Core Stability Relation To Physical Performance In Some Collectivity Games

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ABSTRACT

Study Design: Correlation study

Objectives: To objectively evaluate the relationship between core stability and athletic performance measures in male collegiate athletes.

Background: The relationship between core stability and athletic performance has yet to be quantified in the available literature. The current literature does not demonstrate whether or not core stability relates to functional performance. Questions remain regarding the most important components of core stability, the role of sport specificity, and the measurement of core stability in relation to athletic performance.

Methods: A sample was thirty collegiate athletic, selected intentionally from the student athletes in Minia University teams, The athletic teams represented in the current study population included; men's basketball (10), men's Handball (10), men's Volleyball (10). Participants performed a series of eight tests: Trunk Flexion, Back extensors, Right Flexion, Left Flexion, the forty yard dash, the T-test, vertical jump, and a medicine ball throw.

Results: Correlations between the some core stability tests and each of the other four performance tests were determined .

Conclusions: There appears to be a link between a core stability test and athletic performance tests; however, more research is needed to provide a definitive answer on the nature of this relationship. Ideally, specific performance tests will be able to better define and to examine relationships to core stability. Future studies should also seek to determine if there are specific sub-categories of core stability which are most important to allow for optimal training and performance for individual sports.

" Core Stability Relation To Physical Performance In Some Collectivity Games "

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Introduction:

It is believed that a strong core allows an athlete the full transfer of forces generated with the lower extremities, through the torso, and to the upper extremities and sometimes an implement. A weak core is believed to interrupt the transfer of energy, resulting in reduced sport performance and risk of injury to a weak or underdeveloped muscle group. For this reason, there is an assumption that an increase in core strength will result in increased sport performance. Therefore, training the core has become popular among strength coaches and personal trainers as a means to improve performance and reduce the chance for injury .

The current literature offers a variety of suggestions for defining core stability, but remains unclear on a precise conclusion. According to Tse et al,(2005) "The core musculature includes muscles of the trunk and pelvis that are responsible for maintaining the stability of the spine and pelvis and are critical for the transfer of energy from larger torso to smaller extremities during many sports activities." Therefore, it is theoretically believed that if the extremities are strong and the core is weak the decrease in muscular summation through the core will result in less force production and inefficient movement patterns.

The core is comprised of nearly 30 different muscles that basically wrap around the body in the area between the hips and ribcage. This area connects upper and lower body so it can function as one. The core is fundamental to all body movements. Any one hardly make a movement without engaging core. A strong core provides balance and stability, a necessity in athletic movement, so core is the basis for all athletic movement, whether hitting, throwing, twisting, swing or running, he is relying on core strength, all athletic powerful movements start from the center (core) of the body out, and never from the limbs alone. Core strength allows the body to maintain a solid foundation in the torso and transfer that energy from the center of the body out to the limbs (Lovelace, B. 2009.p2).

According to Chabut, L. (2009) Core stabilization is the expression used for how the muscles in your trunk keep your spine and your body stable. When all the muscles in your core work together, you'll see the following results:

✓ Better posture.
✓ More powerful and efficient movements.
✓ A more balanced body.
✓ Fewer injuries.
✓ Tighter internal and external muscles.
✓ Better control over your extremities (arms and legs) (Chabut, L. 2009. p29)

Kibler, et al.(2006) appended that; Core stability is a pivotal component in normal athletic activities. It is best understood as a highly integrated activation of multiple segments that provides force generation, proximal stability for distal mobility, and generates interactive moments (Kibler, W.B. et al. 2006. P197).

Core stability and core strength have been subject to research since the early 1980s. Research has highlighted benefits of training these processes for people with back pain and for carrying out everyday activities. However, less research has been performed on the

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benefits of core training for elite athletes and how this training should be carried out to optimize sporting performance (Hibbs et al. 2008. P995).

There were many review articles as Hibbs (2008), Cissik (2011), Kibler (2006), Gamble (2007), Stanton (2004), Willardson (2007), or literature like Akuthota (2008) and Lovelace (2009) that promote core training programmes and exercises for performance enhancement. Withal there are some books and scientific review as Chabut (2009), McGill (2007), Clover (2007), Clark (2004), and Boyle (2004) has reference to a clearer understanding of the roles that specific muscles have during core stability. Some experimental studies like Stanton (2004), Samson (2005), Tse (2005), Sato (2009), Sharma (2012), and Nagi (2013) which finding in their results that core stability exercises enable more functional effects and positive impact on the performance, which result in a more direct/indirect effective transfer of these skills to actual sporting activities.

