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## A review on volleyball injuries

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### Abstract

*Introduction:* Unlike other team sports on the court, volleyball lacks physical contact between players, the teams being separated by the net. However, lower limb injuries take place during spiking and blocking through unintentional and illegal intrusion of a player in the opponent's court. Due to the specificity of the game, the joints of the upper limbs are also subject to overload.

*The purpose* of this study is to analyze the international literature on injury and trauma in performance volleyball.

*Methods:* We analysed several studies about injuries in performance volleyball which were identified using online databases: Google Scholar, EBSCO, Springer, Elsevier, and Scopus.

*Results:* The injury pattern shows the ankle sprain as being by far the most common injury in volleyball with a percentage of 31.9%. The knee is the second most injured anatomic site, 17.38% of injuries affecting this joint. Third most frequent injury affects the fingers 13.44%, followed by lower back 12.38% and shoulder trauma 12.18%. The hand is injured in 6.97%, while other injuries were found in 5.25% of cases.

*Conclusions:* The need for in depth analysis of volleyball injuries still persists. Analysing the literature we are coming to understand the mechanisms that produce the injuries with the purpose of finding methods to avoid these unfortunate events before they happen. It is no longer enough to recover from an injury, it must be prevented entirely if possible. Time spent by a player recovering may negatively affect the team's performance.

Injury prevention measures must occupy an important place in training. Coaches should take into account all the factors that influence injury incidence and design the training plan accordingly.

**Key words:** injuries, volleyball, ankle sprain, shoulder, performance

### Rezumat

Spre deosebire de celelalte jocuri sportive de pe parchet, putem spune că în volei lipsește contactul dintre jucători, echipele fiind separate de fileu în cele două jumătăți ale terenului. Cu toate acestea, majoritatea accidentărilor membrelor inferioare au loc în timpul acțiunilor de atac și blocaj prin pătrunderea neintenționată și neregulamentară a jucătorului în terenul advers. Datorită specificului jocului, articulațiile membrelor superioare sunt și ele supuse suprasolicitației.

*Scopul* acestui studiu este acela de a analiza literatura de specialitate internațională pe tema accidentărilor și traumatismelor în voleiul de performanță.

*Metode:* Am analizat mai multe studii referitoare la leziunile întâlnite în voleiul de performanță care au fost identificate folosind bazele de date online: Google Scholar, EBSCO, Springer, Elsevier și Scopus.

*Rezultate:* Tiparul accidentărilor arată faptul că entorsa de gleznă este pe departe cel mai comun traumatism în voleiul de performanță cu un procent de 31.9%. Genunchiul este al doilea, 17.38% din accidentări afectează această articulație. Al treilea traumatism ca frecvență afectează degetele mâinii 13.44%, urmat de accidentările la nivelul coloanei lombare 12.38 % și a umărului cu un procent de 12.18%. Încheietura mâinii este afectată în 6.97% din cazuri, în timp ce alte traumatisme au fost raportate cu o frecvență de 5.25%.

*Concluzii:* Nevoia de analiză în profunzime a traumatismelor specifice în volei persistă. Analizând literatura ajungem să înțelegem mecanismele ce produc accidentările cu scopul de a găsi metode de evitare a evenimentelor neplăcute înainte ca ele să se întâmple. Nu mai este suficientă recuperarea după accidentare, aceasta trebuie prevenită în totalitate dacă se poate. Timpul petrecut de un jucător ce se recuperează poate afecta negativ performanța echipei.

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Metodele de profilaxie a traumatismelor trebuie sa ocupe un loc important în antrenament. Este necesar ca antrenorii să ia în calcul toți factorii ce influențează incidența accidentărilor și să conceapă planul de antrenament în consecință.

**Cuvinte cheie:** *accidentari, volei, entorsă de gleznă, umăr, performanță*

## Introduction

There are very few studies that cover volleyball injuries, and the international literature includes papers with such various design and methodology that is quite difficult to compare them to each other. Studies on volleyball incidence during match play and training are mainly retrospective and reliable information on season long prospective studies is rare [1].

In contrary to popular belief the subject of injuries in elite volleyball is quite a serious one and overlooking it would be a mistake.

Unlike the other team sports on the court, volleyball lacks physical contact between players, the teams being separated by the net. However, lower limb injuries take place during spiking and blocking through unintentional and illegal intrusion of a player in the opponent's court, the ankle sprain being the most common. Repetitive jumping and unbalanced landings take their toll on the knees and can cause overuse and acute injuries. A notable fact is that female players are more susceptible to knee ligament injuries than males probably due to the more pronounced valgus of the lower limbs [2,3,4]. Volleyball is an overhead type sport in which, excepting the bump pass, all contact with the ball takes place above the player. This repeated process subjects the shoulder and the adjacent muscle groups to a great mechanical stress, leading finally to injuries like impingement syndrome and rotator cuff tendinitis and even rotator cuff tears. A determinant factor for rotator cuff injuries is strength imbalance between internal and external rotators of the shoulder [3].

