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Sandip Sinha

Research Scholar, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India

Dr. Anil Mili

Assistant Professor, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India

The effectiveness of core stability to improve motor skills among football players

Sandip Sinha and Dr. Anil Mili

Abstract

The core of our body is mainly considered as the central part of the body and anatomically called as the torso or trunk. All the functional movements made by an individual depend on the core of the body. A lack of core muscular development can not only lead to various sports injuries, but also affect the degree of performance among athletes. An individual's ability to stabilize the core is said to have a better core stability. The core is greatly involved in aiding various movements in the body. Football is a team sport known as soccer in USA and Canada, demanding a very good physical fitness and motor skills and abilities. Core stability has its direct impact on the various components of physical fitness – strength, speed, power, agility, readiness, etc. and training load bearing capacity of an athlete; optimization of all these elements and factors can be achieved through core stability. Understanding the growing demand for the standard of football players especially in various tactical systems – total football, anti-football, catenaccio, tiki-taka, etc. and fast recovery from sports injuries, the core stability need to be optimized for better results. Thus, the purpose of the study is to find out the effectiveness of core stability to improve motor skills among football players.

Keywords: Core, centre of gravity, sports injury, motor skills, hip mobility, core stability

Abbreviations: USA: United States of America, COG: Center of Gravity, CLBP: Chronic Low Back Pain, CNS: Central Nervous System, PNS: Peripheral Nervous System, VO₂ max: Volume of Oxygen Maximum, MHR: Maximum Heart rate

Introduction

The core of the human body is broadly considered to be the torso. The major muscles of the core reside in the area of the belly, mid-back, lower-back, and peripherally includes the hip muscle, shoulder muscle, and neck muscle. The major muscles of the core are the pelvic floor muscles, transverse abdominis, multifidus, internal oblique, external oblique, rectus abdominis, erector spinae, longissimus thoracis, and the diaphragm. The quadratus lumborum, lumbar muscles, deep rotators, cervical muscles, rectus capitis anterior and lateralis, and longus coli can be considered as members of the core group.

The core is useful to stabilize the thorax and pelvis especially during dynamic movements. It also helps by providing internal pressure to expel out substances from the body. Core stability is the ability to control the movement and position of the core. A footballer can greatly control over the movement, position of the core, and other related parts of the body by stabilizing the core.

The core refers to the muscles which are involved to hold the torso in position. The abdominal, lower back and the hip muscles are also involved in positioning the spine and the pelvis. Pelvic stability enables the trunk and pelvic muscles to keep the spine and pelvis in its optimal position during any sporting activity. Any footballer who is able to keep these structures in an optimal alignment enables the muscles and joints present in the lower limbs to function efficiently. The muscles of the lumbo-pelvic hip complex play a vital role in coordinating movement.

In football, the core strength enhances the player's ability to move fast and gain speed, agile enough to change directions easily and quickly with the ball and without ball, optimizing both defensive and offensive tackling skills. The core muscles serve as the base for endurance, correct posture, strength and power, muscular coordination, reducing injury and fast recovery

Corresponding Author:

Dr. Anil Mili

Assistant Professor, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India

for football players. Being the most popular and widely spread team sport, completely depends directly on many different athletic qualities. Speed, agility, power, readiness, flexibility, strength, aerobic and anaerobic capacity are all the required qualities that must be trained properly for optimizing the degree of performance.

Football is becoming increasingly more physical in the present scenario because of the growing demand which urge for best performance level among the players. This urge and demand emphasise on strength training, which play a vital role in the ability to generate force and power. Generating required amount of force and power enables an athlete to perform the given task efficiently and give the best performance. As a result of sports training, emphasizing on core stability and very well-conditioned core muscles allows a footballer to move faster, more explosive and more efficient too. Core development for football players is much needed, and it requires a very scientific approach for preparing the core muscles to gain core stability for pre-match, during match, and post-match sessions.

This study will avail some very specific information to lead a more detailed knowledge on optimizing the strength of the core muscles to achieve core stability with various scientific approaches.

Materials and Methods

A good core program relies less on mindless repetition of exercise and focuses more on awareness. People with good core strength learn to identify and activate the muscles needed to accomplish the task. Learning to activate the core requires concentration, and leads to being more in tune with the body (Lauren Elson, 2018) ^[3].

