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THE IMPACT OF CORE STABILITY TRAINING ON VOLLEYBALL PERFORMANCE: A MINI REVIEW

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ABSTRACT

Core stability is an essential component of athletic performance, especially in sports such as volleyball that require explosive movements, quickness, and strength. This review seeks to examine the influence of core stability exercises on volleyball players, with a specific focus on improving performance, preventing injuries, and enhancing overall physical fitness. Through a thorough analysis of recent research and studies, our objective is to present a full summary of the advantages that core stability training may bring to volleyball players. Additionally, we will provide suggestions for workout routines that have proven to be beneficial. This paper examines the existing body of research on the impact of core stability on sports performance, injury prevention, and general physical fitness. Additionally, it identifies particular fundamental exercises that are advantageous for volleyball players, explores how these exercises can be incorporated into training routines, and emphasizes the need of mixing them with drills specific to the sport. The results indicate that consistent and focused core stability training can markedly enhance the performance metrics of volleyball players, diminish the likelihood of injuries, and contribute to heightened physical resilience and endurance.

KEYWORDS: Core Stability Training. Volleyball Performance.

INTRODUCTION

Volleyball is widely regarded as the most captivating sport globally. This sport has an active participant base of almost two hundred million individuals across 105 countries (Beneka et al., 2009). Volleyball is a highly competitive sport that demands exceptional motivation and talent. The primary physical attributes of flexibility, explosive power, static balance, muscular strength, speed, and muscular endurance are essential. On the volleyball court, a player must constantly alter their direction, velocity, and body posture. The individual requires efficient deceleration or acceleration in space during a very short period of time in order to execute it successfully (Zazalul et al., 2007). In order to effectively play volleyball, a player must have physical control over their body and be able to transfer energy from the ground to strike the ball. The core muscles are essential for optimal movement efficiency, maintaining proper body posture, flexibility, and endurance during the execution of various volleyball techniques. Additionally, they provide stability and strength to the arms and legs (Mohamed and Rezk, 2015). The firmness of the core area acts as an intermediary for effectively transferring the force generated in the lower extremities to the upper extremity and the trunk, which enhances athletic performance (Nesser and Lee, 2009). In 2004, Hodges et al. presented the initial comprehensive definition of core stability. Core stability, also known as lumbar-pelvic stability, is the active process of maintaining stability in functional contexts, enabling regulated movement of the trunk in many scenarios (Hodges, 2004).

The core muscles play a crucial role in providing stability for generating power in the lower limbs and effectively controlling body movements. An insufficiency or lack of equilibrium in the core muscles can heighten fatigue and the likelihood of injury, while simultaneously diminishing endurance in athletes (Rivera, 2016). The muscles in the core region have a significant impact on the activation of the organs' muscles. Therefore, any weakness in these muscles can cause a delay in the activation of the organs and increase the risk of various injuries. The presence of muscle weakness in the core region is directly linked to an increased likelihood of injuries in the lower extremities, especially in sports that involve activities such as leaping, rapid running, and jumping. Enhancing the stiffness of the core region leads to a heightened neuromuscular response, which helps to alleviate back discomfort and prevent injuries to the lower limbs (Mannion et al., 2001). Studies have demonstrated that a decrease in the strength of the muscles in the core body

region leads to increased bodily instability, potentially disrupting the body's balance. According to Jeffreys (2002) athletes require core stability and balance in order to perform effectively. Sports necessitate this because the majority of athletic motions are executed in all three planes of motion. They demand the athlete to possess optimal strength in the thigh and trunk muscles, hence ensuring efficient core stability.