Overuse of the lumbar spine as a result of extension coupled with torsion during the spike is also common among taller players [1].

Another type of injury that takes place during the game involves the hands and fingers. Ball speed during spikes and jump serves commonly exceeds 100 km/h. Misplacing the hand during the block or overhead reception leads to finger sprains.

## Aim

The purpose of this study is to analyze the international literature on injury and trauma in performance volleyball

## Methods

We performed the search in Google Scholar, EBSCO, Springer, Elsevier, and Scopus data bases. The criteria for inclusion were information regarding injuries and incidence of injuries in performance volleyball players. The terms used for the search were "volleyball injuries".

We have found 29 high impact studies covering injury incidence, general volleyball injuries and particular volleyball injuries.

The publications ranged from the year 1984 [5] to 2015 [6].

## Results

Out of the 29 papers found, 8 mentioned the incidence rate of injuries. The measuring unit for injury incidence is player injuries per 1000 hours of play or training.

Injury incidence rate varied from 2.4 [7] to 4.2 [5] player injuries per 1000 h. We also found a particular study from 2011 that aimed to determine relationship between prevalence and types of injuries and anthropometric properties of 91 male elite volleyball players from Iran having a incidence of 0.9 player injuries per 1000 h. This value is considered very low compared to the results from other papers. One reason for this contradiction could be the difference between the technical and tactical level of training in Iran compared to other countries [9].

The average injury incidence found was 3.05 player injuries per 1000 hours (Table I).

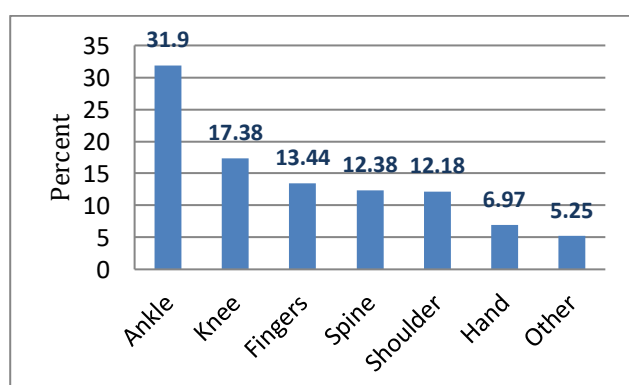
**Table I.** Player injury incidence per 1000 hours

Ref.	Year	Players	Injuries	Player Inj./1000h
[8]	1996	277	286	4.2
[10]	1996	137	177	3.8
[11]	1997	272	89	3.5
[1]	2004	486	100	2.6
[12]	2006	114	363	3.2
[7]	2009	407	248	2.4
[9]	2011	91		0.9
[6]	2015			3.8
		mean inj. incidence		3.05
		SD		1.06

**Table II.** Injury location (%)

Ref.	Players	Injuries	Injury location (%)					
			Shoulder	Hand	Fingers	Spine	Knee	Ankle
[13]	522	124						36.5
[1]	486	100	9	7		10	12	41
[12]	114	363	18		5.5	12.4	18.2	51
[7]	407	248	12.7	10		14	24.4	38.9
[8]	277	286	16		18		17	23
[11]	272	89	8		7	11	8	54
[10]	137	177	15		21		16	18
[14]	86	46			22	17	30	26
[15]	269	278					6	31
[16]	144	178	11.8	3.9	6.17	10.7	21.9	23
[9]	91		14.28		22.61		21.86	22.37
[17]	158		12		8	15	18	23
[18]*	106		9*				59*	24*
[6]			5		10.7	8.9	15.2	26.9
		mean	12.18	6.97	13.44	12.38	17.38	31.90
		SD	3.95	3.05	7.33	2.76	6.76	11.51

\* Acute injuries


**Figure 1.** Injury distribution

The injury pattern (Fig. 1.) shows the ankle sprain as being by far the most common injury in volleyball with a percentage of 31.9%. The knee is the second most injured anatomic site, 17.38% of injuries affecting this joint. Third most frequent injury affects the fingers 13.44%, followed by lower back 12.38% and shoulder trauma 12.18%. The hand is injured in 6.97% of the cases with other injuries found at 5.25%.

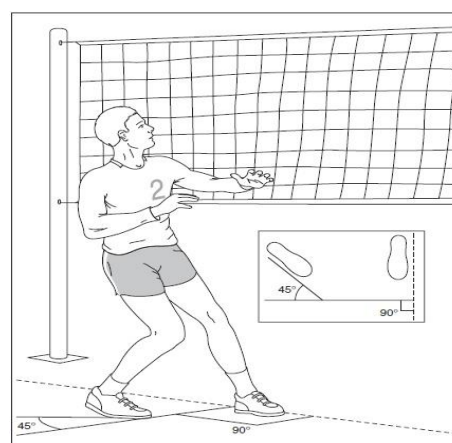
#### Ankle

The most common anatomic site of injury in volleyball is the ankle [13,12,,7, 8, 11,15,16,17,6]. The rate of ankle sprains which account for about half of the acute injuries in volleyball is comparable

to that of other contact sports like handball or basketball [2, 18]. This type of injury mainly occurs at the net, during spiking or blocking by landing on an opponent or a teammate's foot. A previous ankle sprain is another serious risk factor. There is an increased chance for the player to sustain a re-injury in 6 to 12 months after the initial sprain [18].

