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Profiling musculoskeletal injuries in stone Press (metal shield) and kabbadeh-keshi (iron weight) skills of zurkhaneh (palestra) sports

Running title: Profiling musculoskeletal injuries

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***Abstract*---**Background: As a destructive factor for the success of athletes, the identification of sports injury helps to prevent and reduce it and is associated with the optimal performance of the athlete. Therefore, the present study aimed to profile musculoskeletal injuries in stone Press (metal shield) and kabbadeh-keshi (iron weight) skills of zurkhaneh (palestra) sports. Methods: In this study, 361 athletes engaged in two zurkhaneh skills were studied in 2019. Data were collected by a questionnaire and analyzed by the Chi-square test at a level of 5% error using SPSS software version 22. Results: The results of the 51 surveyed athletes indicated that the numbers and frequencies of injuries in the metal shield skill were one (5.9%), two (76.5%), and three (17.6%), with an average number of 2.12 ± 0.48 injuries for this skill. Moreover, spasm, sprain, strain, and disc injuries were the most common types of injuries among the stone Press athletes. In the kabbadeh-keshi skill, one (0.18%), two (48.0%), three (0.28%), and four (0.6%) injuries were recorded among 50 athletes examined in this category, with an average number of 22.82 ± 2.82 injuries for athletes in this skill. Conclusions: Most of the injuries occurred in the upper body and the reason for this is more involvement of upper body members in this sport. Finally, it seems

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that more attention of coaches and athletes in learning and training techniques, proper warm-up and basic exercises, before training and competition and complete and principled rehabilitation of injuries by specialists is necessary.

Keywords---*Zurkhaneh sports, musculoskeletal injuries, profiling.*

Introduction

Zurkhaneh sports are among the most popular traditional sports that are practiced by the Iranian people for a long time.[1] This traditional sport will not only be the most effective, scientific, and valuable project but also has its origin in the history of Iran and is acceptable to society.[2] Zurkhaneh became known as a place where the most elegant characters, like magnanimity, forgiveness, sacrifice, altruism, combating ignorance, and adherence to moral principles and virtues, were fostered.[1] Its exercises are of the interval type.[3]

All sports activities mainly aim at general health along with improving physical condition[4], which will not be achieved without scientific and correct exercise. Unfortunately, the phenomenon of physical injury has always been associated with and has grown alongside sports and physical education in addition to all its benefits.[5,6] Although regular exercise reduces the risk of cardiovascular disease, hypertension, cancer, obesity, diabetes, etc., participation in sports competitions has a significant potential of injuries to (novice and skilled) athletes[7], making the issue of sports injury a matter of concern nowadays for athletes, coaches, and sports authorities.[8]

Major structural changes occur in the muscles and joints of professional athletes who are active in a sport for long years and repeat a specific movement pattern.[9] Long-term and highly specialized training, in addition to mastering the sport, has been shown to result in persistent and often undesirable changes in the musculoskeletal system.[10,11] In addition, studies indicate that athletes are exposed to physical deviations compared to non-athletes.[12-14]

Kalantariyan[15] reported that CrossFit could be a harmful sport with the non-observance of the safety protocols, including proper warming and cooling of the body, as well as increasing the knowledge and information of coaches and athletes about the causes of injury. Kurdi et al.[16] provided evidence that most injuries of basketball, volleyball, and handball occur in the lower extremities, which are often of the sprain type, including ankle sprains and the rupture of knee ligaments. Askari[17] observed a significant relationship between running injuries and arch height. Nodehi Moghadam et al.[18] showed that the lower extremities and lower back were among the most frequently involved regions during military training for 6 months. They claimed that a history of exercise and probably a higher level of physical fitness could play a protective role in the occurrence of musculoskeletal disorders in these people. As reported by Ebrahimi Varkiani et al.[19], the incidence of injury during exercise was much higher than that during the competition. They concluded that injury prevention programs should apparently be offered in the lower limbs, particularly the knee and ankle

joints, for both genders. Al-Hosseini[20] found the highest injuries with indoor soccer (futsal) and handball while basketball and volleyball were less injurious. In the injured sites, the lower limbs and the head/face were the most and the least injured ones, with the highest frequency observed for musculoskeletal injuries.

