Post-Hoc Test for Two Experimental Groups and the Control Group with Regard VO_2 Max.

Means		Mean Difference	Sig
Experimental Group-A 49.44	Experimental Group-B 48.90	.54	.09
	Control Group 47.76	1.67	.00
Experimental Group-B 48.90	Experimental Group-A 49.44	.54	.09
	Control Group 47.76	1.13	.00
Control Group 47.76	Experimental Group-A 49.44	1.67	.00
	Experimental Group-B 48.90	1.13	.00

Level of Significant at 0.05

1. The mean difference between Experimental Group-A and Experimental Group-B was .54 and the P-value (Sig.) being .09 proving Experimental Group-A had shown better VO_2 Max than their counterpart Experimental Group-B although not very significantly.
2. The mean difference between Experimental Group-A and Control Group was 1.67 and corresponding P-value (Sig.) .00 which established that Experimental Group-A showed significantly better VO_2 Max than in their counterpart Control Group.
3. The mean difference between Experimental Group-B and Control Group was 1.13 and corresponding P-value (Sig.) .00 which established that Experimental Group-A showed significantly better VO_2 Max than in their counterpart Control Group.

REFERENCES

1. Stanton R, Reaburn PR, Humphries B. (2004). The effect of short-term Swiss ball training on core stability and running economy, *J Strength Cond Res* 18 (3): 522-8.
2. Fig G. (2005). Sport-specific conditioning: strength training for swimmers - training the core, *Strength Cond J*. 27 (2): 40-2.
3. Faries MD, Greenwood M. (2007). Core training: stabilizing the confusion, *Strength Cond J*; 29 (2): 10-25.
4. Nadler SF, Malanga GA, Bartoli LA, et al. (2002). Hip muscle imbalance and low back pain in athletes: influence of core strengthening, *Med Sci Sports Exerc*; 34 (1):9-16.
5. Barr K. P, Griggs M and Cadby T. (2005). Lumbar stabilization: Core concepts and current literature, part 1, American *Journal of Physiology and Medical Rehabilitation*, 84: 473–480.
6. Verkhoshansky, Y.V. (1996). Quickness and Velocity in Sports Movements, *New Studies in Athletics*, 11(2-3), 29-37.
7. Altug, Z., Altug, T., & Altug, A. (1987). A test selection guide for assessing and evaluating athletes, *National Strength and Conditioning Association Journal*; 9(3), 62-66.
8. Young, W.B., Benton, D., Duthie, G., & Pryor, J. (2001a). Resistance Training for Short Sprints and Maximum-Speed Sprints, *Strength and Conditioning Journal*, 23(2), pp.7-13.
9. Young, W.B., Mcdowell, M.H., & Scarlett, B.J. (2001). Specificity of Sprint and Agility Training Methods, Jounrla *of Strength and Conditioning Research*, 15(3), 315-20.
10. Radosław Laskowski, Ewa Ziemann, Tomasz Grzywacz. (2009). Comparison of aerobic capacity in various groups of adolescent athletes, *Archives of Budo*; Vol (5): 21-25.
11. John F. Moxens, Kjell Hausken. (2012).Comparing VO_2 max Improvement in Five Training Methods, *Adv. Studies Theor. Phys; Vol*. (60), no.19, 931-957.
12. Steven A. Hawkins R.A. Wiswell. (2003). Rate and Mechanism of Maximal Oxygen Consumption Decline with Aging. *Sports Med*; 33(12):877-888.