While training the core one should avoid using momentum and instead perform each exercise with awareness so that the core is actually engaged. Core stability has been invaluable for managing back pain and Scoliosis, and can be done by any individual (Jenny Henderson, 2019) ^[4].

The cornerstone of all athletic movements is the abdominal or core muscles. An athlete can train to increase strength, power, speed, agility, and quickness but if the core muscles are weak the athlete will not reap the full benefits of this hard work. The core muscles serve as a force couple to transfer the power developed in the hips and legs into the arms vice versa. A strong core will also help to protect the back from potential injuries associated with sport participation. Not only is overall core strength important, just as valuable is core muscle coordination. Exercises that place the body in an unbalanced position help to develop the needed strength and coordination needed for the core muscles to function properly. These exercises must be performed properly, the spine must be held in a neutral position with appropriate pelvic tilt (Dr. Sonam Angchok & Sanjeev Jamwal).

Core training is sometimes also referred to as abs or abdominal training; this is actually not entirely accurate. Abdominal exercises primarily work the rectus abdominus, external obliques, internal obliques, and transverse abdominus. Core work uses the abdominal muscles and also includes the multifidus and rotators stabilizer muscles, the erector spinae (both the length and lateral portions), the latissimus dorsi, the gluteus maximus, the trapezius, and a handful of others.

All human movement occurs through a complex sequencing of different muscle groups that interact in either stability or a mobility manner. The body's center of gravity (COG) is typically the basis for most body movements and needs to be

stabilized first before simple things like taking a step, turning to reach, or bending can occur. The various muscles that provide stability around the body's center of gravity are what we know as "The Core". In fact, there are four (04) groups of abdominal muscles, and two of them look good on infomercials but are not as significant in terms of stabilizing the center of gravity. The transverse abdominus and internal oblique have a much bigger role but also work together with certain spinal muscles, like the multifidus to control the center of gravity in all movements (Fluid Physio, 2017) ^[5].

When people talk about having a strong center of gravity, they usually mean good balance, although one's center of gravity is only one part of the equation for balance and stability. In athletics, and especially contact sports like football, rugby and wrestling, a strong, low center of gravity is a key to success, and many athletes take great care to maintain this asset. One can improve on this by assessing the mass distribution, and by exercising the legs, core and stabilizer muscles (Michael Shiva Best).

Some of the researchers urged that the generation of intra-abdominal pressure caused by the activation of the core muscles especially the transverse abdominis serve to lend support for the lumbar spine. The core is also associated with the body's 'Center of Gravity' (COG). During the standard anatomical position, the center of gravity is located anterior to the second sacral vertebrae. The precise location of the center of gravity changes its position with every movement made. The lumbar spine is primarily responsible for posture and stability, and also provides strength required for involvement in dynamic sport, as urged by Michael Yessis.

A Descriptive Approach is used to understand the relationship between core stability and its benefits for improvement in motor skills among football players, finally aiding in increased sports performance along with reducing sports injuries. The study is to draw connectivity among the core of the body with core strength, core stability, center of gravity, components of physical fitness, principles of training load, recovery, and sports injury.

Observations

Theoretically a strong core allows an athlete for the fullest transfer of force generated from the ground through the lower part of the body, the trunk, and finally towards the upper body. A weak core or an unstable core is believed to cause some alternations in the transfer of energy and force resulting in negative sports performance and higher risk of injury to any weak group of muscle.

The first acknowledgement of core stability was by Henry and Florence Kendall who were both physiotherapists and first developed the idea of 'neutral pelvis' in 1940/1950's. Core stability was first introduced by Hodges and Richardson in 1990's during studying the timing of trunk muscles in patients suffering from chronic low back pain (CLBP).

There has been a controversy and a bit of confusion on the definition of the term "Core Stability". Traditionally the term refers to: active component to stabilize the core system which includes deep/local muscles that provide segmental stability (eg. transverse abdominis, lumbar multifidus), and superficial/global muscles (eg. rectus abdominis, erector spinae) which enables trunk movement, torque generation and finally assist to gain stability during more physically demanding tasks. Core stability is also defined as the ability to maintain equilibrium and control the spine and pelvic region during movement without compensatory movement.