Given the importance of athletes' injuries, their negligence will exacerbate the injury in the long term, ultimately impacting negatively the daily lives of athletes, which indicates the importance of detecting injuries in sports. Since zurkhaneh sports include the skills of stone Press, heavy milkeshi, milbazi, sharp wheel, grass wheel, kabbadeh-keshi, team zurkhaneh, and mentoring, injury is inseparable and specific to each sport skill. Despite its oldness, zurkhaneh sport has been studied scarcely and less attention has been paid to the potential injuries caused by this sport in athletes. However, there is a need for specialized research on this sport owing to its globalization and expansion worldwide. Accordingly, this study aims to focus on the injuries of athletes caused by zurkhaneh sport in stone Press and kabbadeh-keshi skills to answer the question on the types of injuries that exist in stone Press and kabbadeh-keshi of zurkhaneh sports? The answer to this question can pave the ground for the authorities, managers, and coaches of this sport for the further success of athletes.

Materials and methods

In this descriptive, extensive, ex post facto (after-the-fact), and practical research in terms of using the results, the statistical population comprised all male athletes (n = 130) participating in the national adult championship in zurkhaneh and champion (pahlavani) sports in Sanandaj city of Kurdistan province in 2019. Considering a 10% surplus sample, 117 athletes were included in the sample due to the possible imperfection of information recording forms. Among these athletes, the information of 16 athletes was incomplete or blemished. Finally, data were analyzed based on the information of 101 athletes.

Purposive sampling was based on inclusion criteria, including at least 8 years of continuous activity in zurkhaneh sport, participating in at least four national championships, male gender, voluntarily participation in the study, no simultaneous engagement in other sports, and non-occurrence of injury outside the training and competition hours.

This study focused on an injury in which the athlete was not able to perform exercise or competition for at least 24 h. Data were collected by field and library methods and analyzed at both descriptive (the frequency distribution table, statistical graphs, and mean and standard deviation indices) and inferential levels, in which the injury rates between different sport skills, different types of injuries, and different affected sites were compared in different groups using the Chi-square test a 95% confidence interval and a 5% error level by SPSS software (version 22). The ethics code (1399.003IR.IAU.KHUISF.REC.) was received from the Ethics Committee in the Humanities Faculty of the Islamic Azad University of Isfahan (Khorasgan).

Results

In terms of age, the age groups of 25-30 and over 40 years comprised the highest (41.8%) and the lowest (3.3%) numbers of athletes, respectively, with an average age of 31.74 ± 4.50 years. In terms of body mass index (BMI), the highest (44.0%, BMI 25-30) and the lowest (20.8%, BMI > 30) number of athletes were overweight and obese, respectively, with a mean BMI of 27.01 ± 3.73 measured in the athletes. With regard to the history of sports activity, histories of 10-15 and 15-20 years were observed in the highest (66.5%) and the lowest (6.1%) numbers of athletes with an average history of 13.82. ± 4.05 years.

The frequency distribution of stone Press athletes based on the number of their injuries is shown in Table I. Accordingly, the numbers and frequencies of injuries in the metal shield skill were one (5.9%), two (76.5%), and three (17.6%), with an average number of 2.12 ± 0.48 injuries among the 51 athletes surveyed in this skill. A total of 108 injuries of athletes in this skill were observed during exercises for 1 year. The total exercise time of the athletes was 7875 h during this period, and therefore the incidence rate of injury per 1000 h of training for all stone Press athletes was equal to 13.71 with a 95% confidence interval (11.16-14.29).

Out of 108 injuries recorded in athletes, 63.9% and 36.1% of cases were respectively observed on the right and left sides of athletes' bodies. Exacerbations of previous injuries and new ones were 38.0% and 34.3%, respectively, and 46.6% of the injuries occurred in the late exercises. Low and moderate severities of injuries were detected in 59.3% and 39.8% of cases, and 80.6% of injuries were treated by athletes' self-medication.

Concerning the area of injury, chest (18.5%), elbow (18.5%), waist (16.7%), scapula/shoulder (14.8%), and fingers (11.1%) were the five mostly involved organs in injury in stone Press athletes. Among 99 types of injuries, spasm (31.5%), sprain (23.1%), strain (21.3%), and disc damages (18.5%) were the most prevalent ones in athletes. The examination of the mechanism of injuries in the stone Press skill indicated that the highest number of injuries occurred during rolling stone Press (45.4%), press stone Press (38.9%), and stone Press (15.7%). In the study of the causes of athletes' injuries in the stone Press skill, the highest number of injuries was caused by the low level of physical fitness (27.78%).