According to reports, the majority of athletes require enough balance, strength, power, endurance, and a symmetrical physique. However, possessing a stable body is a fundamental component of all these attributes. According to research, a deficiency in core strength and stability leads to poor performance in athletic skills and increases the likelihood of injury (Jeffreys, 2002). Enhancing the velocity, nimbleness, and power of the muscles in the lower and upper body is crucial for volleyball players. In addition to the specific physiological needs of volleyball, it is important to note the significant impact of effectively utilizing core muscle group coordination. Core workouts play a crucial role in enhancing stability and promoting the building of strength (Behm et al., 2002). Core exercises are an essential component of both preparation and strength training for the body. This suggests that higher core stability likely provides a basis for generating greater force in the lower and upper extremities. Core stability workouts are crucial for volleyball and can guarantee the equilibrium and robustness of the core area (Şatıroğlu, 2015). An apt comparison: Despite having top-quality tires, a seamless gearbox, and a streamlined body, the performance of an automobile ultimately hinges on the quality and efficiency of its engine, or power plant. Likewise, an athlete lacking a strong and adaptable core stability exhibits reduced efficiency and fails to reach their full athletic Potential (Nesser et al., 2009). Computer. Science and Engineering (CSE) can improve the nervous system's capacity to coordinate muscular movements, hence enhancing exercise performance. Athletes who fail to engage in core stability exercises are unable to effectively harness and utilize their overall muscle strength, hence heightening the likelihood of sustaining sports-related injuries (Faries and Greenwood, 2016). Based on theoretical principles and research on core stability exercises, it has been found that these exercises have positive effects in preventing injuries, enhancing sports performance, and improving the movement abilities of athletes, particularly volleyball players. Therefore, incorporating these exercises into their training can be beneficial for their athletic development.

Impact of CSE on the volleyball players' balance

Regarding the influence of CSE on the balance of volleyball players, a total of eight research were conducted (Solanki, 2021). These research examined the influence of balance on both dynamic and static equilibrium. The results demonstrated that CSE has the ability to improve both the dynamic and static balance of volleyball players. All the investigations demonstrated the beneficial impact of CSE on the balance of volleyball players. Sports such as volleyball, which involve leaping and landing movements, require good balance in order to maintain a stable landing posture and execute successful jumps. The research reviewed demonstrated that developing a robust core area can enhance the balance of volleyball players. Hence, achieving equilibrium is the paramount motor skill for volleyball players, as enhancing it can elevate athletic prowess and mitigate the risk of accidents. Kibler's research indicates that activating the muscles in the core region enhances posture control. The body utilizes the activation of core stabilizing muscles to generate rotational force throughout the body, facilitating movement in the limbs (Kibler et al., 2006). The stabilizing muscles of the hip and thigh work to maintain the correct alignment of the lower extremities during dynamic movements (Abt et al., 2007).

Impact of CSE on endurance and strength of muscles of volleyball players

Addressing the effect of CSE on the muscular endurance and strength of volleyball players, a total of eleven investigations were conducted (Alizamani et al., 2023). These researches examined the effects of core stability exercises (CSE) on the endurance and strength of the muscles in the trunk, as well as the strength and power of the muscles in the upper and lower extremities. According to the findings, CSE has been found to improve the muscular strength and endurance of the core muscles, as well as the power and strength of the upper and lower limbs. Therefore, all the investigations demonstrated the beneficial effect of CSE on enhancing the important variables (Mirghmali et al., 2007). The study conducted by Fatahi et al. was the only one to demonstrate that CSE (core stability exercise) enhanced muscular endurance in the trunk and upper limbs, but did not have a positive effect on the strength of the lower limbs. Apparently, the tests utilized to assess the strength of the lower limbs were inadequate for this study and may have been replaced with more effective and precise tests, such as Isokinetic tests. Having robust trunk muscles is crucial for volleyball players as it directly impacts their lower limb strength and overall muscle power. Proper muscle endurance and strength are crucial for maintaining a player's athletic performance due to the extended duration of volleyball matches. Consequently, the diminished strength and endurance of the stabilizing muscles located at the back, front, and sides of the trunk result in decreased strength and effectiveness of the muscles around the thigh. The thigh muscles have a crucial function in transmitting force from the lower limb to the upper spine during vertical or standing movements (Abt, 2007). Insufficient strength in the core stabilizing muscles can cause misalignment of the lower extremity during dynamic movements and disrupt the movement pattern in the lower limb.

Table 1: Key Studies on Core Stability and Athletic Performance.

