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ORIGINAL ARTICLE

Upper extremity health profile in Turkish overhead throwing athletes: the effect of current level of play, sports participation, sports type, and previous injury

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Purpose: The aim of this study was to investigate the upper extremity health profile and to analyze the effect of sports participation, sports type, and previous injury on the health profile in Turkish overhead athletes.
Methods: One hundred and thirty-four competitive overhead throwing athletes included the study. Upper extremity pain existence and severity, disability and functional status were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) and the American Shoulder and Elbow Surgeons Evaluation Form (ASES).
Results: Upper extremity problems were observed in 41.8% of the participants. The DASH and ASES scores showed significant difference when subgroups of athletes compared based on their current level of play and previous injury history ($p<0.05$). Shoulder pain was the most common clinical presentation. Additionally, sport type and the duration of participation in professional sports did not correlate with the upper extremity health status in Turkish overhead throwing athletes ($p>0.05$).
Conclusion: Upper extremity problems are seen at a high ranks in overhead throwing athletes. This study identified the upper extremity health profile in Turkish overhead throwing athletes, thereby creating considerations for prevention sports-related upper extremity injuries.
Keywords: Athletes, Shoulder, Elbow.

Türk baş üstü fırlatma sporcularında üst ekstremite sağlık profili: oyun seviyesi, spora katılım, spor tipi ve yaralanma hikayesinin etkisi

Amaç: Bu çalışmanın amacı Türk baş üstü fırlatma sporcularında üst ekstremite sağlık profili üzerine oyun seviyesi, spora katılım, spor dalı ve yaralanma hikayesinin etkisini araştırmaktı.
Yöntem: Çalışmaya 134 baş üstü fırlatma sporcusu dahil edildi. Üst ekstremite ağrı varlığı ve şiddeti, özür seviyesi ve fonksiyonel aktivite düzeyi Kol, Omuz ve El Sorunları Anketi (DASH) ve Amerikan Omuz ve Dirsek Cerrahları Değerlendirme Formu (ASES) kullanılarak değerlendirildi.
Bulgular: Katılımcıların % 41,8'inde üst ekstremite sorunları gözlendi. Oyun seviyesine ve önceki yaralanma hikayesine göre gruplara ayrılan bireyler karşılaştırıldığında DASH ve ASES skorlarında farklılıklar gözlendi ($p<0,05$). Omuz ağrısı en sık karşılaşılan klinik semptomdu. Ayrıca, spor dalı ve spora katılım süresi Türk baş üstü fırlatma sporcularında gözlenen üst ekstremite yaralanmaları ile istatistiksel ilişki göstermedi ($p>0,05$).
Sonuç: Baş üstü fırlatma sporcularında üst ekstremite problemleri yüksek oranda gözlenmektedir. Bu çalışma Türk baş üstü fırlatma sporcularında üst ekstremite sağlık profilini belirlemiş ve böylelikle sporla ilişkili üst ekstremite yaralanmalarının önlenmesi açısından bilgi sağlamıştır.
Anahtar kelimeler: Sporcular, Omuz, Dirsek.

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The importance of the physically active lifestyle and the sports participation has been raised because of the relative health benefits of training.[1] Therefore, participation in sports has grown tremendously over the past few decades. Although the health benefits of participation in competitive and recreational athletic events are numerous; including improved cardiovascular, musculoskeletal and psychosocial health, one adverse consequence is sport-related injuries.[2]

Overhead athletes are considered as a specific group within the population of athletes, who have high demands on their upper extremity due to repetitive shoulder elevation, external rotation and elbow flexion-extension.[3] A high incidence of sports-related shoulder and elbow injuries are documented in this group of athletes.[4,5] Overuse injuries are the most common injuries for arm in overhead-throwing athletes.[6] The potential risk factors previously hypothesized to predispose athletes to an arm injury including age, body mass index, and performance characteristics, altered mobility, flexibility and neuromuscular control.[7] Previously, McMaster and Troup reported that the injured athletes with shoulder pain had a history of shoulder pain.[8] Investigating the health profile and the injury factors are important because the information should be the emphasis of training and prevention programs for the athletes.