According to the results in Table II, one (0.18%), two (48.0%), three (0.28%), and four (0.6%) injuries were recorded among 50 athletes examined in this category, with an average number of 22.82 ± 2.82 injuries for athletes in this skill. Totally, 111 injuries of athletes in this skill were observed in the training period for 1 year, during which the total exercise time of athletes was 9400 h, and therefore the incidence rate of injury per 1000 h of the exercise for all athletes in this skill was equal to 11.81 with a 95% confidence interval (9.62-14.00).

Out of 111 injuries recorded in athletes, 75.5% and 24.3% cases were respectively noticed on the right and left sides of athletes' bodies. Recurrences of previous injuries and those that occurred in the late of exercises accounted for 64.0% and

49.5%, respectively. The severity of the injury was low in 63.1% of cases, and 81.1% of injuries were treated by the athlete's self-medication.

In terms of the injury site, the elbow (39.6%) and the forearm (22.5%) were the two most involved organs in athletes' injuries. Regarding the type of injury, sprain (51.4%) and spasm (27.9%) were the most prevalent types of injuries in athletes. In the study of the mechanism of damage in the kabbadeh-keshi skill, the highest number of injuries (0.91%) occurred during simple kabbadeh-keshi. The examination of the cause of athletes' injuries in the kabbadeh-keshi skill revealed that the highest number of injuries (21.62%) occurred due to one-sided training (21.62%).

Based on Table III, the two skills of zurkhaneh sports were not significantly different in terms of the injured side ($p < 0.001$), nature of injury ($p < 0.001$), and time of injury ($p < 0.001$). The results of Fisher's exact test revealed that the severity of injury ($p < 0.001$) and the type of injury treatment ($p < 0.001$) were significantly different between athletes of the two skills.

In terms of Table IV, significant differences were observed between the two skills of zurkhaneh sports in head and face ($p < 0.001$), waist ($p = 0.008$), chest ($p < 0.001$), knee ($p < 0.001$), talus ($p < 0.001$), toes ($p = 0.001$), arm ($p < 0.001$), scapula ($p = 0.017$), elbow ($p < 0.001$) , forearm ($p < 0.001$), wrist ($p = 0.035$), and fingers ($p < 0.001$) based on the Chi-square test results. However, there were no significant differences between the two skills in the neck ($p = 0.586$), back ($p = 0.406$), pelvis ($p = 0.307$), crus ($p = 0.079$), and sole ($p = 0.513$).

In terms of the type of injury, the Chi-square test results indicated significant differences between the two zurkhaneh skills in injuries of sprain, spasm, strain, scratch, bruise, disc injuries ($p < 0.001$), and fracture ($p = 0.005$), but the two skills were not significantly different in meniscus injuries ($p = 0.971$). (Table V)

According Table VI, In the study of the causes of injuries indicated significant differences between the two zurkhaneh skills in terms of improper warm-up, incorrect sports movements, non-standard equipment, competition rules, low level of physical fitness, one-sided exercise ($p < 0.001$), and non-standard places ($p = 0.039$) based on the Chi-square test results.

Discussion

As a destructive factor for the success of athletes, the identification of sports injury helps to prevent and reduce it and is associated with the optimal performance of the athlete. Therefore, the present study aimed to profile musculoskeletal injuries in stone Press and kabbadeh-keshi skills of zurkhaneh sports. The age and sports history of athletes averaged 31.74 ± 4.50 and 13.82. ± 4.05 years, respectively. Data were collected by a questionnaire comprising two parts of demographic information and an injury report form including injured limb, injured side of the body, time period of injury in exercise, nature of the injury, time of injury, type of injury, mechanism of injury, the severity of the injury, treatment type, and other factors.