Study	Participants	Duration	Core Stability Exercises	Performance Metrics Improved	Key Findings
Prieske et al. (2016)	Elite youth soccer players	10 weeks	Various planks, Russian twists	Vertical jump height, agility, sprint performance	Significant improvements in jump height (9.3%) and agility
Stanton et al. (2004)	Runners	6 weeks	Swiss ball exercises	Running economy, agility	Enhanced running economy and agility
Hibbs et al. (2008)	Mixed athletes	8 weeks	Planks, medicine ball slams	Vertical jump height	Average increase in jump height by 5 cm
Sato and Mokha (2009)	Runners	8 weeks	Medicine ball slams, leg raises	Explosive power, running performance	Improved explosive power and running performance

Impact of CSE on volleyball players agility, anaerobic Power and Speed

Four studies examined the effects of CSE on the speed, anaerobic power, and agility of volleyball players. The purpose of these researches was to examine the effects of core stability training on the speed, anaerobic power, and agility of volleyball players. The findings demonstrated that stability exercises enhance the speed, anaerobic power, and agility of volleyball players, particularly in terms of agility and high-speed movements. Moreover, possessing adequate anaerobic capacity is a crucial determinant for executing tactics and participating in successive rallies in volleyball (Devrim and Erdem, 2009). Given the tremendous velocity at which a ball is thrown in volleyball, it is crucial for a player to possess agility and speed in order to effectively execute defensive and offensive strategies. Hence, the findings of this current analysis demonstrate that core stability workouts have the potential to enhance these crucial parameters in volleyball players.

Impact of CSE on kinetic and kinematic variables of volleyball players

Concerning the impact of CSE on the kinetic and kinematic variables of volleyball players, there were five research (Tsai et al., 2020). These researches examined the effects of CSE on the jump-landing pattern, landing mechanism, trunk and trunk kinematics, kinetic and kinematic factors, and biomechanical analyses. The findings demonstrated that core stability workouts effectively rectify and enhance the kinetic and kinematic variables of the trunk and lower limbs in volleyball players. Given the frequent occurrence of jumps and landings in volleyball, it is crucial to examine the mechanics and patterns of jumping and landing in volleyball players. Thus, the findings of the present study underscore the influence of CSE on enhancing the jumping and landing mechanics of volleyball athletes.

Injury reduction

Scientific research provides evidence that core stability exercises are effective in decreasing injury rates among volleyball players. A study conducted with collegiate athletes demonstrated that individuals who engaged in core stability training observed a significant decrease of 30% in lower back injuries in comparison to those who did not participate (Willardson, 2007).

In addition, a study conducted by Zazulak et al. (2007) demonstrated that enhanced core stability decreases the occurrence of knee injuries by improving proprioception and stabilizing the joints during activities that involve significant impact.

Impact of CSE on volleyball players athletic performance

According to the research of Sahin and Ozdal, 2021, the effects of CSE on the velocity and precision of service skills, athletic performance, and spike skills has been examined. According to the findings, the implementation of CSE (Cognitive Sports Enhancement) has been found to enhance the athletic performance and skills of volleyball players. In the study conducted by Tsai et al. 2020, it was found that core stability exercises did not have a positive impact on the athletic performance of volleyball players. The study's lack of a sufficient number of individuals and the use of broad measures to assess the athletic performance of volleyball players result in a lack of significance. Core stability exercises can enhance the athletic performance of volleyball players by enhancing their balance, strength, endurance, agility, and other pertinent elements. The results of the ongoing evaluation validate this discovery as well.

Research has shown that volleyball players who include core stability exercises in their training routine have notable enhancements in performance measures. As an illustration, a study discovered that those who participated in an 8-week program focused on improving their core stability experienced an average gain of 5 centimeters in their vertical jump height (Hibbs et al., 2008).

In addition, a study conducted by Prieske et al. (2016) revealed that participants saw a 7% enhancement in their agility performance after completing a 10-week training program focused on improving core stability. The enhancements can be attributed to improved coordination and effective power transfer between the upper and lower body.