Furthermore, there is a correlation or description studies which search relationships between core stability and sport performance, like Nesser (2008), Nesser (2009), Sharrock (2011), Okada (2011), The objective of these studies was to critically evaluate the relationship between a core stability test and athletic performance measures.

According to previous, there was a clearer understanding for the researcher's. That's, there are fewer in the studies which search the relationship between core stability and athletic performance measures, especially in the Arab environment. Therefore, the purpose of this study was to identify a relationship between core stability and athletic performance measures in a group of collegiate athletes.

Research Objectives:

The aim of this research was to investigate the relationship between core stability and athletic performance tests in college athletes.

Research Hypotheses:

We hypothesized that there would be a significant relationship between core stability and performance in this community.

Research terminology:

Core:

The central section of the body consisting of the cervical, thoracic and lumbar spine, pelvic girdle and hip joint, and all of the muscles that attach to these specific areas .(Clark, M.A. et al., 2004, p288).

Core Musculature:

The musculoskeletal core of the body includes the spine, hips and pelvis, proximal lower limb and abdominal structures. The core musculature includes the muscles of the trunk and pelvis that are responsible for the maintenance of stability of the spine and pelvis and help in the generation and transfer of energy from large to small body parts during many sports activities (Kibler WB, et al. 2006, p189).

According to "Clark, M.A. et al." (2004) The core Musculature has been defined as the lumbo-pelvic-hip complex, thoracic and cervical spine. The core is where the body’s center of gravity is located and where all movement begins (Clark, M.A. et al., 2004, p287).

Core stability:

Defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities. (Kibler WB, et al.2006; p189).

Research plan and procedures:

I - Research Methodology

Researchers used correlation design with measurements for one group as it suits research nature and to fulfill research goals.

II - Research community

The research community has selected the subjects from the student athletes in Minia University teams for the academic year 2012/2013.

III - Research sample

Sample was thirty collegiate athletic, selected intentionally from the student athletes in Minia University teams, The athletic teams represented in the current study population included; men's basketball (10), men's Handball (10), men's Volleyball (10). Subjects were excluded if they had experienced a musculoskeletal and/or abdominal injury which required them to seek treatment in the past 60 days.

Table (1) Average, standard deviation, median and skewness coefficient for research sample (n = 30)

Variables		Mean	St.dev	Median	skew
Height (cm)		174.37	6.69	172	2.01
Weight (kg)		63.23	4.79	61	1.22
Age (years)		21.87	0.35	22	-2.27
Age training (years)		4.33	0.55	4	1.41
Core stability tests	**Trunk Flexion (sec)**	130.36	9.05	135	-0.68
	Back Extension (sec)	165.17	2.78	165.5	-0.29
	Right Flexion (sec)	103.2	2.38	103	0.69
	Left Flexion (sec)	99.6	1.96	99	0.64
Performance tests	**T–run agility (sec)**	7.33	0.15	7.3	0.26
	40 yard dash (sec)	6.11	0.53	6.28	-0.78
	Medicine ball throw (cm)	735.7	28.94	724.5	0.85
	Vertical jump (cm)	50.37	3.79	50	0.63

Table (1) results reveal that skewness coefficients for research sample are between (± 3), which refers to normal distribution for research sample in these variables.

Data Collecting tools

I - Tests used in the research:

In light of what mentioned in the previous studies Through what was seen by researchers from previous studies : Nesser (2008), Nesser (2009), Sharrock (2011), Okada (2011), Tse MA, et. al.(2005) ; following tests have been selected to be used in this research:

1- Core stability assessment:

McGill's trunk muscle endurance tests were used to assess core stability. Results from previous studies show that the 4 trunk isometric muscle endurance tests have excellent reliability coefficients, A handheld stopwatch was used to measure the length of time participants were able to hold each isometric position. Individuals were given a minimum of 5 minutes of rest between each test:

(1) Trunk Flexion (Flexor endurance) test.
(2) Back extensors test.
(3) Right Flexion (Right side bridge) test.
(4) Left Flexion (Left side bridge) test.

