J. Appl. Environ. Biol. Sci., 4(12S)235-241, 2015

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Comparison of the Prevalence of Musculoskeletal Disorders and Sport Injuries among Elite Male Fencers Participating in Tehran World Cup in Fields Epee and Sabre

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Received: November 21, 2014
Accepted: January 25, 2015

ABSTRACT

Present study aims to compare the prevalence of musculoskeletal disorders and sports injuries among the elite male fencers who participate in the Tehran World Cup in the field s Epee and Sabre. The research method is survey and the required information collected by using the researcher-made questionnaire, checkerboard, meters, scales, New York Standard Test and plummet. To analyze the collected data, we used the Mann-Whitney test and the ratio test. The target population includes all 96 participants in the match. A sample of the size of 42 participants was selected, where 15 and 27 were from Epee and Sabre, respectively. The results show (1) there is significant difference between the prevalence of Genu Valgumamong Epee and Sabre fencers,(2) there is no significant difference between the prevalence of hallux valgus deformity among Epee and Sabre fencers, and (3) there is no significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers. Also, it was revealed that (4) there is no significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers,(5) there is no significant difference between the prevalence of osseous injuries among Epee and Sabre fencers,6) there is no significant difference between the prevalence of other damages among Epee and Sabre fencers.

KEYWORDS: musculoskeletal disorders, sport damages, Epee and Sabre fencers

INTRODUCTION

Continuous use of some muscles and organs in various fields may lead to the muscular imbalance (Habibi, 1992). In addition, in some sport fields, in order to athletes learn skills better place themselves in poor physical conditions. Research results show that although sometimes adopting a bad posture or habits may lead to better and more successful implementation of a given skill (Dreisinger, Thomas E., and Nelson, Brian, 1996), but it may lead to the postural pains in long term, which in turn exacerbates injuries and positional anomalies (Alizadeh, 1999).Therefore, in sports like fencing, that musculoskeletal structure of fencers and their competitors is greatly effective on their performance, identification and solving the anomalies would result in more efficiency and success of fencers (Hashemi, 2013). Although regular exercises reduces the risk of heart and vascular diseases, high blood pressure, overweight and so on (Kain D., Khachrin, 1989), but participating in competitions provide significantly high potential of hurt to the athletes, whether they are amateur or professional(Alizadeh, 1999). Despite all the whole benefits of regular presence in the physical activities, but the risk of being hurt, especially in competitive and championship sport, is an obvious reality. Being aware about the causes of hurt in athletes, especially young athletes, is an interesting issue in medical fields because of its physical, emotional and movement properties(Alizadeh, 1989). Barani et al. (2007) studied damage to the lower organs in the women footballers. Among 64 players participating in the Futsal Champion League, 26 were hurt in lower organs. The most frequently damaged organs were knee with 5.45% and the wrist of foot with 5.20%. The most common damages were sprain with 63.6 percent and then soreness with 11.4.About 61% damages were resulted due to a crash and 36.8 percent were not so. Severe damages with 69% were significantly more than moderate and weak ones with 27.3% and 13.6%, respectively. Seventeen cases of injured players (48.6% of all players) were with an experience of previous injury (Barani, 2007). Goldstein et al. (2011) studying gymnast women at different levels of the sport concluded that with increasing levels of exercise, abnormalities of the spine would also increase (Barani, 2007). Dorr (2012) studied the level of injury in different weightlifting competitions and reported damages to the upper limbs as follows: hand fingers 6%, elbow 27%, shoulder 7%, abdominal 5% and back 14%. He also reported damages to the lower limbs as follows: thigh 21%, the area between thigh and the pelvic 3%, knees 12%, leg 3% and foot 7%. In addition, studies of Mulhern and Kied George (2011) on gymnast showed that the level of lumbar and kyphosis lordosis anomalies in gymnasts in comparison to other athletes is significantly higher. Bakalara et al. (2010) showed that

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among 970000 athletes who participated in exercises with sinkers, about 82% experienced similar injuries in trunk and hand and the type of injuries were mostly elongation and torsion (The Rain, 2007).
Calhoun et al. (1999) reported injuries of weightlifters in their elbow (2.5%), palms and fingers (10%), knee (19.1%), leg (1.6%), neck (5.4%). Rask et al. (2002) investigated incidence of injuries among elite weightlifters and reported on average 2.6 injuries per 1000 hours of activity. The most injury was in shoulder with 0.51 injuries per 1000 hours of activity and in waist and lower limbs with 4.3 injuries per 1000 hours of activity (Daneshmandi, 2011).

