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Prevalence of volleyball-related musculoskeletal injuries among university players: A search for Ethiopian public universities

Ephrem Tamrat Desalegn, Mesay Dessalegn Zenebe and Mohammed Endris Wusen

Abstract

The aim of this study is to determine the prevalence of injuries sustained by beginner and experienced volleyball players of a club in the Ethiopian public universities in one season from October 2012 to February 2013. An exploratory, descriptive, retrospective design was used for this study on 360 volleyball players on the public universities Volleyball Clubs. A self-administered questionnaire was used for the present study. A response rate of 96.3% was obtained. The incidence rate was 3.57 injuries per player. Injuries prevalence was higher among female players 4.35 than male players 2.9. Ankle and finger injuries showed the highest injury prevalence. In the present study 17.22% volleyball players sustained an injury during the season on both competition and match. Of those who sustained injuries, 45.16% were males and 54.84% were females. The occurrence of injuries on players, were 74.19% during match and, 25.81% occurred during team training. In this study Players were injured during blocking and setting activities.

The majority of injured players sustained injuries in the lower extremities was 62.9%, and the upper limbs was 37.1%. Majority of injuries were strain followed by ankle, finger and thumb dislocation. Most injuries occurred during the execution of wrong technique followed by steps on other's foot.

Keywords: Injuries, musculoskeletal, occurrence; prevalence, risk factor, Volleyball

1. Introduction

Volleyball is one of the exciting, fast, dynamic and most popular sports in the world ^[1-6] which is played by approximately 800 million people with diverse characteristics such as: indoors and outdoors, by the young and the old, by males and females ^[7], and by both the able and disable individuals. Further-more, it is unique among team sports in that it has evolved into two distinct Olympic disciplines: an indoor version featuring six players on each team, and a two person per side outdoor game typically played on sand beach volleyball ^[7, 8].

With regard to its worldwide popularity, Many scholars estimated that volleyball ranks second to soccer ^[7, 9]. In Ethiopia also volleyball is very popular sport as athletics and football, and it is estimated that more than two million participants are involved.

Volleyball is described as a "net game". This is to mean that it is a sport that does not involve any physical contact between the athletes and their opponents since the volleyball court is separated by the net ^[3, 6, 10].

Even though it is a non-contact game in which players from the opposing teams are separated by a net ^[11], the prevalence of injuries might be postulated to be low ^[6]. Nevertheless, it is a sport involving very quick and forceful movements of the body both horizontally and vertically, and therefore the large and repetitive forces involved in such movements will make injuries inevitably occur ^[2, 5]. According to ^[12] volleyball injury is defined as any physical complaint sustained by a player that results from a volleyball match or volleyball training.

Verhagen, 2004 ^[2] also explained that an injury is recorded if it occurred as a result of volleyball and caused the subject to stop this activity, or resulted in the subject not participating fully in the next planned sports activity. In this study, volleyball injury is "Any musculoskeletal complaint newly incurred due to competition and/or training during the tournament that received medical attention and/or absence from competition or training."

Studies conducted in different countries show that injury prevalence pattern in volleyball are repetitive [2, 9] in different sexes and age groups [10]. For instance, Schafle, MD, 1990 [13] found an overall injury incidence of 2.3 per 1000 hours during the United States Volleyball Association's six day national tournament; while in Norwegian elite volleyball players, an incidence of 1.7 per 1000 hours has been reported. Anastasia, 2009 [10] also identified that the injury incidence is between 1.7 and 4.2 per 1000 hrs. Of play, and it is the fourth most common source of sports injuries.

In recent years in Ethiopia, there is an increment of the number of participants in volleyball sport under clubs, projects and recreational purposes. In the experience of the investigator as an instructor and a coach in the university and zone sport commission (the former zone youth, sport and culture office) respectively, athletes are highly vulnerable for injuries because of lack of protective equipment, comfortable play grounds, medical facilities, efficient surveillance systems of injuries and skilled manpower (coaches). So given the

vulnerability of athletes regarding sport injuries, it is clearly understood that more studies are needed on the volleyball players, which may give better control over the occurrences of these injuries.