2- Performance assessments:

Results from previous studies show that the 4 performance tests have excellent reliability coefficients. However these tests are not direct measures of sport performance, but they do measure factors or components of many sports. The factors of power, speed, and agility are three components in most sporting events :

(1) T–run agility test.
(2) The 40 yard dash test.
(3) The medicine ball throw test.

(4) The vertical jump test.

II – Devices and tools used:

- Restameter for measuring height and weight.
- A Vertec vertical height measuring device.
- Digital stopwatch.
- Medicine ball.
- Measure tape.

Research Procedures:

Subjects reported to the testing site in groups related to their team membership (Basketball/Handball/Volleyball) and completed the test sequence as a team, All participants completed testing prior to the start of off-season conditioning.

Subjects reported for two test sessions over a period of two days in 3,4 /3/2013 , with 24 hours rest between the two sessions. The first test session included study familiarization followed by data collection for core stability assessment. The Performance assessments were completed during the second session. Prior to testing on each day, subjects warmed-up as a team by completing a series of a light jog and both static and dynamic stretch for a minimum of 15 minutes or until they felt comfortable to perform the tests. Testing immediately followed the warm-up. The order of the tests was randomized among subjects to prevent fatigue and possible test-order effects.

During the current study, the examiner at each station explained the testing procedure and the proper technique to perform the test. Following instruction subjects were given a practice trial at each testing station in order to allow the subject to acclimate to and understand how to perform the test and allow for the best performance possible. The subjects were instructed not to perform at maximum exertion during the practice trial. The subjects were given the opportunity to ask questions of the examiner at the station for further explanation about the test. The examiner gave no other feedback except to correct improper technique as outlined by the researchers in the instruction. The subject was given a 4 minute's rest period following the practice trial before the first recorded performance.

During the recorded performance subjects were not given encouragement or feedback from the examiner except to correct any improper technique as outlined by the researchers in the instruction. Once the subject completed the performance at the first testing station he rotated to the next testing station on his list. Each subject was given a minimum of a 4 minute break between each testing station in order to allow adequate recovery. The subjects completed all testing stations before restarting the sequence, and completed each testing procedure 3 times.

The best score that each participant obtained on each of the performance tests was used for correlation analysis with the best score that the participant achieved in the core stability tests.

Statistical Analyses:

Descriptive statistics were used along with correlation tests in order to determine whether relationships existed between core stability tests and performance on the performance tests (T-test, 40-yard dash, Vertical Jump, Medicine Ball throw). These values were examined between athletes of each sport. To determine whether statistically significant relationships existed.

RESULTS

Table (2) Correlation between Core stability tests and performance tests, all participants (n=40)

	Total core	Trunk Flexion	Back Extension	Right Flexion	Left Flexion
T–run agility	0.898*	0.817*	0.686*	0.456*	0.477*
40 yard dash	0.138	0.420*	-0.097	-0.474*	-0.337*
Medicine ball throw	0.571*	0.456*	0.362*	0.405*	0.562*
Vertical jump	-0.071	-0.429*	0.122	0.461*	0.294

*Statistically significant

(r) significance at degree (28) at the 0.05 level (1-tailed) = 0.306

Table (2) results revealed that there were statistically significant correlations at 0.05 level between some core stability tests and performance tests where (r) calculated values were higher that (r) significance at (0.05), total core positively correlated with the t–run agility and medicine ball throw test, trunk flexion positively correlated with all performance tests, without vertical jump was negative correlation , and both of right/left flexion test positively correlated with the t–run agility and medicine ball throw test, and right flexion test positively correlated with the vertical jump test. While a negative correlation was discovered between both of right/left flexion test and the 40 yard dash. Either correlational data results showed weak, non-significant correlations between the rest of the tests.

Table (3) Correlation between Core stability tests and performance tests, Handball participants (n=10)

	Trunk Flexion	Back Extension	Right Flexion	Left Flexion
T–run agility	0.082	0.844*	0.683*	-0.097
40 yard dash	0.337	0.906*	0.554*	-0.105
Medicine ball throw	0.135	-0.161	0.164	0.676*
Vertical jump	0.075	-0.322	-0.267	-0.368

*Statistically significant

(r) significance at degree (8) at the 0.05 level (1-tailed) = 0.549

Table (2) results revealed that there were significant correlations at 0.05 level between some core stability tests and performance tests where (r) calculated values were higher that (r) significance at (0.05), both of back extension and right flexion test positively correlated with t–run agility and 40 yard dash, and the left flexion test positively correlated with the medicine ball throw test. While correlational data results showed weak, non-significant correlations between the rest of the tests.