The results showed that the numbers and frequencies of injuries in the metal shield skill were one (5.9%), two (76.5%), and three (17.6%), with an average number of 2.12 ± 0.48 injuries, among the 51 athletes surveyed in this skill. Moreover, the incidence rate of injury per 1000 h of exercise for all stone Press athletes was equal to 13.71 with a 95% confidence interval (11.16-14.29). In terms of the side, nature, time, severity, and treatment type of injuries in athletes, 63.9% and 36.1% of cases were respectively observed on the right and left sides of athletes' bodies, 38.0% and 34.3% were respectively exacerbations of previous injuries and new ones, and 46.6% of the injuries occurred in the late of exercises. Low and moderate severities of injuries were detected in 59.3% and 39.8% of cases, and 80.6% of injuries were treated by athletes' self-medication.

In terms of the injury site, chest, elbow, waist, scapula/shoulder, and fingers were the five most injured organs in athletes in the stone Press skill. Concerning the type of injury, spasm, sprain, strain, and disc injuries were the most frequent types of injuries in athletes of the stone Press skill. These findings correspond to Rahmani and Daneshmi[21] who found significant relationships between the pain level and the power of internal and external rotators, extensors, and abductors. Our results on the injury site are inconsistent with those of Ebrahimi Varkiani et al.[19] who observed the lower limb, with 58.9% of all injuries, was the most frequently injured area of the body. This discrepancy may result from the type and field of sport. The present results are also incompatible with a study in which the lower limbs and the head and face were the most and the least injured areas.[20] This inconsistency may be attributed to the type and field of sports, the statistical population, and the statistical sample. They also observed a significant difference between the power of internal and external rotators, adductors, abductors, and flexors between the athlete and non-athlete groups, and the imbalance between the muscle group’s causes damage to athletes and their deprivation from exercise and competition. The frequency distribution of injuries observed in athletes based on the mechanism of injury showed that the highest number of injuries occurred during rolling sang, pressing sang, and stone Press. Furthermore, the highest number of injuries was caused by a low level of physical fitness.

In the kabbadeh-keshi skill, one (18.0%), two (48.0%), three (28.0%), and four (6.5%) injuries were recorded among 50 athletes examined in this category, with an average number of 22.82 ± 2.82 injury for athletes in this skill. Moreover, an incidence rate of 11.81 injuries per 1000 h of the exercise was recorded for all athletes in the kabbadeh-keshi skill. Out of 111 injuries recorded in athletes, 75.5% and 64.0% of the injuries occurred on the right and left sides of the athletes' bodies, and 24.3% of injuries were recurrences of previous ones, with 49.5% occurring in the middle of the exercise. The severity of the injury was low at 63.1% of the cases, and 81.1% of injuries were treated by athletes' self-medication.

In terms of the injury site, the elbow and forearm were the two most injured organs in athletes, and sprain and spasm were the most frequent types of injuries in the participants. These observations are inconsistent with those of Lopez et al.[5] who reported a higher rate of injuries in the lower (12.3%) and then the upper (4.9%) limbs, with less incidence in the trunk (3.5%); this discrepancy may be due

to gender, age, and statistical sample. These findings are consistent with those of Kalantrian[15] who claimed that the upper limb was the most injured site, which seems reasonable considering the movements of the head, the rotation of the arm at the shoulder joint, and long-term use of hands. Examination of the injury mechanism revealed that the greatest number of injuries occurred during simple kabbadeh-keshi. Our data on the cause of athletes' injuries indicated that the highest number of injuries occurred because of one-sided exercises.

Conclusions

Based on the present findings, it can be concluded that most injuries occurred in the upper body and, as mentioned above, were caused by the involvement of most upper-body organs in this sport. Finally, it seems that more attention of coaches and athletes to learning and teaching techniques, proper warm-up, and standard exercises before exercise and competition, as well as complete and principled rehabilitation of injuries, is necessary by a specialist.

According to the results, athletes should be provided with accurate and specialized training to prevent injuries during exercise and competition. It is necessary to identify and correct the rules that cause injuries during competitions by required procedures. Furthermore, corrective movements and exercises should be on the work plan of coaches and athletes to prevent and improve musculoskeletal injuries.