Therefore, this study aims at investigating the rate of injuries (in the competition or match), severity of injuries, anatomical locations, number of recurrent injuries, the injured player's court position (blockers, setter, hitter, universal player), mechanisms of volleyball injuries with particular reference to possible risk factors of injuries on Government Universities Volleyball clubs players in order to provide them with fundamental preventive measures.

2. Subjects, Materials and Methods

A total of 360 university male and female volleyball players participating in volleyball championship in Ethiopian public universities Sport Association (EPUSA) were observed retrospectively for 2012-2013 period. This was 59.6% of the volleyball players participating in the tournament.

Table I: The Anthropometric Characteristics, Age and Engagement in Other Sports of the Involved Participants.

		Sex of the participant				Total
		Female	Percent	Male	Percent	
Weight of the participant	51-65	125	76	97	49.75	222
	66-80	40	24	98	50.25	138
Total		165	100	195	100	360
		Sex of the participant				Total
		Female	Percent	Male	Percent	
Height of the participant	140-155	101	61	56	29	157
	156-170	58	35	123	63	181
	171-185	6	4	16	8	22
Total		165	100	195	100	360
		Sex of the participant				Total
		Female	Percent	Male	Percent	
Age of the participant	17-25	157	95	168	86	325
	26-30	8	5	27	14	35
Total		165	100	195	100	360
Engagement in other sports		Sex of the participant				Total
		Female	percent	Male	percent	
No		150	90.91	177	90.77	327
Yes		15	9.09	18	9.23	33
Total		165	100	195	100	360

2.1 Data Collection and Definition of the Injury

A structured interviewer-administered questionnaire and exposure forms were prepared by the investigators by reviewing different literatures and was used as a data collection instrument. The injury incidence rate, the characteristics of the injuries (severity, diagnosis) and the anatomical location of the muscle skeletal injuries that occurred during practice and competition in the whole championship period were recorded retrospectively.

For the purpose of this study, an injury was defined as, any incident that occurs during warm up or competition that requires medical attention (Zemper & Pieter, 1989) [14] and cause the player to be absent from sport participation either in a training or match session (Mckay, *et al.*2001) [15]. A pre-existing before the tournament and not fully rehabilitated injury was not reported or registered.

Injuries were classified into three grades of severity: minor (absence from training or competition for less than one week), moderate (absence from training or competition for one week to one month) and major (absence from training or competition for more than one month). This classification has been used in many studies [3, 11, 16, 17].

2.2 Statistical Analysis

Data was checked, entered and cleaned using Epi-info version 17 statistical software and then transferred to SPSS (Statistical Package for Social Science) version 20 for further analysis. Frequencies and cross tabulation was used to summarize descriptive statistics of the data and table and graphs were used for data presentation.

Adjusted odds ratio (OR), relative risk [13] with 95% confidence interval and p-value <0.05 was used to show association between explanatory variables and dependent variable. Variables having p-value of less than 0.05 has been considered as significantly associated with the dependent variable.

3. Results

3.1 Injury Rate

A total of 62 injuries occurred during the period of October, 2014 to February, 2015, giving an injury prevalence of 0.17 per player and an incidence of 3.57 injuries per 1000 hours. Of these the incidence of injuries on females was 4.35 per 1000 hours and on males the incidence was 2.9 per 1000 hours. In the present study 17.22% (62/360) volleyball players sustained an injury during the season on both competition and

match. Of those who sustained injuries, 45.16% (28/62) were males and 54.84% (34/62) were females. 298 players (82.78%) did not sustain any injuries. The odds ratio (OR) of female injuries comparison male was 1.548(95%CI: 0.8931 to 2.6831) $p=0.1194>0.05$, the rate of injuries on females seemed more, but there is no significant difference between male and females.