Table (4) Correlation between Core stability tests and performance tests, volleyball participants (n=10)

	Trunk Flexion	Back Extension	Right Flexion	Left Flexion
T–run agility	-0.063	0.709*	0.622*	0.561*
40 yard dash	-0.596*	-0.762*	-0.824*	-0.877*
Medicine ball throw	0.350	0.533	0.619*	0.619*
Vertical jump	-0.015	0.776*	0.891*	0.894*

*Statistically significant

(r) significance at degree (8) at the 0.05 level (1-tailed) = 0.549

Table (3) results revealed that there were significant correlations at 0.05 level between some core stability tests and performance tests where (r) calculated values were higher that (r) significance at (0.05), the t–run agility test positively correlated with back extension and right/left flexion, the medicine ball throw test positively correlated with the right/left flexion test, and the vertical jump test positively correlated with the back extension and right/left flexion test. While a negative correlation was discovered between the 40 yard dash and all core stability tests. Either correlational data results showed weak, non-significant correlations between the rest of the tests.

Table (5) Correlation between Core stability tests and performance tests, Basketball participants (n=10)

	Trunk Flexion	**Back Extension**	**Right Flexion**	**Left Flexion**
T–run agility	0.907*	0.898*	0.068	-0.156
40 yard dash	0.216	0.106	-0.35	-0.333
Medicine ball throw	0.976*	0.964*	0.161	-0.135
Vertical jump	-0.109	-0.149	0.556*	0.456

*Statistically significant

(r) significance at degree (8) at the 0.05 level (1-tailed) = 0.549

Table (3) results revealed that there were significant correlations at 0.05 level between some Core stability tests and performance tests where (r) calculated values were higher that (r) significance at (0.05), both of Trunk Flexion and Back Extension test positively correlated with both of T–run agility and Medicine ball throw test, and the Right Flexion test positively correlated with the Vertical jump test. while correlational data results showed weak, non-significant correlations between the rest of the tests.

DISCUSSION:

In theory, it is accepted that core stability and athletic performance are interrelated, the current study support this relationship. The purpose of this study was to examine the relationship between a core stability test and tests of performance using the mcgill's core stability tests as a measure of core stability in male collegiate athletes in a variety of sports (handball, volleyball and basketball) . The strongest correlation between total core and functional measures was found with the t–run agility and medicine ball throw, trunk flexion positively correlated with all performance tests(without vertical jump was negative correlation), and both of right/left flexion test positively correlated with the t–run agility and medicine ball throw test, and right flexion test positively correlated with the vertical jump.

The results of the current study confirm the work of Scibek et al (2001), which discovered a correlation between a forward medicine ball throw and core stability after a six week therapy ball training program with swimmers.

Our results were confirm too the work of Nagi (2013) who has applied the training programme of the proposed core muscles (12) week (3) training units per week, and the results showed that the proposed training programme has a positive impact on the performance of physical variables and the level of performance of blocking and spiking skills, and that differences between the percentage improvement was attributed to the experimental group.

Current study results are also similar to Nesser et al (2008) who discovered at best only a moderate correlation between several sports-specific measures and core stability. One of the tests used was the bench press, which is a similar test to the medicine ball throw because it is a test of upper extremity power and strength. Other sports-specific measures used in the study included a vertical jump, agility shuttle run, and 40-yard sprints. The purpose of these sports-specific measures is to measure the attributes that are commonly required during many sports

(strength, speed, agility, power, etc.) In hopes of predicting performance ability in an actual game or match. There is no way to predict athletic performance in measures such as points per game, assists per game, etc., but the general thought behind sport specific measures is that the better scores achieved might relate to increased athletic performance (i.e. Faster athletes have better athletic performance).

In the current study, the medicine ball throw was performed in a tall-kneeling position and the participants were prohibited from falling forward after the throw which required isometric control of the core musculature. By performing the test in this manner participants were required to stabilize their trunks while performing an explosive upper extremity countermovement. The other tests used did not focus specifically on stabilizing the trunk and allowed for potential compensation from other non-core muscle groups.