METHODOLOGY

The present research is an applied research. The present study in terms of implementation is quasi-experimental and survey. In this study, due to the homogeneity of the population units, the simple random sampling is used. The target population of the study includes all the elite male Epee and Sabre fencers who had participated in Tehran FIE World Cup 2013.Participants in this tournament were 96 people. Given the number of people who participated in this tournament and based on their cooperation and satisfaction, the sample size was 42 patients, which among them Epee and Sabre fencers were 15 and 27, respectively. To test the research hypotheses based on the distribution of test data, Kolmogorov-Smirnov test, independent t-student or Mann-Whitney test, ratio test, Friedman test and Spearman correlation test were used at a significant level of 0.05.

Research hypotheses

Research hypotheses are as follows:

1- There is significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers,
2- There is significant difference between the prevalence of Genu Valgum disorder among Epee and Sabre fencers,
3- There is significant difference between the prevalence of Genu Varum disorder among Epee and Sabre fencers,
4- There is significant difference between the prevalence of joint injuries among Epee and Sabre fencers,
5- There is significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers,
6- There is significant difference between the prevalence of osseous injuries among Epee and Sabre fencers,
7- There is significant difference between the prevalence of other damages among Epee and Sabre fencers.

Research findings

Kolmogorov-Smirnov test

Regarding that one of the main requiring hypotheses for using the parametric t-student test is normality of the sample distribution, for this purpose the Kolmogorov-Smirnov test is used and results are presented in Table 4-7. In this test, the null and the alternative hypotheses are defined as follows:

H_0: distribution of observations is normal,
H_0: distribution of observations is not normal,

Table 4-7: Results of the normality test.

Component	Kolmogorov statistic	Significance level	Result
Cervical lordosis	1.815	0.003	Abnormal
Crooked neck	2.580	$p < 0.001$	Abnormal
Lordosis	2.108	$p < 0.001$	Abnormal
Kyphosis	2.418	$p < 0.001$	Abnormal
Scoliosis	2.519	$p < 0.001$	Abnormal
Uneven shoulders	3.129	$p < 0.001$	Abnormal
Genu Varum	2.828	$p < 0.001$	Abnormal
GenuValgum	2.452	$p < 0.001$	Abnormal
External leg toeing	1.669	$p < 0.001$	Abnormal
Hallux valgus	2.487	$p < 0.001$	Abnormal

According to significant levels obtained using Kolmogorov-Smirnov test, it was observed that the significance level for all components is less than the first type error, i.e. 0.05 and thus the assumption of normality of observations rejects at the significance level of the first type error, i.e. 0.05 and thus the non-parametric Whitney test is used.

1. First hypothesis: There is significant difference between the prevalence of Genu Valgum disorder among Epee and Sabre fencers.
Results of Mann-Whitney test for this hypothesis of the study is presented in Table 1.

Table 2: Results of Mann-Whitney test (Genu Valgum)

Indicator	Significance level	Z statistic	Mann-Whitney U
Genu Valgum	0.018	-2.374	125

The significant level obtained from the results in Table 1 shows that there is significant difference between the prevalence of Genu Valgum disorder among Epee and Sabre fencers. Therefore, this hypothesis is not accepted and we can say that there is significant difference between the prevalence of Genu Valgum disorder among Epee and Sabre fencers.

Regarding the prevalence of this abnormality in these two study groups, we can say that Epee fencers with 66.7% of moderate (slight) deviation has higher mean than saber fencers with 22.2% of moderate and3.7% of severe deviations. This means that the risk of being injured by Genu Valgum for epee fencers in moderate (slight) deviation is more than that for saber fencers. In addition, in the severe deviation this risk for saber fencers is more than that for Epee fencers.