On the other hand, the probability of females for injury was 20.6% (34/165), for males 14.36% (28/195) with a relative risk ^[13] of 1.4351, (95%CI, 0.9103 to 2.2624) $p=0.1199>0.05$, no significant difference observed. But, female players are 1.4 times more likely to be injured than male players.

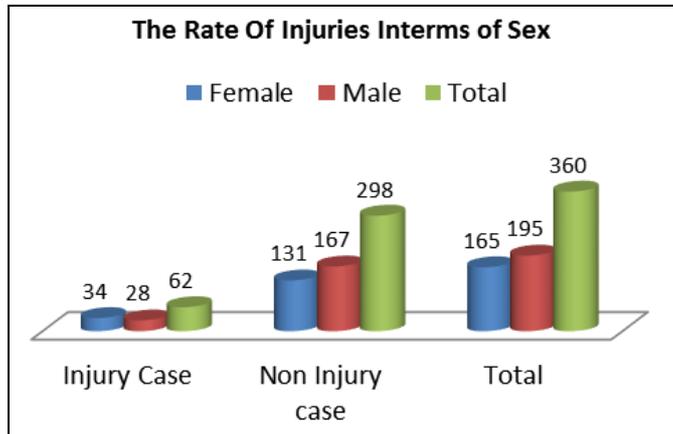


Fig I: The Rate of Injuries In Terms Of Sex

Of the total reported injuries (n=62), the occurrence of injuries on the players, 46(74.19%) were during match and, 16(25.81%) of the injuries were occur during team training. The odds ratio of injuries during match within 18 weeks versus injuries during team training was 3.1497(95%CI, 1.7476 to 5.6768), $p=0.0001<0.0$. The overall risk of injuries was higher for match play than for training. The probability of injury during match was 12.78% and training 4.44% with a relative risk of 2.875 (95%CI: 1.6591 to 4.9821) $p=0.0002$. significant difference was seen, and players during match was 2.9 times more likely to be injured than training. On the other hand, in the present study, 95.55% (58/62) injuries were occur in the age range of 17-25 years, and the rest 6.45% (4/62) were on the age range of 26-30 years. Injuries according to body parts (calculated from the total number of injuries) knee and ankle occurred at the highest rate 25.5% (13/51), followed by injuries in the shoulder 19.6% (10/51), fingers 9.8% (5/51) and hand 7.8% (4/51).

Table II: The Rate of Injuries In Terms Of Body Part

Body Part	Injury Exposure		Total
	Frequency	Percent	
Ankle	35	56.45	35
Shoulder	5	8.06	5
Finger	14	22.58	14
Thumb	4	6.45	4
Achilles Tendon	2	3.23	2
Hamstring	2	3.23	2
Total	62	100	62

The majority of injured players sustained injuries in the lower extremities 62.9% (39/62), followed by the upper limbs 37.1% (23/62). The odds ratio (OR) of injuries in the lower extremities in the season versus upper extremities was 2.8752(95%CI, 1.3874 to 5.9588) $p=0.0045<0.05$, significant

difference was observed, the rate of injuries in the lower extremity seemed more than upper extremity, but statistically there is no significant difference between them.

In the present study, 46.78% (n=29) injuries were strain followed by ankle, finger and thumb dislocation, 42.94% (n=26) muscle cramp and tendonitis were 4.84% (n=3) and 3.22% (n=2) respectively. Sprain and bursitis were very small 1.61% (n=1) each. In comparison with the rate and type of injuries, female players were exposed more for dislocation (n=16, 47.06%) and males (n=10, 35.71%) by strain, males were more (n=16, 57.14%) and females (n=13, 38.23%).

Table III: Rate and Diagnose Of Injury Related To Sex

Type of injury /diagnosis	Sex of the participant				Total
	Female	%	Male	%	
Dislocation	16	26.81	10	16.13	26
Strain/rupture	13	20.97	16	25.81	29
Sprain	1	1.61	0	0	1
Muscle cramp	3	4.84	0	0	3
Tendonitis	0	0	2	3.22	2
Bursitis	1	1.61	0	0	1
Total	34	55.84	28	45.16	62

Regarding the type of injury sustained on the body parts, dislocation and strain was more on ankle (33.87% and 22.58%) respectively followed by finger, thumb and shoulder (3.22%, 3.22%, 1.61%), in the case of strain, shoulder, finger and thumb were (1.61%, 19.35%, 3.22%) respectively.

