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RESEARCH ARTICLE

THE IMPORTANCE OF FUNCTIONAL TRAINING IN REDUCING THE INCIDENCE OF LCA INJURIES IN FOOTBOLYSTS

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ABSTRACT

The present study through literature review aimed to discuss the importance of functional training in reducing the incidence of ACL injuries in soccer players. The objective of the study was to demonstrate mechanisms of functional training that positively evidence its intervention in the reduction of injuries, including neuromuscular training and proprioceptive training. In addition, the present study may serve as a research source for health professionals, especially professionals in the area of Physical Education. Therefore, it can be concluded that anterior cruciate ligament (ACL) injury is considered to be the most common among the most serious and most frequent in soccer players.

Key words: Football, Previous Cross Ligament, Functional Training.

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INTRODUCTION

When analyzing football within its global and systemic sphere, it is possible to perceive that the modernization of the soccer scene is due to considerable changes in the structuring and applicability of training loads and volumes. As soccer is considered a modality with a high risk of injury, more and more, physical trainers have concerns about the incidence, causes and severity of injuries in modern soccer (Brito 2009). Among these lesions, the most serious of all can be considered the Anterior Cruciate Ligament (ACL) in soccer players (Rocha 2007). However, modern football prioritizes the training requirements within the specificity, with objectives aimed at increasing performance and lower incidence of injuries in footballers (Sargentim, 2010) being considered as functional training. Within the specialized literature and with the advances of the studies on the functional training, it was possible to identify diverse evidences that approach the ACL lesions in soccer players, especially in athletes considered of high sport yield. Therefore, functional training applied to soccer is congruent with the premise of specificity, increasing its mechanical efficiency and, consequently, its sports performance and minimizing the incidence of injuries (Sargentim and Passos 2012; D'Elia, 2017; Boyle; However, In sum, it is believed that functional training is also important in reducing the incidence of ACL injuries in soccer players, research indicates that the high incidence of injuries does not

only affect the youngest of the basic categories, the high incidence rate is also found in the professional (Checchi, 2013), with an even more convincing warning of the importance of functional / preventive work at all stages of training. In other words, it is of vital importance the operationalization of the functional training based on prescriptions of stimuli that are congruent with the specificity of the soccer. Therefore, it is important that the professional that militates within the football context knows about the harm of the ACL injury and about possible practical interventions that can be stimulated to minimize the chances of injury. Since several studies show that ACL injury in soccer players is considered one of the most serious injuries when compared to other more traditional injuries (PEREIRA, 2017).

Objective

The objective of this study is to highlight the importance of functional training applied in the prevention of ACL injuries in soccer players. More specifically, we seek to analyze the data to formulate a scientific theoretical framework on the prescription of functional training for preventive measures of ACL in soccer players.

METHODOLOGY

It is a bibliographical research, based on material already published in the form of electronic websites and materials available in databases such as Scielo, PubMed, periodicals,

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bireme, cev, search and digital library, in Portuguese language, held in the month of September 2018 and has involved articles published in the last 20 years. Using the following descriptors: ACL injury, Functional training, injuries prevention, Functional soccer training.

LITERATURE REVIEW

The Concept of Functional Training

The functional training for FUNCTIONAL TRAINING FOR SPORTS is the training that provides the athletes with the mechanical efficiency in movements with their own body weight, in different planes and anatomical axes. For Michael Boyle, the concept that defines functional training is to train with purpose, making sense of the stimuli within the intended function, bringing a corporal consciousness to the practitioner in all the planes and axes of the movement, within the specificity and basic movement patterns of pull and push vertically and horizontally. To train with purpose, is exactly to train what works, both for objective purposes in the prevention of injuries as in the increase of the performance, always aiming at the quality of the movement patterns. The purpose as training prescription leads to a purpose, based on the motor functionality versus the sport practiced (Boyle, 2018). With this, we compose with all the exercises that resemble the mechanical characteristics of the modality, understanding that the formation of an intelligent and healthy body happens through a series of movements originating from the systemic complexities of soccer, that is, functional training should stimulate the footballer to be more prepared and confident to solve the problems arising from the game itself (Sargentim and Passos 2012).