2. Second hypothesis: There is no significant difference between the prevalence of hallux valgus disorder among Epee and Sabre fencers.
Results of Mann-Whitney test for this hypothesis of the study is presented in Table 2.

Table 2: Results of Mann-Whitney test (hallux valgus)

Indicator	Significance level	Z statistic	Mann-Whitney U
Hallux valgus	0.966	-0.043	201

The significant level obtained from the results in Table 2 shows that there is no significant difference between the prevalence of hallux valgus disorder among Epee and Sabre fencers. Therefore, this hypothesis is accepted and we can say that there is no significant difference between the prevalence of hallux valgus disorder among Epee and Sabre fencers.

Regarding the prevalence of this abnormality in these two study groups, it can be said that Epee fencers with 60% of moderate (slight) deviation and 13.3% of severe deviation have higher mean than saber fencers with 66.7% of moderate deviation and 3.7% of severe deviation. This means that the risks of injury for epee fencers in severe deviation is more than that for saber fencers. However, for the moderate (slight) deviation, the risk of hallux valgus in saber fencers is more than that for Epee fencers.

3. Third hypothesis: There is no significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers.
Results of Mann-Whitney test for this hypothesis of the study is presented in Table 3.

Table 3: Results of Mann-Whitney test (external leg toeing)

Indicator	Significance level	Z statistic	Mann-Whitney U
External leg toeing	0.141	-1.473	157

The significant level obtained from the results in Table 3 shows that there is no significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers. Therefore, this hypothesis is accepted and we can say that there is no significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers.
Regarding the prevalence of this abnormality in these two study groups, it can be said that Epee fencers with 73.4% of moderate (slight) deviation and 13.3% of severe deviation have higher mean than saber fencers with 44.4% of moderate deviation and 22.2% of severe deviation. This means that the risks of injury for saber fencers in severe deviation of external leg toeing is more than that for epee fencers, whereas in moderate (slight) deviation, the risk of external leg toeing in Epee fencers is more than that for saber fencers.

4. Fourth hypothesis: There is no significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers.
Results of ratio test for this hypothesis of the study is presented in Table 4.

Table 4: Results of Ratio test (tendon muscle)

Indicator	Significance level	Z statistic	Mean difference
Tendon muscle	0.454	-0.75	-0.089

The significant level obtained from the results in Table 4 shows that there is no significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers. Therefore, this hypothesis is accepted and we can say that there is no significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers.

Regarding the prevalence of this abnormality in these two study groups, it can be said that saber fencers with 22.2% of moderate (slight) deviation have higher mean than Epee fencers with 13.3% of moderate deviation. This means that the risk of injury for saber fencers in this disorder is more than that for epee fencers.

5. Fifth hypothesis: There is no significant difference between the prevalence of joint injuriesamong Epee and Sabre fencers.
Results of ratio test for this hypothesis of the study is presented in Table 5.

Table 5: Results of Ratio test (joint injuries)

Indicator	Significance level	Z statistic	Mean difference
Joint injuries	0.355	0.93	0.141

The significant level obtained from the results in Table 5 shows that there is no significant difference between the prevalence of joint injuries among Epee and Sabre fencers. Therefore, this hypothesis is accepted and we can say that there is no significant difference between the prevalence of joint injuries among Epee and Sabre fencers.
Regarding the prevalence of this abnormality in these two study groups, it can be said that epeefencers with 40% in terms of being injured by this injury have had higher mean than Sabre fencers with 25.9%. This means that the risk of this injury for epee fencers is more than that for sabre fencers.

6. Sixth hypothesis: There is no significant difference between the prevalence of osseous injuries among Epee and Sabre fencers.
Results of ratio test for this hypothesis of the study is presented in Table 6.