Figure 2, below shows that 52.94% (18/34) of injured females and 50% (14/28) of injured male got injured due to blocking. Due to setting, 39.29% (11/28) of injured males players and 17.65% (6/34) of females sustain injuries.

The probability of setters to be injured during setting is 83.3% and the probability of injuries on other court positions is 16.7%, with a relative risk ^[13] of 5.0 (95%CI, 1.7436 to 14.3379) $p=0.0027<0.05$, showed that volleyball players in the setter position were significantly more likely to be injured during setting. Players in the left and right front row were significantly more prone to be injured during spiking ($p=0.006$).

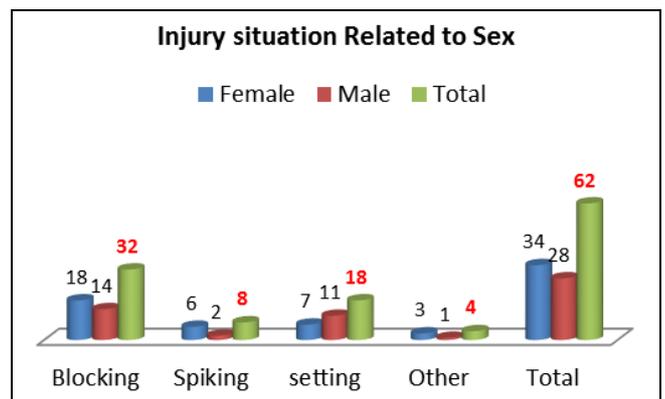


Fig 2: Injury Situations Related To Sex

In this study, as table 4 shows, more than half 53.57% (15/28) of the injuries on males and 38.24% (13/34) injuries on females were caused by the execution of wrong technique, 41.17% (14/34) females and 28.57% (8/28) males were injured due to steps on other's foot, the rest 20.59% (7/34) of females and 17.86% (5/28) males were exposed because of ball contact.

Table IV: Injury Factors In Terms of Sex

Injury factor	Sex of the participant				Total
	Female	%	Male	%	
Wrong technique	13	38.24	15	53.57	28
Steps on other's foot	14	41.17	8	28.57	22
Ball contact	7	20.59	5	17.86	12
Total	34	100	28	100	62

3.2 Injury Classifications In Terms Of Sex

From the total injuries sustained in the season (n=62), 91.94% (57/62) were acute. Of these, 50% (31/62) were on females and 41.94% (26/62) were on male players. On the other hand, 8.06% (5/62) injuries were overuse, 4.84% (3/62) on female and 3.22% (2/62) on males. (fig.4.6.)

The odds ratio (OR) of females acute injuries versus males is 1.3846(95%CI, 0.6816 to 2.8127) p=0.3681>0.05, no significance difference observed.

The probability of females for acute injuries was 18.79% for males 14.36% with a relative risk of 1.4091(95%CI, 0.8735 to 2.2731) p=0.1599>0.05, no significance difference between the two sexes.

As table 5. shows that, during 18 weeks volleyball training and match 62 players were injured, of these 47.06% (n=16) of female and 35.71% (n=10) male injured players were the left/right front row players, 26.47(9/34) female and 25% (7/28) male injured players were center players, 17.65% (6/34) female and 32.14% (9/28) male players were on the setter position the rest 8.82% (3/34) female and 7.14% (2/28) male injured players were in the back line or row of the court.

Table V: Players Court Position at the Time of Injury

player position	Sex of the participant				Total
	Female	%	Male	%	
Setter	6	17.65	9	32.14	15
Center	9	26.47	7	25.00	16
Left/right front row	16	47.06	10	35.71	26
Back line	3	8.82	2	7.14	5
Total	34	100	28	100	62

In the present study Small number of volleyball players was involved in some prevention programmes in the season 31.7% (114/360), as illustrated in Table 4.9.in relation to the injured players, 30.65% (19/62) of the players were performing some kind of preventive exercises.

