

The Comparison of Sport Injuries in Different Parts of the Body of Elite Male Volleyball Players

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Abstract

The purpose of this study was to compare sport injuries occurring in various parts of the body of elite male volleyball players participating in sport Olympiad of Iran universities. This study was descriptive and the statistical society consisted of elite male volleyball players participating in sport Olympiad. The subjects consisted of 72 elite athletes with average age (24.61 ± 2.28 yr), height (167.27 ± 6.61 cm), weight (58.17 ± 6.03 kg) and history of volleyball activities (8.43 ± 2.98 yr). Data of occurred injuries in the above mentioned tournament were recorded by Fuller et al questionnaire. Data were analyzed by descriptive and inferential statistics ($p \leq 0.05$) using SPSS-16 software (Chi – square test). Based on the results obtained in both training and match time, a significant correlation was observed between the kind of sport injuries and different parts of body ($K^2 = 727.06$, $p = 0.001$). The most vulnerable parts of body were upper limb (37.5%), and the most prevalent injuries were tendomuscular (45.7%). The most common injury was muscle spasms, (17.8%) overall and hand fingers (12.6%) were the most vulnerable parts of body. Thus, volleyball is so much superior risk professional volleyball players of tendomuscular injuries especially in upper limbs; such as fingers, knee and ankle injuries. Therefore, coaches and athletes should consider special training programs to strengthen the muscles of the body parts.

Keywords: Sport injury, Volleyball, Upper limb, Lower limb.

Introduction

Volleyball is an international collective sport that has a considerable effect on players' health, growth and physical development. Based on International Volleyball Federation report, there are more than 800 million persons who play this game at least weekly. However, importance of injury in this course cannot be neglected [1]. Injury is a potential hazard in all athletic fields [2, 3]. Moreover, injury is an inevitable part of sport [3, 4, 5]. Most of the damages experienced in sport occurred in lower extremity [1]. Bahr and Reeser (2003) found that 10%-19% of acute injuries treated in hospitals are related to sport and most of them occur in lower limbs, especially in knee and ankle [6].

Every injury can be a result of accidental events or due to an interaction between internal and external risk factors. Internal risk factors comprise those innate personal characteristics that result in injury or increase its risk. Gender, age, weight, flexibility, muscle strength, aerobic fitness, sexual hormones, women's menstruation and previous injury are examples of internal risk factors. External risk factors

refer to sport facilities and environment. These factors are skill level, competition level, type of sneakers, ankle brace, weather condition and the surface on which the game is carried out [7]. Another aspect of injury study is to identify movements and practices which lead to injury. Bach et al. (1992), for example, reported that during falling strokes on stiff surfaces and also during diving handling, acute injuries occur in acromioclavicular joint (clavicular-acromial) and with sudden strokes and repeated pressure of volleyball, glenohumeral joint can be injured [8]. Watkins (1992), Bahr et al. (1994), Rice and Anderson (1994), Aaggald and Jorgensen (1996), Aaggard et al. (1997) maintained that shoulder injury is often a consequence of extreme use and constitutes 20%-23% of all the injuries happened in volleyball [9,10,11,12,13]. According to reports, in professional volleyball players, 75-90% of shoulder injuries are due to overuse of this joint resulting in tendon soreness at extensor carpi radialis brevis muscles and biceps brachii muscle [9, 10, 11, 14, 15, 16]. Luxation of phalanges joints frequently occurs in volleyball players, and in more than 80% of the cases, thumb and little fingers is hurt. When lateral luxation occurs, lateral ligament of joint, placed against luxation direction, is injured while in the case of posterior

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luxation, both the lateral ligament and anterior capsule ligaments are partly injured [17].

Knee injuries are also widespread in volleyball. Gerbrich et al. (1987) showed that knee injuries included 59%-61% of all injuries occurred in volleyball [18]. Kujala et al. (1995) conducted an investigation among 886 volleyball players and found that 11.6% of the athletes suffered from knee inclinations, among which knee arthritis included 37.9%, knee inclination 1.9% and rest of the injuries 22.3% [19]. Rice and Anderson (1994) reported that among 222 members of U.S.A international team who suffered from musculo-skeletal injuries, 19.4% suffered from knee injuries occurred from 1980 to 1990, among which patellar tendonitis was the most frequent one [11]. In their study, Shafle et al. (1990) reported 17 kinds of knee injuries among which contusion and inclination were as frequent as 6.37% and 23.5% respectively [20]. Knee joint is also prone to injuries resulting from extreme use [15, 16, 20, 21, 22, 23]. Results of Bahr and Reeser (2003) in German volleyball showed that knee, ankle and hand fingers account for 30%, 17% and 17% of the injuries respectively [6].