The objective principle of functional training is to produce in the athlete a greater body stability without losing the quality of the movement. Obviously, in order to absorb all this promotion from the method, it will be of fundamental importance that the professional has a great knowledge of the principles underlying this methodology, as well as generating mechanisms that will produce a specific postural control system for football and increase the athlete's performance indexes during training and especially in competition. On postural control Rothwell (1994) basically defines as the support of the body, stabilization and the balance of the body on the basis of support. Similarly, for Gambeta and Gray (2002) (Boyle, 2018) "Functional training programs need to introduce controlled amounts of instability so that the athlete must react in order to regain their own stability." Thus, the premise of functional training is to offer stimuli that are compatible with the specific need of the modality, through dynamic movements, with different intensities and, especially, involving several joints. For authors Virtuso Junior and Tribess (2005), they advocate functional training with objective purposes in the functional capacity of the individual, as a result of exercises that stimulate the proprioceptive receptors present in the body, which provide improvement in the development of the cenesthetic consciousness and the body control. The ultimate pillar of functional training is to get the practitioner to exercise with the highest possible level of technique, acquiring bodily awareness through intelligent movements that use their own mass in different planes, axes and, depending on the case, surfaces. The principle of never losing quality of movement is a theme defended strictly in all the method of functional training, where it is not a priority to know if the athlete is performing the

movement with more weight, what really makes sense within the functional training is to know if the athlete did not lose the functional / anatomical quality of the movement. There is a theory defended by Charles Poliquin (Boyle, 2015) that emphasizes on the technical fault, where it defends the theory of never counting a repetition after the practitioner to realize the collapse of the technique.

The Concept of functional Training

In opposition sports, it is necessary for the athlete to be able to remain balanced to the detriment of the various propitious demands of the game, such as those related to the specific gesture of soccer (passing, kicking, heading, etc.) and the inevitable physical contact. Therefore, this postural orientation is one of the most important pillars that the functional training should provide the footballer, knowing that this ability to remain stable and / or balanced in different circumstances of the external disturbing stimuli is of great value for the increase of the sporting performance (Sargentim and Passos 2012). For the authors cited, the effectiveness of functional training within soccer should be based on these three strands: (1) Strength; (2) core and (3) Proprioception. Finally, the same authors emphasize that functional football training operations should have two clear and interdependent objectives: 1 - "Improvement of the specific movement of the footballer during the intense and decisive phases of the game; 2 - Greater balance of muscular chains, thus minimizing the chances of pain and injury inherent to the footballer" (Sargentim e Passos 2012, p.72). Neuman (2002) affirms that it is important for the individual to have a well-balanced and strengthened core, so that the player can perform muscular actions more safely, producing more strength at the extremities and lower energy expenditure - minimizing the indices fatigue - during movements.

In the course of the evolution of the physical preparation of modern soccer, the professionals who militated in this scenario were realizing the importance of questioning the traditional method used to acquire performance of these athletes. In actual physical preparation, much has been discussed about the motor functionality applied to the preparation of footballers rather than exclusively thinking about performance. Thus, the functional training applied to soccer is congruent with this premise, where it allows the athlete to perform the more specific movements of soccer, increasing their mechanics and, consequently, their sports performance (Sargentim and Passos 2012). With the advances of studies with character in the functional training for footballers, one of the foundations more evidenced in the literature is the specific global proportionality that the mentioned method evidences, what makes the training more dynamic and attractive. Therefore, the great value of functional training in soccer is to be able to work with athletes seeking results of different proportions, which may be related to the increase in performance or those related to the reduction of injury risks (D'Elia 2017). Therefore, new knowledge verified by researchers in this area of training, has been unleashing concepts that support the reliability of application of the method.

The concept of core and its importance in football

KIBLER *et al.* (2006) found that the core can be defined as the nucleus, the center of the body, being responsible for generating control and movement of the trunk over the pelvis,

allowing the production, transfer and control of force. According to Handzel (2003) the core has several preponderant functions for sport and daily life, since it judges to classify the core as responsible for maintaining balance, stability, strength and coordination improvement during movement. Corroborating with such assumptions presented by the previous authors, Para Santos and Freitas (2010), the body's primary goal is to provide the individual with strength, power and neuromuscular control. These authors further complement the assertion that it is in the center of gravity of the body that initiates all movements, as well as acceleration, deceleration and, especially, the dynamic stabilization during the functional movements (SANTOS and FREITAS 2010) considered specific for soccer. In anatomical terms, the core muscle consists of 29 muscles that help stabilize the spine, pelvis and kinetic chain during functional movements (FREDERICSON, 2005). A methodology based on core training should aim to create bases of support for the application of other physical values, that is, the stabilization and later the strengthening of the core region, will guarantee in a more assured and sustained way, the acquisition of other capacities physical characteristics of the athlete. This makes it necessary to apply this method in the different training stages (Sargentim and Passos 2012), including those of sports initiation, respecting the biological and cognitive individualities of the young soccer player. The pedagogical progression in the operationalization of this strand is a matter of great value within this context, since evolution has only reached its fullness when there is a gradual development of these bases of support (Boyle, 2018). Unlike the conventional sense, the core is a training idea that, in addition to preventing joint and especially muscular injuries, is a methodology that increases the performance and performance levels of the footballer (Sargentim and Passos 2012). With all the studies published over the years on functional training and specifically core training, there are still some paradigms that need to be broken when it comes to functional coaching in soccer. Many professionals with unfounded theories still hold methods that have in fact brought many results, but within the eminent modernization of the evolution of science and sports medicine are methods that should sometimes be discarded and / or unusable.

