

## BIOMECHANICAL, PSYCHOLOGICAL AND PHYSIOLOGICAL RISK FACTORS OF KNEE AND ANKLE INJURIES IN VOLLEYBALL PLAYER: A CRITICAL REVIEW

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### ABSTRACT

Volleyball is a highly dynamic sport that involves almost all joints during play. One special feature of volleyball is that it can be played in different environments. Volleyball, like other dynamic sports, sees common musculoskeletal injuries in various body locations. Identifying of injury is first step in avoiding any type of injury. All kinds of injuries must be considered in psychological, physiological, and biomechanical aspects. Therefore, this literature review focuses on the etiology of knee and ankle injuries, as many studies show that these are the most common injuries in volleyball. Otherwise, when looking for any type of injury in any sport, the psychological, physiological, and biomechanical aspects should be considered. Focusing on one aspect does not give a clear image of any injury, especially when referring to professional players. Designing a perfect injury prevention program requires a focus on all aspects of the injury, the sports profile, and the surrounding environment. Rules change in the sports community to increase player safety and decrease the rate of injury as much as possible without affecting the aesthetic of the game. These risk factors do not mean that volleyball is a dangerous sport, as it is totally safe and recommended, especially when compared to other sports.

**Keywords:** Volleyball, injury prevention, knee injuries, risk factors.

### 1. INTRODUCTION

Volleyball is one of the most popular sports. Around 500 million people play volleyball worldwide, making it the world's second-most popular sport, followed by soccer in most countries. Because it is so widespread, it has a high incidence of injuries. Although playing is dependent on the use of the hands, statistics say that most volleyball injuries occur in the lower body as a result of repeated jumping and sometimes landing incorrectly. Volleyball games can take place either in closed gymnasiums or on beaches; because of this diversity in the playing terrain, the types of injury vary, but are mostly injuries to the lower part of the body. More specifically, two areas where injuries are frequently found are the knee and the ankle (Bere, Kruczynski, Veintimilla, Hamu, & Bahr, 2015; Verhagen, Van der Beek, Bouter, Bahr, & Van Mechelen, 2004). Most ankle sprain injuries in volleyball are from repeated jumping and high network between teams (Bahr & Reeser, 2003). All kinds of injuries must be considered in all aspects: psychological, physiological, and biomechanical. Each of these factors influences the type of injury, intensity, and even rehabilitation for the injury. Consequently, everything must be seen and corrected to ensure the lowest rate of injury and also the fastest recovery. The importance of looking at three factors is necessary to fully determine the rehabilitation programme and the causes in order to avoid it as much as possible. Neglecting one can cause a delay or deviation from the course of treatment and other factors that may be marginalized, such as the psychological impact on players after injury. Although the importance of sports psychology specialists is equal to that of physical therapy specialists or body training specialists, many clubs have no sports psychology specialists, and psychological problems are numerous.

Some of these are related directly to the injury, including the result of external factors, such as the effect on family or friends. This is an important consideration and dealing with them professionally increases the efficiency of a player after an injury and sometimes even in the case of players who do not suffer from any physical injury. A player's anger can become frustration, then after beginning denial, eventually accept the subject. The sooner the player accepts the situation, the better it is for the player, especially given that most players have their greatest expectations at the beginning of the season. A sudden change because of injury can be unexpected and annoying and needs to be dealt with professionally. Good season plans reflect very heavily on the players in terms of improving their performance and raising their

fitness levels and most importantly minimizing the possibility of injuries to players. A lot of clubs have begun to focus on this science; some of them have brought in specialists in biomechanical science to observe the differences in the players. Volleyball fully relies on mechanical factors both when the player jumps for the ball and when landing. Focusing on these points would help professional players avoid a lot of problems in terms of injuries, raising the level of efficiency. These two works together to influence a third factor physiology, which is the result of the internal reactions of the body that are affected by psychological and mechanical factors.

## **2. BIOMECHANICAL ASPECT**

The following is a breakdown of each injury and the factors affecting it. Many studies have shown that most volleyball injuries to the ankle and knee (Bere et al., 2015). Speaking here of what causes those injuries, we will focus initially on the injury situation and the mechanical injuries.

Someone with frequent ankle injuries plays close to the net. The reason for this is because of the enthusiasm and pressure during the game, as well as the possibility of the player landing on another player's foot, which is one of the most common causes of ankle injury (Bere et al., 2015). Landing inappropriately can lead to an ankle sprain, mostly due to twisting the ankle. Poor landing may also lead to ankle fractures, because the ankle cannot tolerate the weight of the body. Loss of balance can happen when a player jumps to block an opponent. This makes the players in front more vulnerable to these injuries than the players in back. Injuries that result from overuse due to repeatedly jumping during a match or training mostly lead to ruptures or inflammation of the ankle ligament, such as an Achilles tendon injury (Bahr, 2009) or a stress fracture. It cannot be overlooked that athletic shoes must be suitable for the player; a narrow shoe negatively affects the foot and make the player uncomfortable, leading to difficulty of movement. It can also lead to joint inflammation. Oversized shoes generally lead to loss of balance while landing and is one of the causes of ankle sprain.