International studies also documented the injured athletes suffer the most severe injuries requiring the greatest number of days lost from practice and the competition.[9] Therefore, screening and identifying concomitant upper extremity pain and dysfunction are becoming an important issue. The self-reported outcome scores can be easily applied and provide subjective sportive performance and functional status information to screen, to monitor the treatment and rehabilitation effectiveness, and to evaluate return to the respective sport after injuries in the overhead athletes.

Although many overhead athletes report upper extremity related pain, the prevalence of specific upper extremity problems remains controversial in Turkish population. Therefore, this study investigates the upper extremity health profile in Turkish overhead athletes and the effect of sports participation, sports type, and previous injury on the health profile.

METHODS

A total of 134 overhead throwing athletes completed a survey regarding the demographic characteristics, sports participation, injury history, and current status of presence of upper extremity problems and sports involvement, pain existence and severity, disability and functional status. Participants who have current shoulder pain were further examined.

The eligibility criteria were determined as being at 18 years or older overhead throwing athlete who is currently active or not playing sports due to arm trouble. Each athlete was asked to check the category that best described their current self-reported functional status according to three subgroups: (1) playing without any arm trouble, (2) playing, but with arm trouble, or (3) not playing due to arm trouble.

All participants provided written informed consent, and the Institutional Ethics Committee approved the present study.

To be able to examine upper extremity health profile two questionnaires had been previously translated to Turkish, their measurement properties have been tested, and reports have shown good results were used. The validated the Disabilities of the Arm, Shoulder, and Hand (DASH) scoring system,[10,11] and the American Shoulder and Elbow Surgeons Evaluation Form (ASES)[12] were applied. The DASH score was used to measure disability status of the upper extremities and is scored in two components: the disability/symptom section (30 items, scored between 1 and 5) and the high performance sports module (4 items, scored between 1 and 5).[13] Each item was converted to a percentage and results were presented in the form of two total scores ranging from 0–100; higher scores indicate higher levels of disability. ASES evaluates subjective shoulder pain and function/disability.[14] The total ASES score is derived from a pain question using the VAS (ranging from 0 mm [no pain] to 100 mm [worst pain]) in addition to a 10-item function score that is graded on a 4-point Likert's scale and is evaluated by the level of difficulty experienced during activities of daily life such as combing hair and reaching a high shelf. Scores ranged from 0 (unable to perform the activity) to 3 (no difficulty performing the

activity). The ASES has two subscores; the pain score and the cumulative activities of daily living score that are weighted equally (50 points each) and combined for a total score (possible 100 points). A score of 100 indicates good shoulder function.

Statistical analysis

Descriptive statistics are reported as mean, standard deviation, counts, and percentages. Statistical significance was set to $p<0.05$. All analyses were performed using SPSS Statistics, version 21 software (IBM Corporation, Armonk, NY). The ANOVA test was used to compare the presence of symptoms, disability, and functional status between the groups of athletes who categorized as (1) playing without any arm trouble, (2) playing, but with arm trouble, or (3) not playing due to arm trouble. Chi-square test was also used for analyze gender, sport type and history of previous injury frequency distribution in these subgroups of athletes. Other separate ANOVAs were used to compare the presence of symptoms, disability, and functional status between the groups of athletes categorized by their sport type or presence of previous injury for all participants. Additionally, for all participants, Spearman's correlation co-efficient (r) test was used to analyze the relationship between the duration of sports participation and clinical scores to be able to determine the effect of sports participation on the health profile.

RESULTS

No differences were found in age, gender or sports type when the three subgroups of athletes including playing without any arm trouble (n=78, 58.2%); playing, but with arm trouble (n=38, 28.4%); and not playing due to arm trouble (n=18, 13.4%) were compared ($p>0.05$, Table 1). However, the DASH and ASES scores significantly differed between the three subgroups of athletes (Table 2). Additionally, statistically significant differences were found in prevalence of previous injury rates between the three subgroups of athletes ($p<0.001$) (Table 1). Previous upper extremity injury history was reported by 36.8% of athletes, who were playing, but with arm trouble and by 94.4% of athletes who were not playing due to arm trouble (Table 1). When athletes with injury history (n=33) compared with those without injury history (n=101), the DASH and ASES scores were statistically different (Table 3).