Opting for a training method that is based on the specificity of movement is one of the greatest riches that sports science has been adhering to over the years (Boyle, 2018). The main foundation that the professional acquires when operating the core training method is the aforementioned specificity, although some movements are not similar to those that soccer players perform in the field, but the trunk activation will be the same as Sargentim (2010, p. 96) "the force, before being activated in the limbs for the execution of the movement, begins in the core region." The foundation created by the good application of this idea of training has in its essence all the contributions contributing to the quality training of the footballer, going through all stages of performance as those related to injury prevention, being characterized with those of higher levels of support, stabilization and body awareness. The use of this current methodology would help in the production of strength in the specific execution of soccer, besides minimizing the chances of muscle fatigue in extremities / peripheral limbs (MONTEIRO & EVANGELISTA, 2011). Therefore, reliable application of the core will bring more assured results from a long-term perspective, serving as a basis for other physical training strands such as speed, agility, endurance and different

fundamental manifestations of strength for the footballer (Wilson, 2006).

Functional Training in Reducing the Injury of Lesions

The main guiding principle of the whole process is to understand that injury prevention is not synonymous with reducing the incidence of injuries. We are not used to thinking about injury prevention, since preventing a human injury from happening is inevitable, what is believed is that it is possible to think of reducing the incidence of the injury (Boyle, 2015), rather than preventing it from happening. With this clarity in the definition, we believe in the applicability of the functional training method with the majority purpose of preventing injuries and, subsequently, improving performance (MONTEIRO & EVANGELISTA, 2011). The injury has been growing more and more within football, even at early ages the footballer of the basic categories has suffered from this significant increase of injuries in recent years (Paschoal *et al.*, 2013). However, it is known that the injury comes from all sports that requires a certain degree of dispute and invasion, which does not prevent the need for preventive measures to curb this event. Nevertheless, this problem is not only based on the initial categories of training, current research indicates that the high incidence of injuries is also in professional football (Checchi., 2013), with an even more convincing warning that preventive work should part of the periodizations already in the initial stages of formation. Researches indicate that injuries in footballers are due to lack of preventive training, nutritional orientation and psychological factors. Therefore, it is worth mentioning that preventive training can make it possible to reduce the incidence of injuries in the basic categories (Paschoal, 2013) and in the adult phase. For Boyle (2015), the constancy of reports of injuries from physiotherapists was directly related to weak stabilizing muscles. Musculatures are known as internal and transverse oblique of the abdomen for the deep abdominal, gluteus medius, adductors, lumbar quadrants and external rotators of the hip for (b) hip stabilizers and, finally, for the muscles of (c) retraction of the rhomboid scapula and inferior trapezius.

What is Previous Cross Link (ACL)

The anterior cruciate ligament (ACL) is the ligament that establishes a connection between the femur and the tibia, thus providing greater stability for the rotational movements of the knee and preventing excessive anterior translation of the tibia to the femur. (COSTA, LEANRO, GAMA, NOBLE, SANOS, 2016, p.01). LCA is composed of fibrous tissue. Its origin lies in the medial internal portion of the femoral condyle being inserted in the central portion of the tibia. (Pinheiro, Souza, 2015). According to SANTOS (2014), in the majority of cases ACL injuries occur due to sprains, without contact with another athlete, in soccer, this is due to the large amount of rotational movements and changes of direction, and may also occur by mechanism of stress, as well as hyperextension and direct trauma.