Table VII: Injury Severity Related To Sex

Sex	Injury Severity						
	More than 4 weeks	%	2-4 weeks	%	Less than 1 week	%	Total
Female	7	50	13	54.17	14	58.33	34
Male	7	50	11	45.83	10	41.67	28
Total	14	100	24	100	24	100	62

4. Discussion

The total response rate in the study was 96.3% from a sample of 360 players. The high response rate supports the validity of the study even though the small sample size limits the generalization potential of the study. The high response rate in this study is similar to previous studies [6, 18].

Male participation was higher (54.2%) than in the case of females (45.8%). This was similar to the study conducted by (Bahr & Bahr, 1997) [6]. The level of participation among males and females was different from the previous studies by (Augustsson *et al.*, 2006; Verhagen *et al.*, 2004) [2, 17] which had a higher response rate among females than males. According to Richard, *et al.* [19], the level of participation

Most of the players (60.53%, 69/114) did preventive exercise related to technique drills in the season, 33.33 (38/114), of those performed strength training and 6.145(7/114) players were doing plyometric exercises. Those who performed strength (15.79%, 6/38), technique drills (17.39%, 12/69) and plyometric (14.29%, 1/7) preventive exercises during the season were injured. While 30.65% (19/62), of those who performed prevention exercises during the season were injured and the areas affected were the ankle and the finger.

3.3 Injury Newness Related To Sex

As shown in fig. 4.7, from the total registered injures during the season (n=62), 72.58% (45/62) injuries were new and 27.42% (17/62) injuries were recurrent. Of these 44.44% (20/45) new and 47.06% (8/17) recurrent injuries were occurred on males and 55.56% (25/45) new and 52.94% (9/17) recurrent injuries were on females.

Table 4.8. indicates that, Small number of volleyball players was involved in some prevention programmes in the season 31.7% (114/360), as illustrated in Table 4.9.in relation to the injured players, 30.65% (19/62) of the players were performing some kind of preventive exercises.

Most of the players (60.53%, 69/114) did preventive exercise related to technique drills in the season, 33.33 (38/114), of those performed strength training and 6.145(7/114) players were doing plyometric exercises. Those who performed strength (15.79%, 6/38), technique drills (17.39%, 12/69) and plyometric (14.29%, 1/7) preventive exercises during the season were injured. While 30.65% (19/62), of those who performed prevention exercises during the season were injured and the areas affected were the ankle and the finger.

Table VI: Involvement of Preventive Programms In Terms Of Sex

Preventive Exercise	Sex of the participant				Total
	Female	%	Male	%	
No	130	78.78	116	59.49	246
Yes	35	21.21	79	40.51	114
Total	165	100	195	100	360

3.4 Injury Severity Related To Sex

During the 18 weeks volleyball training and match 62 injuries were registered. Of these in terms of degree of severity 14(22.58%) were Sevier, 24 (38.71%) were moderate and the same as moderate 24(38.71%) were minor injuries.

among females is higher in volleyball.

In this study, there were 17.22% of the volleyball players sustained injuries during the season. This finding was higher than that of a previous study by Schafle *et al.*, (1990) [13] and nearly the same with Augustsson *et al.*, (2006) [17] finding, whereby only 17.22% of the players sustained an injury. The incidence of injury in the current study was 3.57 injuries for each player. This injury incidence was higher than a previous study by (Augustsson *et al.*, 2006) [17], which found an injury incidence of 0.68 per player.

Augustsson *et al.*, (2006) [17], reported that various factors such as better training, experience of coaches, experience of players, proper facilities, accessibility to injury rehabilitation,

and proper preventative exercises can be attributed to the decrease in the prevalence of volleyball injuries.