#### Knee

The knee was the next most common injury site. Volleyball players are exposed to two different types of knee injuries. The first one is an overuse injury known as patellar tendinopathy or jumper's knee. This overuse syndrome originates from the repetitive loads the quadriceps patellar tendon is exposed to during the jump landing sequence. Degenerative changes to the tendon can take place after cumulative micro-trauma. There are factors related to patellar tendinopathy such as training volume, floor type and gender. Harder surfaces lead to a higher risk of jumper's knee [14]. Also males are twice more susceptible than female players due to the higher power generated during a jump [20]. The right knee is affected more often than the left among volleyball players. One explanation could be the dynamic biomechanical factors acting upon the leg extensor apparatus during a spike jump with the right-left take off. This is expected to cause a higher eccentric-concentric loading of the right knee compared to the left [21] (Fig. 2).


**Figure 2.** Spike jump with right-left take off

Note the greater flexion angle of the right knee compared to the left. This may result in higher loads on the right knee during eccentric phase of the jump[21]

The second type of knee injury is the knee ligament injury. The large volumes of jumps involved in the game with frequent body turns and loss of balance are particularly harmful for the knees. It has been found that volleyball should be included among sports considered high risk to the knee joint. Women are more at risk to this type of injury due to the more pronounced valgus of the lower limbs. Acute knee injuries are more common during the game than during training sessions [22].

#### Lower back

From our findings lower back trauma accounts for 12.38 % of volleyball injuries.

There is an increased risk of developing stress fractures on the pars interarticularis of the vertebral bodies of the lumbar spine [27]. This condition is common among volleyball players, especially spikers and jump servers due to demanding repetitive lumbar hyperextension, truncal rotation and axial loading, and is referred as spondylolysis [21].

#### Shoulder

A volleyball player's shoulders are also exposed to overuse syndrome. Most of the skills used during the game are performed with the upper limbs in an overhead position. As a result, the players experience shoulder dysfunction. Attackers and jump servers are especially at risk compared to setters and defense specialists [23]. It has been estimated that an elite volleyball player will perform 40,000 spikes in one season of competition. With this volume and load it is not surprising that the most common shoulder injuries for volleyball players are overuse in character. Of these we name the following: glenohumeral instability syndrome, rotator cuff tendinopathy and suprascapular neuropathy[21].

Shoulder injuries are a more serious problem in females [10].

#### Hand and fingers

We have found that volleyball players sustain a high number of injuries to their hands. Finger trauma accounts for about 14% of all volleyball injuries. This does not come as a surprise as the ball speed during a spike or jump serve exceeds 100 km/h. If the hands and fingers are not in the correct position

at contact with the ball, sprains, strains and sometimes fractures can occur at this level. Index finger and thumb are the most exposed to injury being at the edge of the palm [24]. Even though it is a frequent injury, it is not uncommon for volleyball players to perform with sprained fingers. Taping is a solution for this kind of injury. Usually the injured finger is strapped to an adjacent, uninjured one. The thumb is immobilized separately (Fig. 3).



Figure 3. Finger taping [25]

#### Discussions

There are different factors that can influence the incidence of an injury. Intrinsic factors are age, gender, core instability, muscle imbalances whereas extrinsic factors are the position played and service style [23].

Most injuries take place in the front row, at the net, during blocking and spiking [10]. The middle blocker, being replaced in the back row by the defense specialist plays exclusively in the front row, thus he is more exposed to ankle sprains due to interference with the opponent during landing. On the other hand, outside hitters and opposites, being the main attacking force, tend to have a higher chance of shoulder dysfunction as a consequence of overuse [6].

Male players have a higher chance of knee overuse syndrome whereas women are more exposed to acute ligament injury at this level [20]. Also female players are more prone to shoulder dysfunction compared to men. The number of overuse injuries in male volleyball has increased over the last decade. The rise by 50% in training activity may be to blame [10].

In volleyball ankle and finger injuries are typical acute trauma, whereas shoulder, knee and lower back injuries are overuse injuries. [10]

## Conclusions

The need for in depth analysis of volleyball injuries still persists. Analysing the literature we are coming to understand the mechanisms that produce the injuries and we have to find methods to avoid these unfortunate events before they happen. It is no longer enough to recover from an injury, it must be prevented entirely if possible. Time spent by a player recovering may negatively affect the team's performance.

Injury prevention measures must occupy an important place in training. Coaches should take into account all the factors that influence injury incidence and design the training plan accordingly.

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