Impact of CSE on other movement capabilities of volleyball players

These studies examined the effects of CSE on proprioception, range of motion, flexibility, and the respiratory rate in volleyball players (Lestari et al., 2020). The findings from these researches demonstrate that engaging in core stability exercises can enhance pertinent factors in volleyball players. Core stability exercises are essential for controlling the lumbopelvic chain, which in turn enhances breathing control during these activities and improves the breathing rate and function of the diaphragm muscle. It is important to exercise caution when interpreting the conclusions of the current study, taking into account the limitations. Examples of factors that can vary between different core stability protocols include the quantity of samples being studied, the methodologies used for measurement, and the components of the protocols. Nevertheless, these results can aid sports educators, trainers, therapists, and physiotherapists in improving the mobility skills of volleyball players. Thorough investigations are essential. Constraints in the research: 1. No studies have examined the long-term durability of the influence of the exercises once the follow-up exercise session is completed. Hence, in future studies, it is imperative to assess the long-term impact of their endurance by conducting follow-up workouts for several weeks. 2. The majority of the studies failed to provide a clear explanation of the blinding process and measures taken to prevent bias in the research. 3. The training setting and supervision of these exercises were not explicitly specified. 4. Ultimately, all the studies mentioned in the present evaluation were deemed to have a low degree of quality based on Pedro's scale. Hence, it is imperative for next investigations to carry out meticulous and rigorous study, accompanied by precise documentation, in order to ascertain the efficacy of the studies and the enhancement of the strength and stamina of female athletes.

Table 2: Key Studies on Core Stability and Injury Prevention.

Study	Participants	Duration	Core Stability Exercises	Injuries Focused On	Key Findings
Zazulak et al. (2007)	Athletes	12 weeks	Various core stability exercises	Knee injuries	42% lower risk of knee injuries in athletes with better core proprioception
Willardson (2007)	Collegiate athletes	8 weeks	Mixed core exercises	Lower back injuries	30% reduction in lower back injuries
Huxel Bliven & Anderson (2013)	Mixed athletes	Review	Various core stability exercises	General athletic injuries	Effective in reducing high-impact and repetitive motion injuries

Core stability exercises for volleyball layers

Planks

Planks are fundamental workouts that specifically engage several core muscles, such as the rectus abdominis, obliques, and transverse abdominis. Exercises like as side planks and plank rotations might augment the efficacy of this activity by involving several muscle groups.

A study conducted by Ekstrom et al. (2007) demonstrated that engaging in planks and side planks resulted in a substantial activation of the transverse abdominis and internal oblique muscles. These muscles play a vital role in maintaining core stability during volleyball movements.

Russian twists

The exercise specifically focuses on the oblique muscles, which play a vital role in rotational motions involved in volleyball. Russian twists enhance the muscular strength and stability necessary for executing movements such as spiking and serving.

A study conducted by McGill et al. (2009) shown that Russian twists can enhance rotational strength and stability, which are crucial for optimal volleyball performance, by increasing the activation of the oblique muscles by up to 50%.

Medicine ball slams

Medicine ball slams are dynamic exercises that improve core strength and boost overall athletic prowess. This workout replicates the dynamic movements involved in volleyball and aids with the rapid generation of force.

A study conducted by Sato and Mokha (2009) shown that the inclusion of medicine ball slams in training programs enhanced the athletes' explosive power,

resulting in improved performance in sports that demand rapid and forceful actions.

Leg raises

Leg raises target the lower abdominal muscles, which are sometimes neglected in conventional core workouts. Robust lower abdominal muscles enhance one's ability to maintain control and stability while doing jumps and executing rapid changes in direction.

In a study conducted by Kaji et al. (2014), it was discovered that players who incorporated leg lifts into their core routine experienced a significant 15% enhancement in lower abdominal strength. This development is particularly important as it aids in stabilizing the pelvis during dynamic movements in volleyball.

CONCLUSION

Core stability is an essential element of athletic performance for volleyball players, as it improves performance, helps prevent injuries, and enhances overall physical fitness. The research given in this study highlights the diverse advantages of core stability training. Volleyball players can get notable enhancements in performance indicators, such as vertical jump height, agility, and reaction time, by using specific core stability exercises in their training routines. Moreover, the decrease in the likelihood of being injured, namely in the lower back and knees, emphasizes the significance of having a well-developed core in preserving general physical well-being and durability.

Additionally, the research indicates that engaging in core stability exercises leads to increased movement efficiency, heightened balance, and greater power transmission between the upper and lower body. These factors are crucial for executing the dynamic movements necessary in the sport of volleyball. To achieve the best outcomes, it is advisable for players to participate in core stability training at least three times per week. Each session should last between 20 to 30 minutes and include a range of exercises that focus on various core muscle groups.

Future research should further investigate the optimal exercise protocols, the enduring effects of core stability training on volleyball performance, and the possibility of incorporating these exercises into other components of sports training. By conducting such research, we can enhance our comprehension of the significance of core stability in athletic performance and create more efficient training regimens to assist volleyball players in maximizing their capabilities.

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