The injury incidence of the current study was higher than the study conducted by Bahr & Bahr (1997) ^[6], which had an incidence of 1.7 injuries per player. The reason for this is the lesser exposure time which is a total of 17358 player hours compared to the study of Bahr & Bahr (1997) ^[6], which had a sample size of 272 volleyball players with 51588 player hours.

17.22% of the players sustained an injury in the season. There were a total of 62 injuries which occurred in the season. The Injury prevalence was lower in the present study as compared to the previous study by Bahr & Reeser (2003) ^[20], which found a prevalence of 43% and higher study by Schafle (1990) which was 10%.

Among the injured players, ankle and Finger injuries showed the highest prevalence in the present study which correlate well with studies conducted by different scholars ^[2, 6, 10, 17].

On both training and match sessions, most injuries sustained were minor injuries. This compares well with the findings in the study by Aagaard and Jorgensen (1996) ^[21], which showed that most major/severe injuries occur during match.

The reason for overuse injuries occurring during matches is attributed to the importance of the matches and therefore the increased intensity and over exertion by players ^[17, 22]. In the training, Verhagen *et al.* (2004) ^[2], related the injury occurrence to the high exposure time.

The rates of injuries occurring were higher during matches than training sessions (74.19%) in this study. The study of Augustsson *et al.*, (2006) ^[17], showed high injury prevalence during training while the study of Bahr & Bahr (1997) ^[6], showed an increase of injuries during matches.

The majority of injuries pertaining to training and match times, occurred at the ankle, which was similar to the study of Augustsson *et al.*, (2006). It is further supported by other studies which report that ankle injuries are the most common acute injury which occurs in volleyball ^[2, 7, 17, 23].

This study showed that 8.1% of players had injuries that occurred gradually and they could not indicate whether it occurred during a match, training, or warm-up. This is lower than the rate of injuries occurred gradually in the study of Augustsson *et al.*, (2006) ^[17], which indicated 41%.

This correlate well with other studies. According to Augustsson *et al.*, (2006) ^[17], several studies reported an increase in number of injuries occurred gradually and that is due to the increase number of training hours. In this study, number of hours during training was lower than the study of Augustsson *et al.*, (2006).

More than half of the injuries which occurred gradually ^[24] were in the shoulder and the Achilles tendon followed by hamstring. This is due to continuous overuse of the shoulder ^[17, 21]. This is similar to the study conducted by (Verhagen *et al.*, 2004) ^[2] which stated that the most overuse injuries are sustained in the shoulder and the knee.

This differs from a study by Bahr & Reeser (2003) ^[20], which found that most of the injuries with gradual onset, occurred in the back. The study by Bahr & Reeser (2003) ^[25], was conducted with beach volleyball players and the nature of the surface in beach volleyball is different which needs more physical strength and more stability than the indoor court surface. According to smith (2006) ^[26], the ability to transfer position during playing is more difficult on the sand as compared to hard court volleyball. In addition, the vertical jumping requires more energy in beach volleyball and causes more stress to the back muscles.

The Majority of the injuries that occurred in the current study were not due to contact with another player. That is similar to the study conducted by Briner & Kamcar (1997) ^[27], which found that most of the injuries in volleyball were associated with no contact with other player/s.

According to Agel *et al.*, (2007) ^[28], most injuries occurred in the ankle is due to contact. In this study, Injuries occurred in the ankle were steps on other's foot at the center line or conflict zone which is 45.16% (28/62).

The performance of prevention exercises also effects injury prevalence. According to (Augustsson *et al.*, 2006; Verhagen *et al.*, 2004; Bahr & Bahr 1997) ^[2, 6, 17], prevention programmes have gained attention in recent years due to its direct impact in reducing the prevalence of injuries in sports. The performance of prevention exercises pre-season and during season was higher in the study of Augustsson *et al.*, (2006) ^[7]. In this study the injury prevalence is higher and the performance of preventative exercises is lower.