Overall, our results found significant strong relationships between some core stability and strength and power performance variables. There are two possible reasons for these results: 1) the tests used to measure core strength are specific to strength and power in sports of (handball, volleyball and basketball) , and 2) our study incorporated McGill's core stability tests. These tests were designed to measure muscle endurance of the core musculature. Muscles that can sustain prolonged contractions (i.e., muscle endurance) are less likely to fatigue and can thus continue to provide support to the torso over time, reducing the chance of injury or to maintain sport performance. Therefore, greater (i.e., longer) core muscle endurance should correspond with a greater capacity to do work. Because the core stability tests used in the study had reported reliability coefficients of $0.98, we believe that McGill's assessment of core strength is accurate ; however, it may not represent how the muscles operate under functional loads and movements.

According to data from the current study, Handball participants scored in both of Back Extension and Right Flexion test positively correlated with T–run agility and 40 yard dash, and the Left Flexion test positively correlated with the medicine ball throw test. While volleyball participants scored in The T–run agility test positively correlated with Back Extension and Right/left Flexion, the medicine ball throw test positively correlated with the Right/Left Flexion test, and the Vertical jump test positively correlated with the Back Extension and Right/Left Flexion test, and basketball participants scored in both of Trunk Flexion and Back Extension test positively correlated with both of T–run agility and Medicine ball throw test, and the Right Flexion test positively correlated with the Vertical jump test.

Our results were not similar to those of Tse et al. (2005), who also used McGill's tests to measure core muscle endurance and compared core strength with performance variables in rowers, subjects who completed core training and showed improvements in core muscle endurance (McGill's test) did not show improvements in their performance variables, which included one-time measurements of power and a 2000-m time trial on a rowing ergometer. It is interesting to note that even though the 2000-m time trial is a test of muscle endurance and involves the muscles of the torso, the improvement in core strength still had no affect on 2000-m rowing performance. This may be attributable to the specificity of testing and the capacity in which muscles are being used to execute each of the tests; the core stability tests are a measure of static muscle endurance, whereas the 2000-m rowing ergometer trial is a measure of dynamic muscle endurance.

Correlations did improve when the four core tests were added together. The individual core stability tests can be used to determine a core muscle imbalance, which may lead to back pain as suggested by McGill (2007). Because the core muscles work synergistically during movement, it is difficult to single out one specific aspect of core stability and deem it responsible for any given sporting success or failure. The core works together as a unit and, thus, should be analyzed as a unit.

Core stability is a broad construct that includes pro-prospective control, strength, power, and endurance. Tests need to be determined for each of these subcategories because it remains unclear as to which element may be the most important for different sports, as well as which best reflects the combination of tasks related to sport participation. A creation of a gold standard test or test battery would greatly enhance the current knowledge of and the ability to study the relationship between core stability and athletic performance

Possible limitations in this study include the absence of height and weight measurements for the subjects used in the study. It could be possible that relationships exist between these variables and core stability. The population used in this study may have also impacted the results of the data. A small sample of volunteers with similar demographics and a limited variety of sports were examined. The motivational component of the participants' performance was not measured and may have played a role in test outcomes; some may have been more or less motivated to perform at their greatest ability. The athletes were participants in collegiate athletic, selected intentionally from the student athletes in Minia University teams and possibly do not reflect elite athletic performers. Future researchers should attempt to include larger samples, a greater variety of sports (as there may be other activities that require greater core control), elite athletes, and a more demographically diverse sample.

It is the authors' opinion that core training is necessary for optimal sport performance and should not be dismissed. Determination of the role of core stability requires additional research and sport-specific means of determining its effectiveness. One general test may be sufficient to determine an individual's base core stability values, but a true understanding of core training's role regarding whole-body movements for sport performance requires sport-specific testing.

Conclusion

The results of this study suggest that a significant relationship exists between some core stability measure and some of performance measure . Future researchers should seek to identify a gold standard test or battery of tests that quantifies core stability as it pertains to athletic performance. Also, the specific functions of the core, such as stability, strength, or endurance, should be examined separately to determine the relative importance of each. Additional research should focus on specific sports and actual sports performance outcomes such as points per game, goals scored, etc. but also include maximal performances ideally linked to the activity of choice (i.e.-ball speed or distance if related to throwing). It also would be beneficial to examine the relationship between core stability and additional athletic performance tests. The body of literature concerning athletic performance and core stability continues to evolve, but many essential questions remain unanswered. Until the relationship between core stability and athletic performance can be scientifically demonstrated the in the evidence, it will remain hypothetical and theoretical in nature.

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