Relationship between Body Core Stabilization and Athletic Function in Football, Basketball and Swimming Athletes

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Abstract: Core stability is an ability to control movement and position of trunk on pelvic that permits distal segments to control and transfer force and motions during sport activities. Muscle contraction can improve this stability. Improving core stability can also cause improvement in athletic functions, prevention of injury, increasing power, improve stability and balance. This study determines the relationship between core stability and athletic functions in football, basketball and swimming athletes. This study had easy sample and participants were men between 20-30 years old; consist of 3 groups, 20 persons in each one, professional athletes of football, basketball and swimming. Participants which had inclusion criteria examined in two continues days.in the first day core stability tests such as anterior, posterior and lateral (right, left) abdominal muscles endurance test, and in the second day functional tests including vertical jump, 40 yard running, medicine ball throw and star excursion balance test were done. Statistical techniques were ANOVA and Pearson Correlation. According to findings it was showed that core stability means in football, basketball and swimming athletes had not significant differences with each other. In assessment of relationship between core stability tests with functional tests (vertical jump, medicine ball throw and star test) small positive relationship was seen, but between core stability and 40 yard running, no significant relationship was found. Although we found small relationship between core stability test and functional tests (except running) but correlation was small one. So we can't conclude about this relationship and we need to do some more researches.
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Introduction

The importance of core stabilization system in creating stability and power system during sport activities has an important consideration. Core stabilization system monitors the movement of the trunk on the pelvis and cause of the generation, transmission and control of force and motions to the lower extremity in sports activities. Core stabilization is defined as the ability of set or lumbar, pelvic, femoral flexion to avoid bend and return of balance after instability. Vertical pressure, resulting in muscle contraction can increase core stability [3-4].

Core stabilization controls body movement on pelvis. This system also control and transfer of force and moving to the distal segment in sporting activities. It also plays an important role in restoring balance in the body after instability. Stability depends on the coordination of the muscles around the lumbar spine. Increasing of core stability to improve athletic performance or prevent injuries in athletes is still controversial. In this regard, little research has been conducted and the results of different studies on the relationship between core stability and athletic performance shown.

Strengthen of the body core stabilizer muscles has been as a way to enhance athletic performance [5]. Body core stability is an important component and it enhancing lead to highest level of athletic performance [6]. Increased stability for improved athletic performance is a controversial issue. Thus, core stabilization as functional cause of protection of the pelvis neutral position while protecting the lumbar spine. It is also very important in terms of injury prevention.

Studies have shown several conclusions about the relationship between core stability and athletic programs. It seems that the core muscles play an important role in the energy transfer process from the trunk to the extremities [8]. Nikolaidis (2010) investigated core stability in tree groups of players, including a woman group and two men groups. In this study performed four core stability test consisting of trunk flexor muscle endurance, straight trunk and the left and right side of the bridge. The result shows no differences between groups in the trunk flexor muscle endurance. Female athletes were better in trunk right muscle endurance compare to male group. Also, female athletes reported that trunk flexor muscle endurance is lower compare to right muscles of the trunk [3].

Handzel (2003) conducted a series of power exercises and Plyometric in three days. Chopping and Single leg Squat exercises placed in the first day, Plank exercises and Standing one arm row exercise placed in the second day, and Medicine Ball Pull Over and Squat jump throw exercise program placed in third day. The result indicated that exercises program is important for core stability. Also, exercises program cause to reduce damage, even if some of exercise place in sick daily exercise program. But this does not mean that these exercises can be replaced by other strengthening exercises. It can be recommended functional and specific exercises for athletes to improve the success of them [1].

Wilson (2005) determines the relationship between core stability and lower extremity function and injury, respectively. The results show that appropriate interventions can reduce damage of inferior extremities [4]. Nikolenko (2011) studied the relationship between the two core tests as with emphasis on power and exercise performance. The results utilized a significant relationship between core muscles and athletic performance [8].

Sharrock (2011) investigated relationship between core stability and performance in men and women athleth students. The results indicated a negative relationship between core stability and ball throw test [11]. Clayton et al. (2011) investigated the relationship between Isokinetic core power and functional test in male baseball players. The first research findings show that there is a significant relationship between medicine ball throws to back from overhead and Isokinetic core power when that trunk flexion is done with ball throw simultaneously. Also result of the study indicated that there is a significant relationship between trunk flexion and body weight, BMI, fat percentage of body and fat weight. The complexity of core muscle should be considered due to effect of core mussels on specific athletic activities [12].

Core stability training program are done largely by trainer. Despite importance of athletic performance on increasing of core stability and central power, few studies have shown increasing of athletic performance by core stabilization exercises. Studies are limited about relationship between core stability and athletic performance. Since central system is center of all activities in athletic activities, it seems that power and function of muscles have affected on inferior and superior extremities [6]. So, the purpose of the present study is to determine relationship between body core stability and athletic performance in swimming, football and basketball athletes.