Prevention programme supervision can reduce injury occurrence in cases where the trainer is experienced in sport-specific injuries and have the knowledge of designing training programmes to achieve high performance and prevent injuries Kraemer, *et al.*, (2002) ^[29]. The performance of preventative exercises with supervision (51.75%) in this study was higher than without supervision (48.25%). It is different from the study by Augustsson *et al.*, (2006), which shows increased performance without supervision (58%). According to Reeser, J., & Bahr, R. (n.d.) ^[30], proper preventative exercises need enough experience by the coach.

Therefore, performing preventive exercise without supervision is one of the risk factors to the Ethiopian public Universities Volleyball Players.

Results show that the training schedule of the Universities volleyball club is limited to 2 or 3 times per week for less than 3 hours per session. In the study by Augustsson *et al.*, (2006) more time was spent on training which enhances the players experience in performing this kind of exercises, leading to better physical performance and experience (Kraemer *et al.*, 2002) ^[29].

The majority of the players (60.53%) made use of technique drill training followed by strength training incorporated in their prevention programme.

Players in the left and right front row were significantly more prone to be injured during spiking

According to studies by (Agel *et al.*, 2007; Bahr & Bahr 1997) ^[6, 28], volleyball players near the net are more prone to injuries than players in any other position. In the results it is shown that more than 70% of injuries occurred in the three front positions, which are similar to the findings of Augustsson *et al.*, (2006). This is due to the fact that players in these positions perform spiking and blocking, which are the most common actions for injuries in volleyball.

Injury prevalence in this study was higher in females (20.60%) than males (14.36%), which is similar to what was shown in the study by Augustsson *et al.*, (2006) ^[17].

Injuries in lower limbs were higher in females than males. This is different to the study conducted by Augustsson *et al.*, (2006).

Another finding of the study was that 9.17% of the volleyball players also engaged in other sporting activities. According to Aagaard & Jorgensen (1996) ^[21], an increase of overuse injuries is related to participation in other sport activities due to an increase in the training hours.

Participation in different kinds of activities also adds variation to training which can lead to a beneficial effect.

5. Conclusion

The overall injury prevalence among the Ethiopian Public Universities Volleyball Players is high as 17.22% of the players were injured. The injury prevalence and the risk to be injured are higher among the female's players.

Ankle and finger injuries are the most common types of injuries. Most of ankle injuries occur due to contact with other players. The shoulder injuries which occur due to overuse are relatively low. Players in left and right front row are more prone to be injured during blocking in the conflict zone.

The participation of players in preventive programs was very limited.