The development of core strength is very important for any

athlete. Core strength development is a must for football players, as the nature of the game is very dynamic, intensive, and long duration one. The core is mainly where the balance originates in the body and is what helps a player to stand up, change directions, stop and start at sudden moments, take turns, etc. Core muscles are very important for football players, where the core strength is used for endurance, which enables a footballer to burst speed and power till the 90th minute or sometimes extended up to 120th minute (during tiebreaker), to win a match.

Motor control is nothing but the regulation of movement which possess a nervous system. Motor control includes reflexes and also directed movements. To control a movement, the nervous system must integrate (CNS and PNS) multimodal sensory information's, both from the environment as well as proprioception and elicit necessary signals to recruit the appropriate muscle to carry out a definite task. This pathway travels through many disciplines, which includes the

multisensory integration, signal processing, neuro-muscular coordination, biomechanics, and cognition. A successful motor control results to balance, posture and stability.

The core stability completely depends upon, how strong our core muscles are? How much load and pressure they can handle? How quickly they respond to change in movement? How they aid or support the body for any physical movement? How far they support for maintaining equilibrium of the body, mainly dynamic equilibrium? All the answers can be understood by understanding our core muscles properly and by drawing a scientific connection between core muscles to core strength to core stability to demand and nature of the game and finally to sports performance achieved.

Theoretically a strong core allows an athlete for the fullest transfer of force generated. A weak core is an un-stabilized core and causes some alternations in the transfer of energy or force resulting in negative sports performance and higher risk of injury to any weak muscle.

Table 1(a): Typology of muscles, names and their functions

Typology of muscle	Characteristic features	Name of the muscle	Function
Local/Deep Muscles	Muscles that contribute to the joint stability and located more centrally near the joint, anatomically attaches to many parts of passive elements of the joint to provide stability for the joint during movement.	Transverse abdominis, Multifidus, Diaphragm, Pelvic floor muscle, Internal oblique	Joint stability, Segmental stabilizing or stiffening effect.
Global Muscles	Muscles that are superficial are known as global muscles or outer unit muscles.	Rectus abdominis, External oblique, Erector spinae.	Control spinal orientation and control spinal motion during application of external loads.

Table 1(b): Name of core muscles and their functions

Name of the core muscles	Function
Erector Spinae	Extends our trunk and to stand up straight after bending over.
Rectus Abdominis	Helps to bend forward.
Obliques	Allow to rotate or bend our trunk.
Transverse Abdominis	Stabilizes our pelvis.
Multifidus	Support our spine.

Physiological demands of football

The demands on a football player during a match can be estimated from the match analysis and physiological measurements during the match played. A number of factors influence the demands of a player, mainly the player's physical capacity, technical qualities, playing position, tactical skills, style of playing, ball possession of the team, opponent's performance, seasonal period, playing surface, and finally environmental factors. The very first attempt to analyze the activity of football players was made in Sweden in late 1960's using video analysis. This approach was further carried and developed in England and later in Denmark. Finally, in the early 1990's data on differences between players playing in different positions were presented in scientific journals. The most successful were the multiple camera systems developed by Amisco and Prozone, and high speed cameras installed in different locations in the stadium. These systems provide detailed information on:

1. Post-game analysis.
2. Tactical analysis.
3. Characteristics of the fitness work in the game.
4. Intensive running.
5. Acceleration of players.
6. Style of play.

Positional differences

The profile activity and demand on an individual player is

determined from the positional role. Studies found that top class central defenders cover less distance and also engaged in less high-intensity running than players playing in other positions. Midfielders cover the longest distances (Mohr *et al.* 2003). Central defenders and central defensive midfield players cover the least high-speed running and sprinting distances, whereas forward players cover the longest high-speed running distances (Dellal *et al.* 2011). Central defensive midfield players cover a greater distance than central attacking midfielders, mainly in English FA Premier League (Dellal *et al.* 2011).

Other match activities on demand

There are other activities which also play a major role in the game of football apart from high-intensity running, such as:

1. Short distance acceleration.
2. Total turns taken during a match.
3. Tackles (Defensive and Offensive).
4. Dribbling with the ball.
5. Jumps taken for heading and collecting or clearing (By Goalkeeper) the ball.
6. Throw-in skill.