In an investigation conducted by Bahr et al. (1997) on volleyball players, ankle (54%), lumbar (11%), knee (5%), shoulder (8%) and hand fingers (7%) were the most exposed limbs to injuries [24]. Knobloch et al. (2004) evaluated volleyball injuries. They found that upper limb with 71.3% and lower limb with 21.5% had the most exposed parts [5]. Daon et al. (2004) investigated volleyball in Ataturk University and reported the ankle as one of the most sensitive limbs [25]. In a study by Heal and Shatell (1985) on federal tournament, ankle was reported as one of the most sensitive limbs to injury having 55.1% of total injuries in 224 volleyball players [24]. Similarly, in an investigation in Norway, Bahr et al. (1994) reported the rate of one injury to ankle and tarsal per 100 hours of playing; this injury risk during the game was four times as much as that occurred during training [12, 24]. Results published by Bahr et al. (1994) and Aaggard et al. (1997) for Norway and Danish volleyball players showed that 9% of volleyball injuries were related to ankle and tarsal [12,9].

According to investigations carried out on volleyball injuries, ankle and tarsal, knee, shoulder, hand and its fingers were the most vulnerable parts of body [9, 10, 14, 15, 18, 16]. Since different parts were reported as vulnerable limbs in various studies and there is not much information on sport injuries prevention approaches, and also it is possible to prevent from injury factors through recognition of sport injuries [4], we conducted this investigation to compare sport injuries in different limbs of male

volleyball player students participating in sports Olympiad of Iranian universities.

Methods

This investigation is in the form of descriptive – correlation studies. Statistical society consisted of male volleyball players of sports Olympiad. 72 elite athletes with more than 4 years of experience of training with average age of (24.61 ± 2.28 yr), height (167.27 ± 6.61 cm), weight (58.17 ± 6.03 kg), and history of volleyball activities (8.43 ± 2.98 yr) were selected for the study. Information on the injuries occurred during the tournament was recorded using Fuller et al. [27] questionnaire whose validity been evaluated ($\alpha=0.84$) in Iran. Questionnaire records were analyzed by Chi – Square test ($p \leq 0.05$) using SPSS-16 software.

Results

According to Tables 1 & 2 and Figures 1 & 2, the most vulnerable body limbs were upper limbs (37.5%), lower limbs (37.4%), trunk and spinal cord (21.7%), head and face (3.4%) and the most widespread injuries included tendomuscular (45.7%), joint – ligament (21.2%), skin (13.5%), pain (12.3%) and bone (7.3%) injuries. The most common tendomuscular injury was cramp (17.8%), while the most widespread injury for joint – ligament and skin injuries were luxation (7.9%) and abrasion (8.9%), respectively. The most vulnerable part of upper limbs, lower limbs, and trunk and spinal cord were hand fingers (12.6%), knee (12.4%), and shoulder (8.3%), respectively. Among all the injuries, the most common one was cramp (17.8%). The most vulnerable limb was hand fingers (12.6%). Table 4 presents percentage and frequency of sport injuries in different parts of the body in subjects. As shown in Tables 3 & 5, in both training and match time, a significant correlation was observed between the kind of sport injuries and different organs of body ($K^2= 727.06$, $p = 0.001$).

Discussions

Our results indicated a significant correlation of sport injuries in various body parts including trunk and spinal cord, upper limbs and lower limbs in the volleyball players, but the correlation in head and face was not significant. This finding is in agreement with the results reported by Rajabi et al. (2006) and Bahr and Reeser (2003) [1, 6]. The most common injury observed in our investigation was of tendomuscular kind including cramp and bruise often occurring in lower limbs (15.15%). This find

Table 1: Variance distribution of sport injuries in different parts of the body in subjects

Elite volleyball player students				
Injury locality	Injured organ	Frequency	Percentage	Total percentage
Head and face	Skull	4	0.8	3.4
	Nose	4	0.8	
	Ear	1	0.2	
	Mouth	8	1.6	
Trunk	Neck	11	2.1	21.7
	Back	12	2.3	
	Shoulder	43	8.3	
	Lumbar	38	7.4	
	Rib	5	1	
	Sternum	3	0.6	
Upper extremity	Fingers	65	12.6	37.5
	Palm	11	2.1	
	Wrist	23	4.4	
	Forearm	19	3.7	
	Elbow	25	4.8	
	Arm	17	3.3	
	Scapula	22	4.3	
	Clavicle	12	2.3	
Lower extremity	Toe	14	2.7	37.4
	Foot	11	2.1	
	Ankle	40	7.7	
	Lower leg	15	2.9	
	Knee	64	12.4	
	Patella	10	1.9	
	Femur	30	5.8	
	Pelvis	10	1.9	