Preventive measures with functional training in lca injuries in footballists

Proprioception in the Prevention of Injury: In soccer, different biomotor abilities are requested, such as motor coordination, speed, thrust, endurance and agility and in different levels of intensities, and great variation of motor

actions performed as space dispute, races, jumps, changes of directions, and due to all these demands, injuries occur through physical contact, muscle overload, sprains and sprains during the season. (Montenegro, 2014). Each year football becomes more competitive, training volume and number of games increase, causing the athlete to reach its limit of exhaustion, increasing the concern with the physical conditioning and the prevention of injuries, having the statistics on injury has become a key factor in assessing training and game overload (Cohen *et al.*, Apud Montenegro, 2014). Because of the sport's motor actions, such as rotations, greater distance traveled at submaximal velocities and the specificity of the sport, the most common body region affected are the lower limbs, potential knee and ankle joints, as an example of sprain ankle and knee, as well as ligament injuries (Junior and Assis, 2010). Due to greater dynamic stability, that is, the ability to return to a position after a change, a program of proprioceptive exercises is indicated, both for maintaining balance and preventing injury (Antes *et al.*, 2009). Due to the increase in proprioception and neuromuscular control, it improves stability and core bias to acquire a more stable hip and ankle, besides the knee alignment in static and dynamic movements (Hauge, 2017). The proprioceptive training is widely used in the recovery of sports injuries and is constantly being recognized as a preponderant tool in reducing the incidence of injuries (EMERY *et al.*, 2005). Already for the author Herman *et al.* (2012), advocate proprioceptive training as an instrument that is summarized in reducing the incidence of injuries as a consequence of better body awareness and joint stability, maximizing protective joint reflexes. All these functional improvements that result in a lower incidence of injuries are being constantly discussed and validated in the association of neuromuscular control adaptations such as proprioception (Zech *et al.*, 2010).

Proprioception is the input given to the central nervous system (CNS) by the various types of proprioceptive receptors that are located in bones, ligaments, tendons, subcutaneous tissue, muscle fascias, and the inner portion of muscles. This is the sensorial input of the proprioceptive receptors to detect joint position and movement, as well as direction, amplitude and velocity, as well as the relative tension on the tendons (Martimbianco *et al.*, 2008; Rossato *et al.*, 2013). The main proprioceptors are located at the joints and are composed of free terminations and the Ruffini and Paccini corpuscles also referred to as mechanoreceptors, and the golgi tendon organ (OTG). In the ligaments, they function as guards and send information on the respective limb position and ligament tension. The receptors are stimulated through their deformation, performed by means of joint or traction coaptations. Other CNS-communicating receptors on the mechanical activities performed are the neuromuscular spindles located in the musculature itself and have the ability to monitor changes in tension, length and contraction state of muscle fibers. (Sargentim *et al.*, 2013, Rossato *et al.*, 2013). The studies on the use of proprioceptive and neuromuscular training show efficiency for the prevention of injuries in soccer, due to the greater protection of the joints and muscles of the lower limbs. Even if injuries can not be prevented due to the different mechanisms that propellants, prevention becomes efficient in reducing the number of incidents per season or reducing the time of removal of the athlete (Myers 2010). For the athlete to have optimal levels of performance related to dynamic or static postural control during any physical activity, a neural adaptation will be necessary, resulting from stimuli in

the training that promotes this body awareness at different moments of the game (Hauge, 2017). In order to have the postural control and efficient movement adjustment, the sensory organs will trigger diverse receptors of sensory information coming from the whole body, where each region will have its respective functionalities when sending messages to the central nervous system (CNS), where this information will be processed and there will be a productive choice of the desired motor action in detriment to the. In soccer, different biomotor abilities are requested, such as motor coordination, speed, thrust, endurance and agility and in different levels of intensities, and great variation of motor actions performed as space dispute, races, jumps, changes of directions, and due to all these demands, injuries occur through physical contact, muscle overload, sprains and sprains during the season. (Montenegro, 2014). Each year football becomes more competitive, training volume and number of games increase, causing the athlete to reach its limit of exhaustion, increasing the concern with the physical conditioning and the prevention of injuries, having the statistics on injury has become a key factor in assessing training and game overload (Cohen *et al.*, Apud Montenegro, 2014). Because of the sport's motor actions, such as rotations, greater distance traveled at submaximal velocities and the specificity of the sport, the most common body region affected are the lower limbs, potential knee and ankle joints, as an example of sprain ankle and knee, as well as ligament injuries (Junior and Assis, 2010). Due to greater dynamic stability, that is, the ability to return to a position after a change, a program of proprioceptive exercises is indicated, both for maintaining balance and preventing injury (Antes *et al.*, 2009). Due to the increase in proprioception and neuromuscular control, it improves stability and core bias to acquire a more stable hip and ankle, besides the knee alignment in static and dynamic movements (Hauge, 2017). The proprioceptive training is widely used in the recovery of sports injuries and is constantly being recognized as a preponderant tool in reducing the incidence of injuries (EMERY *et al.*, 2005). Already for the author Herman *et al.* (2012), advocate proprioceptive training as an instrument that is summarized in reducing the incidence of injuries as a consequence of better body awareness and joint stability, maximizing protective joint reflexes. All these functional improvements that result in a lower incidence of injuries are being constantly discussed and validated in the association of neuromuscular control adaptations such as proprioception (Zech *et al.*, 2010).