Discussion

Football is the most popular sport played throughout the world. The sport is extremely in demand and it depends on many different athletic qualities which include strength, speed, agility, power, readiness, flexibility, aerobic and anaerobic capacity, and all these qualities must be trained properly in order to gain the best performance.

Football is an outdoor sport played on large field (90-120 x 45-90 meters) in dimension, and played over a total time of 90 minutes or 120 minutes (if there is a tiebreaker). Footballers cover a total distance of 8-13 km during a match. The distance varies from player to player because of difference in player's position and style of play. The total distance covered consists

of 24% walking, 36% jogging, 20% persuing, 11% sprinting, 7% moving backward, and 2% moving while on possession of the ball (Reilly 1996). Football player possess a large aerobic capacity with VO_2 max levels reported between 55-70 ml/Kg/min in the elite football players (Bangsbo 1994, Bangsbo, Norregaard; and Thorsoe 1991). The game is played at an average intensity close to the lactate threshold approximately 80-90% of Maximum Heart Rate (MHR) (Reilly 1996, Helgerud *et al.* 2001). These figures give a very clear picture about the importance of training both aerobic and anaerobic capacity in conditioning football players.

Football is gaining its popularity and becoming increasingly more physical challenging due to the emphasis on strength training which enables an athlete to produce force and ultimate power and also by reducing the chances of injury. Improving a footballer's ability to produce force and capacity to work, there is an increase in potential to transfer the force produced to execute the skill efficiently to enhance performance. Undergoing a strength and power training, a footballer becomes more efficient to move faster, more explosive with more efficient moves. A well-conditioned core is very essential to help footballers for boosting the performance level.

Importance of core development for football players

Apart from gaining strength, speed, power, agility, flexibility, readiness, etc. core development and core stability helps a footballer in various ways. Football involves a number of multiple movements in all the three planes namely the sagittal, frontal, and horizontal planes. These movements are highly coordinated and require a great amount of energy transfer from the lower body through the trunk to the upper body and other extremities. Without a stable trunk, the arms and legs cannot effectively execute powerful movements during training and competition. A stable trunk always allows a footballer to maintain an upright posture and helps the respiratory system in providing the necessary air flow for maximum oxygen consumption (VO_2 max), which leads to optimal performance.

A stable core absorbs the external forces easily and reduces the risk of injury. Therefore, it is important to focus on a balanced approach for conditioning the core muscles that contribute to optimal movement patterns (dynamic movement).

Each joint in our body requires certain amount of stability and mobility, where stability refers to the ability to control force movement, and mobility refers to the ability to move freely. A good joint mobility requires the muscles around the joint to function effectively for contraction and relaxation to allow fluid movements smoothly. The core of our body consists of many joints, and the primary function of the core is to provide stability in order to achieve better mobility in the joints. Good core muscles development for football players involves a well-balanced approach which ensures spinal stability and hip mobility.

Exercise progression is always an overlooked variable mostly in many training programs. Failing to include progression in fitness training program increases the risk of sports injury. It is very important for an athlete to perform each exercise flawlessly with proper control over it. This can be achieved with the inclusion of exercise progression in a training session. In summary, it appears safe to conclude that football players should be able to perform repeated high intensity exercises, innumerable factors influence the outcome of the match such as total distance covered by a player, physical capacity of an

athlete, technical qualities, playing position of a player, tactical role, style of playing, ball possession of the team, quality of opponent, playing surface, and environmental factors.

Acknowledgement

Quite frequently a lot of research is carried out, both in academic and non-academic institutions in the field of exercise physiology and sports. I felt encouraged by the urge to go for a descriptive and theoretical study on the benefits of core study in the game of football. The study will further support and help to avail a deeper concept about the effectiveness of core stability to improve motor skills among football players.

I am grateful to my guide Dr. Anil Mili, for motivating me to do the study and supporting me throughout with valuable suggestions and ideas. I personally thank to those who all supported me to carry out the study.

I firmly believe that there is always scope for improvement and accordingly I am looking forward for any valuable suggestion to enrich the quality of study in future days.

Sandip Sinha

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