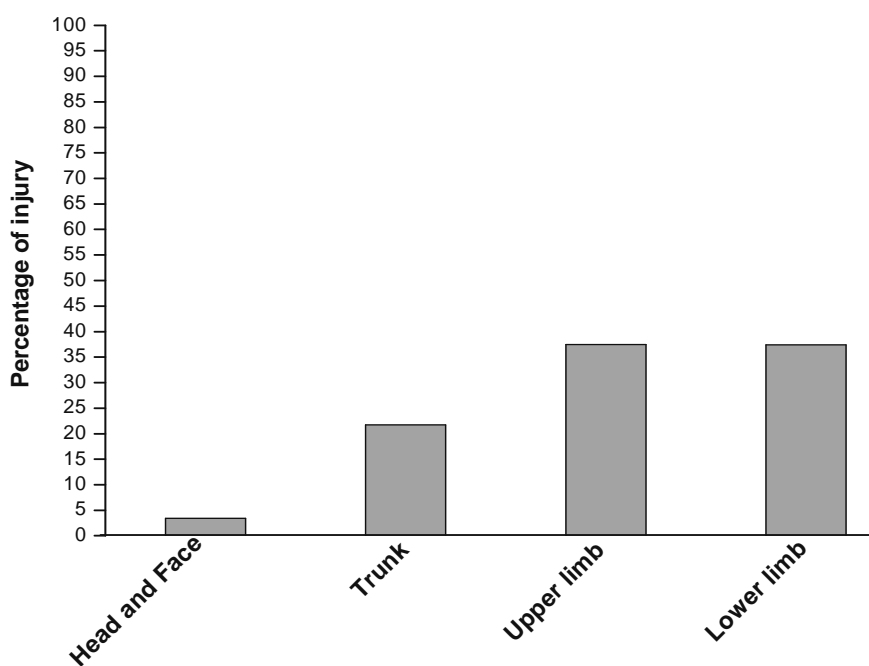
**Figure 1.** Determining the percentage of sport injuries in different parts of the body in subjects

Table 2: Distribution of sport injuries in subjects

Elite volleyball player students				
Injury		Frequency	Percentage	Total percentage
Skin	Abrasion	46	8.9	13.5
	Laceration	10	1.9	
	Blister	4	0.8	
	Corn	5	1	
	Fungus infection	4	0.8	
Muscle-tendon	Spasm	92	17.8	45.7
	Contusion	38	7.4	
	Bruise	48	9.3	
	Hematoma	15	2.9	
	Strain	34	6.6	
	Muscle tear	9	1.7	
Joint-ligament	Sprain	39	7.5	21.2
	Luxation	41	7.9	
	Ligament tear	10	1.9	
	Meniscus tear	3	0.6	
	Joint cartilage	17	3.3	
Bone	Open fracture	15	2.9	7.3
	Closed fracture	23	4.4	
Pain	Acute	24	4.6	12.3
	Chronic	40	7.7	

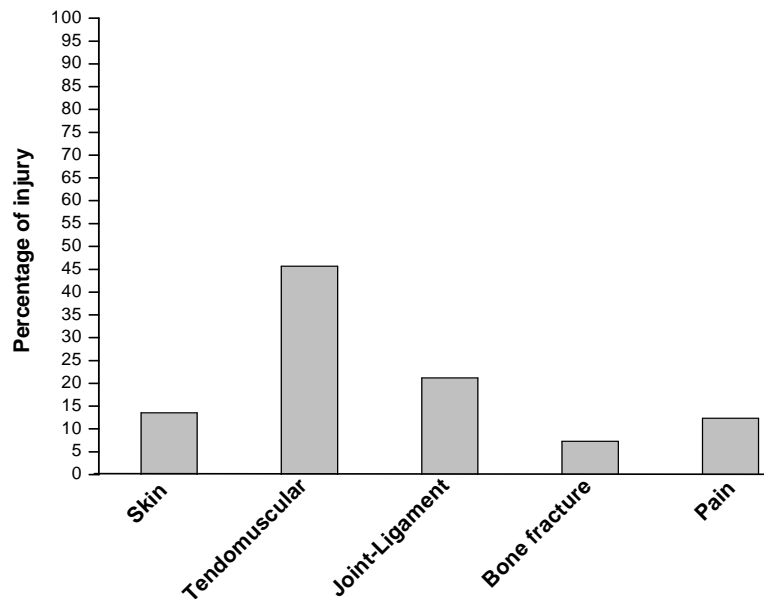


Figure 2: Determining the percentage of sport injuries in subjects

Table 3: Correlation between sport injuries and different parts of the body in subjects