6. References

- Fattahi A, Sadeghi H, Ameli MS. Relationship between Injury Types and Prevalence with Some Anthropometric Properties of Male Elite Volleyball Players of Iran. *World Applied Sciences Journal*. 2011; 15(5):667-672.
- Verhagen EALM. A one season prospective cohort study of volleyball injuries. *Br J Sports Med*. 2004; 38:477-481.
- Zetoua EPM, Lolab A, Tsigganosc G, Godolias G. Factors related to the incidence of injuries' appearance to volleyball players. *Journal of Back and Musculoskeletal Rehabilitation*. 2006; 19:129-134.
- Vanderlei FM. Characteristics and contributing factors related to sports injuries in young volleyball players. Vanderlei *et al*. *BMC Research Notes*. 2013; 6(415):2-7.
- James Watkins BNG. Volleyball injuries: a survey of injuries of Scottish National League male players. *Br J Sp Med*. 1992; 26(2).
- Bahr R, Bahr IA, Bahr R, Bahr IA. Incidence of acute volleyball injuries: a prospective cohort study of injury mechanisms and risk factors. *Scund J Med Sci Sports*. 1997; 7:166-171.
- Reeser JC. Strategies for the prevention of volleyball related injuries. *Br J Sports Med*. 2006; 40:594-600.
- George J. volleyball the sports champion. [cited 2014 Nov,19]; Available from: <http://shreyas3393.wordpress.com/2014/10/27/communication/>.
- Beneka A, Tsigganos PMG, Giftofidou A, Michalopoulou M, Germanou E, Godolias G. A prospective study of injury incidence among elite and local division volleyball players in Greece. *Journal of Back and Musculoskeletal Rehabilitation*. 2007; 20:115-121.
- Beneka A. Injury incidence rate, severity and diagnosis in male volleyball players. *Sport Sci Health*. 2009; 5:93-99.
- George Tsigganos AB, Paraskevi Malliou, Asimena Giftofidou, Helen Zetou, George Godolias. Is the Incidence in Volleyball Injuries Age Related? A Prospective Study in Greek Male Volleyball Players. *Physical Training*, 2007.
- Bahr R. No injuries, but plenty of pain? On the methodology for recording overuse symptoms in sports. *British Journal of Sports Medicine*. 2009; 43:966-972.
- MDS. Injuries in the 1987 national amateur volleyball tournament. *Am J Sports Med*, 1990, 624-631.
- Zemper E, Pieter W. Injury rates at the 1988 U.S. Olympic Team Trials for Taekwondo. *British Journal of Sports Medicine*. 1989; 23(3):161-164.
- McKay G, Payne W, Goldie P, Oakes B, Stanley J. A comparison of the injuries sustained by female basketball and netball players. *The Australian Journal of Science and Medicine in Sport*. 1996; 28(1):12-17.
- Söderman K, Lorentzon JAR, Alfredson H. Injuries in adolescent female players in European football: A prospective study over one outdoor soccer season. *Scand J Med Sci Sports*. 2001; 11:299-304.
- Augustsson SR. Injuries and preventive actions in elite Swedish volleyball. *Scand J Med Sci Sports*. 2006; 16:433-440.
- Bahr R, Holme I. Risk factors for sports injuries—a methodological approach. *Br J Sports Med*. 2003; 37:384-392.
- Richard R, Reeder A, Darling H. Interest and participation in selected sports among New Zealand adolescents. *The New Zealand Medical Journal*. 2004; 117(1195):1-7.
- Reeser J, Bahr R. *Hand Book of Sport Medicine and Science: Volleyball*. USA, 2003.
- Aagaard H, Scavenius U. Injuries in elite volleyball. *Scandinavian Journal of Medicine and Science in Sports*. 1996; 6(4):228-32.
- Agel J, Palmieri-Smith M, Dick R, Wojtys M, Marshall W. Descriptive epidemiology of collegiate women's volleyball injuries: national collegiate athletic association injury surveillance system, 1988-1989 through 2003-2004. *Journal of athletics training*. 2007; 42(2):295-302.
- Alex J, Nelson Christy L, Collins Ellen E, Yard Sarah K, Fields JRDC. Ankle Injuries among United States High School Sports Athletes, 2005–2006. *Journal of Athletic Training*. 2007; 42(3):381-387.
- Staff MCOi. How to prevent training injuries. (n.d.). [cited 2014 November,7]; Available from: <http://www.mayoclinic.org/healthy-living/fitness/in-depth/overuse-injury/art-20045875>.
- Reeser J, Bahr R. *Principles of Prevention and Treatment of Common Volleyball Injuries*. Unpublished, n.d.
- Smith R. Movement in the sand: Training implications for beach volleyball. *Strength and Conditioning Journal*. 2006; 28(5):19-21.
- Briner W, Kacmar L. Common injuries in volleyball. Mechanisms of injury, prevention and rehabilitation. *Journal of Sports Medicine*. 1997; 24(1):65-71.
- Julie Agel, RMPS, Randall Dick, Edward M, Wojtys Stephen W, Marshall, Descriptive Epidemiology of Collegiate Women's Volleyball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. *Journal of Athletic Training*, 2007; 42(2):295-302.
- Kraemer J, Adams K, Cafarelli E, Dudley G, Dooly C, Feigenbaum M, *et al*. American College of Sport Medicine Position Stand. *Medical Science and Sports Exercise*, 2002; 34:364-380.
- Jonathan C, Reeser RB. *Principles of Prevention and Treatment of Common Volleyball Injuries*. FIVB Medical Commission, 1-14.