Objectives

1. To describe the abdominal anterior muscles endurance, trunk posterior muscles endurance, trunk lateral muscles endurance in in swimming, football and basketball athletes.

2. To determine relationship between body core stability and vertical jump in swimming, football and basketball athletes.

3. To determine relationship between body core stability and distance of throw the medicine ball in swimming, football and basketball athletes.

4. To determine relationship between body core stability and time required for 40 yard running in swimming, football and basketball athletes.

5. To determine relationship between body core stability and Star excursion balance test in swimming, football and basketball athletes.

6. To determine difference of body core stability in swimming, football and basketball athletes.

Hypothesis

1. There is a significant relationship between body core stability and vertical jump in swimming, football and basketball athletes.

2. There is a significant relationship between body core stability and distance of throw the medicine ball in swimming, football and basketball athletes.

3 There is a significant relationship between body core stability and time required for running 40 yard in swimming, football and basketball athletes.

4. There is a significant relationship between body core stability and Star excursion balance test in swimming, football and basketball athletes.

5. There is a significant difference in core stability of in swimming, football and basketball athletes.

Methods

Study variables are consist of core stabilities which includes the anterior trunk muscle endurance - posterior trunk muscles endurance - lateral trunk muscle endurance and function that is consist of the vertical jump - Medicine Ball throw distances - 40 yards running time - Star excursion balance. The research method in the present study is cross-sectional and correlation.

Sample and sampling method

According to Software (Mac-calk), the sample size of the present study is 60 athletes. Samples have been selected as available sampling among professional swimming, football and basketball athletes. Inclusion criteria for participants as follow: 1) athletes 20 t0 30 years old, 2) having regular exercise in the sport for at least two sessions per week. Exclusion criteria also included 1) musculoskeletal injury in superior or inferior extremity or vestibular system problem in last six months, 2) chronic backache.

Measures

Samples have been tested in two consecutive days. Data related to body core stability have been conducted in the first day and data related to function have been conducted in the second day [13]. Core stability tests were conducted by McGill [14] to measure trunk anterior, posterior and lateral muscle endurance which is recorded by a timer.

1. Trunk Anterior Muscle Endurance Test

Person sits on the ground. Back of person has a 60-degree angle with the ground and knee and hips are at a 90 degree. Examiner calculated time that person is able to maintain this position [13].

Figure 1

2. Trunk Dorsal Muscle Endurance Testing

Trunk superior placed outside the edge of the bed, while the hands are placed on the opposite shoulder and an inferior extremity is supported. When the stem ends of the horizontal line test has been passed [13]

Figure 2

3. Trunk Lateral Muscle Endurance Testing

This test is done as a full bridge side (both left and right) and person relies on elbows and legs of the same side. Upper foot placed in front of lower foot. Also, the upper hand placed on the opposite shoulder. Person separates his/her pelvis from the ground so that the whole body is in one direction. If person bend his/her lumbar or her/his pelvis comes near ground, test ends. Finally, all tests time have been collected and a unit index is calculated for body core stability [13].

Figure 3

4. Vertical Jump Height Test

At first person is located next to the wall (the meter is calibrated). Person's hand height is measured when standing. Then person should do vertical jump with raise and down her/his hand one time. At the same time, examiner determines the highest point of hand reaching. The jump is done 3 times with three minute break between each jump. Different between maximum hands reaching distance with initial rate was recorded as vertical jump [13].

5. Medicine Ball Throw Distance Test

Person should throw a 2 kg medicine ball from overhead with full of power. While the legs placed together and slightly apart. The maximum throw distance was recorded with three times ball throw.

6. 40 Yards Running Tests

This test is used to determine speed. Running time (three times) was measured and shortest time was recorded.

Data Analysis

Data from the present study were processed and analyzed using Statistical Package for Social Science (SPSS) version 19. Descriptive statistics such as mean score, standard deviation, percentage and frequency distribution were used to describe the demographic profiles of the respondents. Inferential statistics that was used in the data analysis was Pearson Correlation Analysis to conduct of relationship between body core stability and athletic function. Also, ANOVA was used that determine difference of core stability of in swimming, football and basketball athletes.

Results and findings

1. Demographic characteristics

According to Table 1, there is no significant relationship in age ($p=0.787$) and Height ($p=0.774$) between three groups. While there is a significant relationship in weight between three groups ($p<0.05$). This relationship may be due to differences in demographic characteristics in different sports. And certainly as much as basketball players are

taller, the average weight is higher than the other two groups.