Injury →	Head and Face	Trunk	Upper limb	Lower limb	Total
Total of body injury	$k^2 = 2.23$ $P = 0.327$	$k^2 = 161.92$ $*P = 0.001$	$k^2 = 55.88$ $*P = 0.001$	$k^2 = 67.59$ $*P = 0.001$	$k^2 = 727.06$ $*P = 0.001$

* $P < 0.05$

Table 4: The percentage and frequency of sport injuries in different parts of the body in subjects

Limb → ↓ Injury	Head and Face		Trunk		Upper limb		Lower limb	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Skin	2	0.39	7	1.35	29	5.63	31	6.02
Tendomuscular	8	1.55	75	14.57	75	14.57	78	15.15
Joint-Ligament	2	0.39	10	1.95	47	9.12	49	9.51
Bone	3	0.59	1	0.2	16	3.1	18	3.5
Pain	2	0.39	19	3.68	26	5.04	17	3.3

Table 5: Correlation between different parts of the body and sport injuries in subjects

Injury →	Skin	Tendomuscular	Joint-Ligament	Fracture	Pain	Total
Total of body limbs	$k^2 = 65.62$ *P= 0.001	$k^2 = 111.64$ *P= 0.001	$k^2 = 53.63$ *P= 0.001	$k^2 = 1.68$ *P= 0.001	$k^2 = 4.01$ *P= 0.046	$k^2 = 727.01$ *P= 0.001

*P < 0.05

ing is in contrast to those reported by Rajabi et al. (2006) and Knobloch et al. (2004) who reported joint – ligament injuries as the most frequent injuries [1,5]. This contrast can be partly due to different qualities of volleyball players including elite, non-elite and novice. Since the elite volleyball players experience intensive exercises and their joints are involved in different directions [6, 10, 22], probably joint – ligament injuries in these athletes is more common than those in novice ones. Regarding the agreement of the present study with other authors, it should be mentioned that since coordinating agonist and antagonist muscles is an important aspect of neuromuscular coordination and because instant and rapid movement is frequent in volleyball, energy depletion in contraction state occurs very quickly that leads to technical performance and one part of this contraction which remains in the muscle for a while causes cramp [1]. In accordance with Bahr and Reeser (2003) and Aaggard et al. (1997), our results indicated that most injured parts were located in upper limbs and hand fingers were the most vulnerable part to injury [9,6]. These observations are the result of extreme use of upper limbs and power movements during service or spike due to heavy external rotation in shoulder girdle [1]. Moreover, unsuitable position of hand and its fingers toward the ball, high velocity of the ball impacting fingers and power stroke [25] are probable causes of injuries occurring in upper limb specially in hand fingers. Lower limbs go below upper limbs in injuries (37.4%). Since volleyball is a sport with powering jumps, sudden landing and quick redirection after landing, inappropriate position of the legs in the time of landing [1] makes athlete exposed to injury. Moreover, if

the body and ball are not in the same direction, the volleyball player lands on one foot or without balance causing sprain in lower limb joints [25]. Knee and ankle were the most vulnerable parts of lower limb, probably because a force 9-11 times as much as body weight is exerted on the feet during landing, ankle and knee are the first parts receiving this force, so if the foot is not in appropriate angle with the ground [28], it will be exposed to injury more severely. Absorbing the shocks in the time of landing is one of the ankle properties. When jumping off and landing, elasticity of the ankle reduces the pressure on lumbar and upper parts, and this causes a direct shock on ankle [1] and ankle injury during unbalanced landing.

Conclusion:

Based on our results, all volleyball players and coaches should be aware of high rate of tendomuscular injuries in upper limbs especially in fingers, knee and ankle among elite volleyball players and preventive measures should be taken. Percentage of injury in upper limb was almost similar to that in lower limb (37.5%) indicating that not only upper limb, but also lower limb is involved greatly in volleyball training and suggesting that all the body is involved in performing movements and special techniques.

It is recommended that coaches and volleyball players take some training programs for muscles strengthen of these parts of the body. So, to minimize injury percentage, volleyball players should take stretching training and warm-up before the competition and training.

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