Injured knees are another of the most common sports injuries in the world. These are considered to be the most prevalent among all sports and genders equally (Barber-Westin, & Noyes, 2011). A poor landing is the most likely cause of a knee injury when the player makes a high jump and lands with valgus rotation (Sinsurin, Vachalathiti, Jalayondeja, & Limroongreungrat, 2013). This position actually leads to many injuries, one of which is cutting the anterior cruciate ligament in a finding that may come from an opponent or even stepping on an opponent while landing. Injury to the knee valgus or tibia abduction relative to the femur during sports has been reported as a risk of injury to the ACL. In addition, landing incorrectly may cause meniscal injuries either complete or partial rupture. Correct balance and landing in volleyball is very important, especially for those who have already suffered meniscal injuries, because it is a recurring injury (Hewett et al., 2005). The legs especially the knees bear most of the pressure of body's load. With the repetition of jumping, this often leads to meniscus injury or inflammation. Frequent jumping directly affects the knee and causes injuries as a result of overuse, such as OA and patellar tendinopathy (Bahr, & Reeser, 2003).

Frequent jumping during training, matches and tournaments places a tremendous pressure on the knee. With the problems in landing correctly, the high incidence of such injuries is to be expected. The problem with such injuries is that the player cannot be prevented from jumping or be moved to a different position on the field. The only thing medical staff can do is raise the fitness level of the player, work on strengthening the muscles, and not stress the player in an exaggerated manner with exercises. Even when putting the interest of the player first, playing is not allowed when the player is suffering from any infection, because they will often worsen. Most recent studies show the importance of landing correctly (Bahr, & Reeser, 2003; Sinsurin et al., 2013; Verhagen et al., 2004) indicating that it is the most important skill the player should master in volleyball. This is not affected by the level of fitness or the timing of the match, because it is the only factor shared among most of the injuries, especially in terms of lower body injuries. In addition, we must not overlook the importance of gender, which is also a key factor in terms of injuries. Females are more commonly injured in the lower part of the body more than males. This is due to differences in the size of the pelvis between genders (Allison et al., 2015). The female pelvis is wider, causing the knees in valgus status to have the most knee injuries. Landing with valgus status is a fundamental factor in injuries. On the other hand, some recent studies have shown that gender is not considered the essential factor in development, but on a personal level (Williams, Tonymon, & Wadsworth, 1986). Ignoring such genetic and structural differences is difficult, especially given that most of these studies lack a sufficient number of participants with which to contrast the findings with those of the other studies. These studies, which are properly supported, make use of a sufficient number of participants. This makes comparisons of the findings more acceptable.

### 3. PSYCHOLOGICAL ASPECT

A very important aspect which is probably also influenced by the player's technical level is the psychological aspect. Psychological causes of injuries are generally divided into two factors: internal and external factors. One key internal factor is stress. Some studies show that stress can lead to knee or ankle injuries (Williams, et al., 1986) due to the player's loss of concentricity of the field, leading to a twisted knee or ankle. When a player tries to prove himself to the coach to be in the line-up and show superiority over his colleagues, he likely tries hard in training sessions, sometimes training alone and over-training. Pressure on ankle and knee joints and over-training mostly lead to overuse injuries such as OA in the knees and Achilles tendon injuries in the ankle joint. An aggressive player is more likely than other players to have an injury due to trying to hurt an opponent and possibly his colleagues in training sessions. This leads to many contact injuries, such as ACL injury in knee and ankle sprain in ankle joint.

The second psychological factor that might influence a player is external factor. One of the most common external factors affecting a player negatively is pressure from family or fans. It can make a player biased against himself; perhaps that player suffered a minor injury that led to the major injury, like a partial ACL rupture that led to complete rupture in a knee or a partial Achilles tendon rupture that led to complete rupture in an ankle joint. Many players also represent more than one team because international players play in more than one championship with their club, in addition to games with their national team. The media pressure on the players can lead to injuries from overuse without enough rest after a strong season, whether in the knee joint or even in the ankle joint. Dependence on the player by colleagues can lead him to carry an extra burden, resulting in burnout muscle that will lead to injuries such as ACL injuries in knee or ankle sprain in ankle joint. Loss of concentration and family issues can play major roles in player injury, because they affect player concentration during training and competitive matches.