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The components of neuromuscular training include the development of muscular strength - strength and power endurance - and may consider mechanisms essential to soccer (Soares 2007). We can consider neuromuscular strength training to be of paramount importance for any program aimed at reducing the incidence of muscle and joint injuries, since it is the basic element of motor speed, power and control (Schiff 2004; Pfeiffer 2006). In other words, the defended concept of neuromuscular training in reducing the incidence of injuries in footballers is a consequence of the characteristic actions of the game - acceleration, deceleration, starting, jumps, changes of direction, closing among others - require varying levels of forces, making motor control over this perceptual neuromuscular (Soares, 2005). The balance of force between the flexor and extensor muscles of the knee are also determining factors in reducing the incidence of injuries, especially injuries related to the ACL of the footballer. In other words, if unbalanced knee flexor and quadriceps muscle flexors are imbalances, it is advisable to establish customized strength training programs that can incorporate specific rehabilitation exercises (Soares 2007; Soares 2005). Although some studies point to the significant relativity of the hamstring muscles intervening in the ACL lesions, Grelsamer (2005) still considers speculative evidence. However, based on studies by Pollard (2005), it is suggested that the physical trainer invest in the benefits of balanced neuromuscular training between extensors and flexors to assure with greater assertiveness the possibility of reducing the incidence of ACL injuries.

The process of sending the sensory information occurs through the receptive mechanisms called somatosensory, vestibular and visual. Although there is specificity of each sensory receptor, they all act in concomitance within the desired motor action, providing higher levels of efficiency in the soccer player's postural control (Soares 2007). If it is the first of the somatosensory system, it is understood that it is a receptor of great importance for the maintenance of postural control, obtaining mechanisms spread throughout the body, being also

known with the denomination of muscular proprioceptors that are the muscular spindles and organs Golgi tendinosus (OTG), both responsible for capturing information to the CNS and assisting in the control of posture. In the second receptor, it is called the vestibular system, which is located in the inner ear, making it possible to resume posture on unstable mass bases. The information that this receiver is responsible for is those related to the trunk, with flexion, extension and rotation movements, besides providing greater gravitational orientation (Soares 2005). For this receiver the head becomes a preponderant factor to originate the necessary information, being the position of this one is indicative for the sensorial information that facilitates the spatial notion of the soccer player. Therefore, the third is the receiver of the visual system, being a component directly related to the CNS where the information captured comes from the vision. This organ is essential for acquiring learning and developing new motor skills, in addition to making postural maintenance possible (Bernier 2003).

For Sargentim e Passos (2012, p.54), "the action of these receptors happens unconsciously through reflex activities, and the muscles and joints react automatically, in order to perform the movements of the most efficient forms." As the motor response is unconscious for the stimulus in relation to the dynamic joint stability (CAMPOS; COURACCI-NETO 2004, LOUWA; GRIMMERB; VAUCHANC, 2006). In short, ligament rupture(ACL), an injury considered common among the most serious soccer players, can cause biomechanical alterations, minimizing proprioceptive afferation, thus affecting the neuromuscular functions of the knee joint. However, soccer injuries can be reduced by half when an adequate periodization of training of this character is applied (Hauge, 2017). In this study, we evaluated the relationship between knee position and knee position in the knee position (Soligard *et al.*, 2008; Arnason *et al.*, 2008).

Conclusion

Therefore, it can be concluded that anterior cruciate ligament (ACL) injury is considered to be the most common among the most serious and most frequent in soccer players. Through this research, it was possible to find mechanisms of functional training that positively evidenced its intervention in reducing the incidence of ACL injuries in footballers, especially on the optics of the operationalization of proprioceptive and neuromuscular training, aiming at improving the capacity of the Nervous System Central (CNS) versus movement patterns.

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