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Tables

Table I. Frequency distribution of subjects based on the number of their injuries in the stone Press skill

No. of injury	N	%	Mean	Standard deviation
One	*3*	5.9	2.12	0.48
Two	*39*	76.5		
Three	*9*	17.6		
Total	*51*	100.0		

Table II. Frequency distribution of subjects based on the number of injuries in the kabbadeh-keshi skill

No. of injury	N	%	Mean	Standard deviation
One	*9*	18.0	2.22	0.82
Two	*24*	48.0		
Three	*14*	28.0		
Four	*3*	6.0		
Total	*50*	100.0		

Table III. Comparison of athletes in different zurkhaneh sports based on the side, nature, time, severity, and treatment type of their injuries

Variable	Group	stone Press		Kbbadeh-keshi		P-value
		N	%	N	%	
Injured side	Left	*39*	36.1	*27*	24.3	<0.*001*
	Right	*69*	63.9	*84*	57.7	
Injury nature	New	*37*	34.3	*20*	18.0	<0.*001*
	Recurrent	*30*	27.8	*71*	64.0	
	Exacerbation of the fomer	*41*	38.0	*20*	18.0	

Injury time	Early exercise	*26*	24.1	*22*	19.8	<0.*001*
	Middle exercise	*28*	25.9	*55*	49.5	
	Late exercise	*46*	42.6	*21*	18.9	
	Competition time	*8*	7.4	*13*	11.7	
Injury severity	Slight	*1*	0.9	*15*	13.5	<0.*001*
	Low	*64*	59.3	*70*	63.1	
	Moderate	*43*	39.8	*22*	19.8	
	Intermediate	*0*	0.0	*4*	3.6	
	Severe	*0*	0.0	*0*	0.0	
Treatment type	Self-medication	*87*	80.6	*90*	81.1	<0.*001*
	Rescuer	*2*	1.9	*0*	0.0	
	Physician	*19*	17.6	*19*	17.1	
	Hospital	*0*	0.0	*2*	1.8	

Table IV. Comparison of athletes in different zurkhaneh sports based on the sites of their injuries

Injury site	Stone Press		Kbbadeh-keshi		P-value
	N	%	N	%	
Head and face	*0*	0.0	*4*	14.3	<0.*001*
Neck	*10*	25.6	*4*	10.3	0.086
Back	*0*	0.0	*0*	0.0	0.406
Waist	*18*	17.0	*6*	5.7	0.008
Chest	*20*	80.0	*1*	4.0	<0.*001*
Pelvis	*0*	0.0	*0*	0.0	0.846
Thigh	*0*	0.0	*0*	0.0	0.307
Knee	*0*	0.0	*0*	0.0	<0.*001*
Leg	*1*	3.7	*0*	0.0	0.079
Ankle	*0*	0.0	*0*	0.0	<.*001*
Sole of the foot	*0*	0.0	*0*	0.0	0.513
Toes	*0*	0.0	*0*	0.0	0.001
Arm	*5*	9.3	*9*	16.7	<0.*001*
Shoulders and shoulders	*16*	17.2	*5*	5.4	0.017
Elbow	*20*	16.5	*44*	36.4	<0.*001*
Forearm	*6*	6.3	*25*	26.0	<0.*001*
Wrist	*0*	0.0	*4*	9.3	0.035
Fingers	*12*	12.1	*9*	9.1	<0.*001*

Table V. Comparison of athletes in different zurkhaneh sports based on their type of injury

Injury type	Stone Press		Kbbadeh-keshi		P-value
	N	%	N	%	

Sprain	*25*	9.5	*57*	21.8	<0.001
Spasm	34.0	13.5	31.0	12.3	<0.001
Strain	23.0	18.7	11.0	8.9	<0.001
Scratch	0.0	0.0	6.0	5.0	<0.001
Bruising	1.0	1.4	0.0	0.0	<0.001
Disk injuries	20.0	37.0	6.0	11.1	<0.001
Meniscus injuries	5.0	17.9	0.0	0.0	0.971
Fracture	0.0	0.0	0.0	0.0	0.005

Table VI. Comparison of athletes in different zurkhaneh sports based on the causes of their injuries

Cause of injury	Stone Press		Kbbadeh-keshi		P-value
	N	%	N	%	
Improper warm-up	*16*	*13*	*19*	15.4	< 0.001
Improper sports movements	*10*	7.1	*14*	9.9	< 0.001
Non-standard equipment	*6*	5.2	*9*	7.8	< 0.001
Competition rules	*9*	4.2	*12*	5.6	< 0.001
Low physical fitness level	*30*	22.4	*6*	4.5	< 0.001
One-sided exercise	*26*	16.0	*24*	14.7	< 0.001
Non-standard places	*0*	0.0	*0*	0.0	0.039

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