This issue can happen to players at any age, but in general, it happens to young player. Focusing on the mechanism of movement is key in avoiding injuries in any kind of sport. From the biomechanical aspect of knee and ankle injury, repetitive jumping is the main cause of knee or ankle injury. Loss of concentration during games increases the chance of injury. Over-confidence happens when a player has a minor knee or ankle injury and ignores the pain and the main problem, using an ankle or knee support or taping, thinking this will solve the problem. This will actually worsen the injury. Some players have over-confidence towards participants in club and national team matches, even with minor injuries. There are many personal reasons a player can be in this situation, but even with this, the player should do this under any consequences. This is actually the role of the team coach, as he should remove the player from the squad for safety. Coaches should always put player safety first and be smart by dealing with players in different situations. Even elite players in important matches should see the psychiatrist for issues like this, as it may be helpful. On other hand, if a player plays a lot of matches, the coach should give him some days rest to avoid overload, even if the player does not wish to rest. The coach should keep players safe to serve on the team with maximum effort without any fear from overloading injury (Franklyn-Miller, Roberts, Hulse, & Foster, 2014). Player support also will be helpful in these cases, so cooperation between teammates and receiving lectures and education can make the coach and medical staff's jobs easier.

### 4. PHYSIOLOGICAL ASPECT

The physiological aspect is specifically affected by the body system, and I will discuss some diseases that can affect knee and ankle joints and lead to injury. I will start with post-traumatic arthritis, which comes after an injury to the knee or ankle. Stress from the injury can cause joint inflammation or stiffness, even years after the primary injury occurred. Other diseases can affect knee and ankle joints. Osteoarthritis is a degenerative change in joints that usually begins in middle age and slowly progresses. In athletes, it can begin early from repeatedly jumping in the case of volleyball players or from the heavy cardiopulmonary training players do to improve their fitness levels. In osteoarthritis, cartilage between the bones becomes worn down, leading to pain and stiffness in the knee and ankle joints.

Another important physiological cause of injury is the increase of adrenaline levels, which usually happens in finals matches when players' stress levels lead to the release of adrenaline. This added adrenaline makes fine movements harder, making twisted knees and sprained ankles more probable. Changes of climate that affect the body temperature make it easy to injure the ankle or knee joint, specifically if cold weather causes the joints to become cold. Weather can lead to inflammation or rupture in the ligaments.

Malnutrition and sleep disorders are important causes of injury. Poor nutrition and sleep disorders among the players often result in injuries that aggravate minor injury. Players can be easily injured because of muscle weakness, leading to weakness of the ligaments, and thus enabling injuries like an ACL injury in

knee joint or an Achilles tendon injury in ankle joint. We also cannot overlook the effect of sleep disturbance on a player. Sleeping enough is an essential factor for muscle recovery; without sufficient muscle recovery in the lower limbs, knees and ankles are at high risk of injury (Kazman, de la Motte, Bramhall, Purvis, & Deuster, 2015; Kim, Sim, Kim, & Choi, 2015). In this situation, there is no standard for how many hours of sleep a player needs to reach full recovery, because this depends on each player's effort and type of training.

Finally, nutrition is the key to energy. If we talk about players, we should consider this factor. Players have different nutritional needs depending on the sport, the duration of training and the player situation. For example, the nutritional needs of a player in the rehabilitation phase is totally different than nutritional needs of a player in the competitive phase. Studies show that nutrition is an important factor for players to avoid injury. For volleyball players, knee and ankle injuries are the main injuries that occur when players do not take adequate food due to the profile of this sport (Gordon, Kassier, & Biggs, 2015; Graham-Paulson, Perret, Smith, Crosland, & Goosey-Tolfrey, 2015).

## 5. CONCLUSION

What we can conclude from these studies and from the information obtained is that all these factors are important for every athlete, especially in relation to knee and ankle injuries in volleyball. It is considered the basic tools for the player, and the three aspects-biomechanical, psychological, and physiological are nested together. Each factor affects the other in some way, which makes it important to focus on all three factors. It is not assumed that each aspect exists in isolation. Rather, the three factors overlap significantly, and the medical staff should deal with all of them in conjunction with the technical staff of the club and with the cooperation of team colleagues and the fans. This makes it easier for players to cope, and it supports the player and the medical staff. It is assumed that the medical staff and the coaching staff will prepare the player to prevent physical injury by means of a pre-seasonal medical examination. That is the most important factor that helps to reduce injuries among players. Studies demonstrated the importance of these tests, because in some cases, the player was unaware of any injuries. This can reduce the injury rate among these clubs significantly, because the medical staff starts addressing problems before they happen, facilitating their work and readying the player psychologically and physically to start the season with full fitness and power. Eventually, it is very important to know the energy of the player and to look for ambition and abilities; it is necessary to design a program for each player, because each player has a different level of ambition. This would lead to the best psychological condition if monitored carefully. Exercises involving compression lead to injury most often, so understanding the needs of each player on the part of the coaching staff is very important in order to develop and take advantage of their abilities on the pitch. All of these factors can affect knee and ankle joints by increasing or decreasing the chance of injury.

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