Table 6: Results of Ratio test (osseous injuries)

Indicator	Significance level	Z statistic	Mean difference
Osseous injuries	0.142	-1.47	-0.074

The significant level obtained from the results in Table 6 shows that there is no significant difference between the prevalence of osseous injuries among Epee and Sabre fencers. Therefore, this hypothesis is accepted and we can say that there is no significant difference between the prevalence of osseous injuries among Epee and Sabre fencers.
Regarding the prevalence of this abnormality in these two study groups, it can be said that epee fencers with 7.4% than sabre fencers with 0% in terms of being injured by this injury have higher average. This means that the risk of this injury for sabre fencers is more than that for epee fencers.

7. Seventh hypothesis: There is no significant difference between the prevalence of other injuries among Epee and Sabre fencers.
Results of ratio test for this hypothesis of the study is presented in Table 7.

Table 6: Results of Ratio test (osseous injuries)

Indicator	Significance level	Z statistic	Mean difference
Other injuries	0.034	-2.12	-0.274

The significant level obtained from the results in Table 7 shows that there is significant difference between the prevalence of other injuries among Epee and Sabre fencers. Therefore, this hypothesis is not accepted and we can say that there is significant difference between the prevalence of other injuries among Epee and Sabre fencers.
Regarding the prevalence of this abnormality in these two study groups, it can be said that sabre fencers with 40.7%, than epee fencers with 13.3% in terms of being injured by this injury have higher average. This means that the risk of this injury for sabre fencers is more than that for epee fencers.
Among these disorders and injuries, some of the most prevalent ones among fencers can be detected.
In order to identify the most common disorders and injuries among fencers, Friedman nonparametric test was used. The results of this test are presented in Tables 8 and 9. In this test, component based on average ratings were ranked. Since in evaluation of abnormalities figures 5, 3 and 1 assigned to natural, moderate and severe deviations, respectively. Higher average rating means lower incidence of abnormalities. As a result, whatever

the average rate of abnormality is less, its prevalence in the community is higher. However, about injuries, whatever the average rate of abnormality is more, the injury prevalence in the population is more. It is because that in the case of lacking the injury number 1 and otherwise number 2 is attributed to the subjects.

Table 8: Results of Friedman ranking test (disorders)

Component	Rank	Mean rank
Cervical lordosis	7	5.93
Crooked neck	6	5.51
Lordosis	8	6.35
Kyphosis	2	3.81
Scoliosis	3	4.77
Uneven shoulders	1	3.74
Genu Varum	10	7.56
GenuValgum	9	6.96
External leg toeing	4	5.17
Hallux valgus	5	5.20
Chi-square test statistic: 88.504, Significance level: $p < 0.001$		

Table 9: Results of Friedman ranking test (injury)

Component	Component	Component
Muscle injuries	2.45	2
Joint injuries	2.69	1
Osseous injuries	2.17	3
Other injuries	2.69	1
Chi-square test statistic: 12.615, Significance level: 0.006		

According to prioritizing Tables 8 and 9, there is significant difference between prevalence of deformities and injuries between fencers. Based on the mean scores obtained from Table 8, uneven shoulder, kyphosis and scoliosis abnormalities are among the most common abnormalities between elite male fencers who had participated in Tehran FIE World Cup. Results of Table 9 also show that joint injuries and other injuries, e.g. being wounded by the sword, etc., are the most common injuries among studied fencers. As a result, this research hypothesis accepts at the significance level of 95 percent. Rating of other disorders and injuries in terms of prevalence rates are as follows: Anomalies: 1) uneven shoulders, 2) kyphosis, 3) scoliosis, 4) external leg toeing, 5) hallux valgus, 6)crooked neck, 7) cervical lordosis, 8) lordosis, 9) Genu Valgum, and 10) Genu Varum; injuries: 1)joint and other injuries, 2) muscle damages, 3)osseous damages. Causes of injuries among fencers from an anatomical perspective are not distinguishable. In order to investigate the relationship between damages and the anatomical appearance including age, stature, weight and body mass index (BMI), Spearman correlation coefficient was used. The results of estimation of this coefficient are given in Table 10. The null and the alternative hypotheses are defined as follows:

H_0: there is no significant relationship between both components,

H_0: there is significant relationship between both components,

Table 10: Results of Spearman correlation test

		Muscular	Joint	Osseous	Others
Age	Spearman correlation	0.013	0.007	0.035	0.128
	Significance level	0.933	0.966	0.827	0.420
Stature	Spearman correlation	-0.259	0.094	0.056	0.143
	Significance level	0.097	0.553	0.726	0.365
Weight	Spearman correlation	-0.003	0.062	0.028	0.049
	Significance level	0.987	0.698	0.862	0.758
BMI	Spearman correlation	0.115	-0.045	0.023	0.019
	Significance level	0.468	0.779	0.885	0.904

Regarding that obtained significance levels through investigating the relationship between the apparent anatomical features and the prevalence amount of injuries all are more than the first type error, i.e. 0.05, all the relationships were estimated as meaningless. As a result, this research hypothesis rejected at 95% confidence level and thus we can say that causes of injury among fencers from the anatomic perspective are not distinguishable.

CONCLUSIONS

According to the first hypothesis, there is significant difference between the prevalence of Genu Valgum disorder among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that Epee fencers with 66.7% of moderate (slight) deviation have higher mean than saber fencers with 22.2% of moderate deviation and 3.7% of severe deviation. This means that the risk of being injured by Genu Valgum for epee fencers in moderate (slight) deviation is more than that for saber fencers. In addition, in the severe deviation this risk for saber fencers is more than that for Epee fencers. According to the second hypothesis, there is no significant difference between the prevalence of hallux valgus disorder among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that Epee fencers with 60% of moderate (slight) deviation and 13.3% of severe deviation have higher mean than saber fencers with 66.7% of moderate deviation and 3.7% of severe deviation. This means that the risks of injury for epee fencers in severe deviation of hallux valgus is more than that for saber fencers, whereas for the moderate (slight) deviation, the risk of hallux valgus in saber fencers is more than that for Epee fencers. According to the third hypothesis, there is significant difference between the prevalence of external leg toeing disorder among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that Epee fencers with 73.4% of moderate (slight) deviation and 13.3% of severe deviation have higher mean than saber fencers with 44.4% of moderate deviation and 22.2% of severe deviation. This means that the risks of injury for saber fencers in severe deviation of external leg toeing is more than that for epee fencers, whereas in moderate (slight) deviation, the risk of external leg toeing in Epee fencers is more than that for saber fencers. According to the fourth hypothesis, there is significant difference between the prevalence of tendon muscle disorder among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that saber fencers with 22.2% of moderate (slight) deviation have higher mean than Epee fencers with 13.3% of moderate deviation. This means that the risk of injury for saber fencers in this disorder is more than that for epee fencers. According to the fifth hypothesis, there is no significant difference between the prevalence of joint injuries among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that epee fencers with 40% in terms of being injured by this injury have had higher mean than Sabre fencers with 25.9%. This means that the risk of this injury for epee fencers is more than that for sabre fencers. According to the sixth hypothesis, there is no significant difference between the prevalence of osseous injuries among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that epee fencers with 7.4% than sabre fencers with 0% in terms of being injured by this injury have higher average. This means that the risk of this injury for sabre fencers is more than that for epee fencers. According to the seventh hypothesis, there is no significant difference between the prevalence of other damages among Epee and Sabre fencers. Regarding the prevalence of this abnormality in these two study groups, it can be said that sabre fencers with 40.7%, than epee fencers with 13.3% in terms of being injured by this injury have higher average. This means that the risk of this injury for sabre fencers is more than that for epee fencers. Among disorders, some of them that are more prevalent are distinguishable meaning that the risk of being injured by these injuries for epee fencers is more than that for sabre fencers. Rating of other disorders and injuries in terms of prevalence rates are as follows: for anomalies: 1) uneven shoulders, 2) kyphosis, 3) scoliosis, 4) external leg toeing, 5) hallux valgus, 6) crooked neck, 7) cervical lordosis, 8) lordosis, 9) Genu Valgum, and 10) Genu Varum; and for injuries: 1) joint and other injuries, 2) muscle damages, 3) osseous damages. Causes of injuries among fencers from an anatomical perspective are not distinguishable.

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