Table 1: Demographic Characteristics of Respondents

Groups	Swimming	Basketball	Football	
Variables	**Mean ± SD Mean**	**Mean ± SD Mean**	**Mean ± SD Mean**	**p**
Age (years)	2/282±22/95	1/593±22/30	1/861±22/10	0.787
Height	177/30 ± 6/375	181/35 ± 6/401	172/90 ± 5/251	0.774
Weight	70/10± 9/503	75/50 ± 9/259	64/85 ± 5/060	0.022
Anterior	122/65 ± 57/379	127/15 ± 45/903	127 ± 95/575	
Posterior	88/05 ± 23/323	109/30 ± 32/745	92/05 ± 29/918	
Lateral	142/70 ± 42/353	160/30 ± 52/605	159 ± 48/793	

2. To describe the abdominal anterior muscles endurance, trunk posterior muscles endurance, trunk lateral muscles endurance

As shown in Table 1, trunk lateral muscle endurance mean is higher (mean= 159) compare to anterior abdominal muscle endurance (mean= 127) and posterior trunk muscles (mean =92.05) in footballer. Also, trunk lateral muscle endurance mean is higher (mean= 160.30) compare to anterior abdominal muscle endurance (mean= 127.15) and posterior trunk muscles (mean =109.30) in swimmer and basket baller.

3. Relationship between body core stability and athletic function in swimming, football and basketball athletes.

The Pearson correlation analysis was conducted to examine the relationships between body core stabilities and athletic function in swimming, football and basketball athletes. The result of the present study in Table 2 indicated a significant positive relationship between body core stability and vertical jump ($r=0.30$, $p<0.017$). This means that athletes with higher score in body core stability reported higher vertical jump height. Pearson correlation test was also showed that body core stability and distance of ball throw was significantly correlated ($r=0.358$, $p<.05$), however, the strength of correlation between body core stability and distance of ball throw is medium. Pearson correlation results showed that there is a positive significant between body core stability with dynamic balance ($r=0.293$, $p=0.023$). While, there is no significant relationship between body core stability and running ($r=0.14$, $p>0.05$).

Table 2: relationship between body core stability and athletic function

Core stability	Correlation Coefficient	p-value
Vertical jump height	0.308	0.017
Distance of ball throw	0.358	0.005
Running	-0.145	0.268
Dynamic balance	0.293	0.023

4. Difference of body core stability in swimming, football and basketball athletes.

ANOVA test was conducted to test the significant difference of core stability in swimming, football and basketball athletes. The results are displayed in Table 3, findings of the present study showed that there was not a significant difference in body core stability of three groups (P=0.744)

Table 3: Comparison of Mean Body Core Stabilization in Three Groups

Groups	**Group I**	**Group II**	**Group III**	**P-value**
Variable	Mean ± SD	Mean ± SD	Mean ± SD	
Core stability	377/70 ± 130/77	396/75 ± 111/211	367/40 ± 123/840	0/744

Results and Discussion

The purpose of the present study was to determine the relationship between body core stability and athletic function in football, basketball and swim athletes. The results show that mean of core stabilization is fairly equal in three groups of athletes. This means that activity or exercise does not effect on body core stability. In other hand activity or involvement of inferior extremities in soccer and involvement of superior extremities in basketball or summing function does not effect on body core stability and three athletes group had same core stability despite different types of exercise and physical activity.

Pich et al. (2010) indicated that transverse abdominal muscle contraction is independent of the direction and speed of extremities movement. These findings indicate that core stabilization muscle activity is independent of the type and severity of limb movement. Also, the results shows that there is a weak significant relationship between core stability and function tests such as vertical jump, ball throwing and dynamic balance. While there is not a significant relationship between core stability and 40 yard running test. The finding of the present study is consistent with Morgan et al. (2003) that found core stability impact on function improving. Also, there is no significant relationship between core stability and running test. One reason for lack of this relationship is the importance of fitness, individual and genetic differences in term of muscle fiber type, flexibility, and cardiovascular factors in running test. Thus, core stability alone is not effect on running [1]. The finding of the present study is inconsistent with Nikolenko et al. (2011) that found there is not significant relationship between core stability and vertical jump function. The reason for this discrepancy is due to insufficient samples. On the other, there is a weak significant relationship between core stability and vertical jump. Also, the finding of the present study is similar with Megan et al. (2011) that investigated relationship between core power and functional tests. They found that there is a significant relationship between ball throwing and core power. However ball throwing occurred from back in the present study [12].

The finding of the present study is different with Tse et al. (2005) that found there is not a significant relationship between stabilization exercises and function improving. Lack of relationship in Tse et al. (2005) study is due to training was not enough and long or exercises related to core muscles not provided to athletes. Thus, exercises have not improved function [9-10]. The finding of the present study is in line to Sharrock et al. (2011). However, relationship between core stability and function tests was positive. Maybe, different results are due to gender. Population of the present study is consisted male only. While, Sharrock et al. studied both gender and maybe core power or core stability be different in male and female [11].

Conclusions

At first, there is not a significant difference in core stability in swimming, football and basketball athletes. Also, there is a weak significant relationship between core stability and vertical jump, ball throwing and dynamic balance. However, a definitive conclusion in this regard due to the lack of available studies is not possible. Also, need for more studies need to be done.

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