Overall, the study sample was participating volleyball (35.1%), handball (15.7%), tennis (12.7%), basketball (18.7%), swimming (9.7%), and water polo (8.2%). No differences were found in the ASES and DASH scores when the athletes from different sports types compared ($p>0.05$; Table 4).

Collectively, 13.5% of the participants reported experiencing upper extremity problems and they were not playing due to arm trouble, diagnosed with 33.3% rotator cuff tendinopathy including impingement syndrome, 11.1% labral lesions, 22.2% glenohumeral joint instability, 27.7% lateral epicondilitis, and 5.5% fracture at the time of the survey collected (Table 1). Similarly, 28.4% the participants reported that they were playing, but with arm trouble including shoulder problems (81.7%), elbow problems (10.5%), and wrist-hand problems (7.8%).

Duration of sports participation was found to be greater in the athletes who reported current pain on their arm ($p<0.001$, Table 2). However, there was no significant correlation found between duration of sports participation and ASES or DASH scores ($p>0.05$, Table 5).

DISCUSSION

The current study investigated the upper extremity health profile in Turkish overhead athletes. The findings indicated that involvement in overhead sports might result in upper extremity problems with or without corrupting sports participation.

Generally, the reported results are in agreement with previous international research[4,5,8,15] examining the epidemiology of sports injuries, showing similar trends in the types and rates. Shoulder pain was the most common clinical presentation in Turkish overhead throwing athletes. Sport type and duration of participation did not correlate with the upper extremity health status.

Similar to previous findings by Rogalski et al[16] and by Schneider et al,[17] the previous injury history was found as an important

Table 1. Demographics of the cohorts.

	Asymptomatic athletes	Symptomatic athletes			All participants
		Athletes competing with arm trouble	Athletes not competing due to arm trouble	p	
Number of athletes (n)	78 (58.2%)	38 (28.3%)	18 (13.5%)		134 (100%)
Sex (Female/Male; n)	28/50	8/30	3/15	0.11	39/95
Age (years) (Mean (SD))	22.4 (4.9)	22.6 (4.6)	24.1 (5.9)	0.42	22.7 (5.01)
Sports participation (years)	11.3 (5.9)	10.6 (5.03)	11.1 (5.4)	0.85	11.1 (5.5)
Injury history (yes/no; n)	2/76	14/24	17/1	<0.001	33/101
Sports (n)					
Volleyball	32 (41%)	10 (26.3%)	5 (27.8%)		47 (35.1%)
Handball	9 (11.5%)	9 (23.7%)	3 (16.7%)		21 (15.7%)
Tennis	7 (9%)	8 (21.1%)	2 (11.1%)		17 (12.7%)
Basketball	14 (17.3%)	8 (21.1)	3 (16.7%)		25 (18.7%)
Water Polo	8 (10.3%)		3 (16.7%)		11 (8.2%)
Swimming	8 (10.3%)	3 (7.9%)	2 (11.1%)		13 (9.7%)
Current Injury (n)					
Rotator cuff tendinopathy	N/A	N/A	6 (33.3%)		6 (33.3%)
Labral lesion			2 (11.1%)		2 (11.1%)
Instability			4 (22.2%)		4 (22.2%)
Fracture			1 (5.5%)		1 (5.5%)
Lateral epicondilitis			5 (27.7%)		5 (27.7%)

Data are given as mean and standard deviation (for age and years competing), or as counts and percentages (other parameters). *P*-values indicate the results of the ANOVA test for age and sports participation and the results of chi-square test for the sex and the presence of injury history.

Table 2. Subgroup analysis of disability and functional activity status scores.

	Asymptomatic athletes	Symptomatic athletes			All participants
		Athletes competing with arm trouble	Athletes not competing due to arm trouble	p	
Number of athletes	78 (58.2%)	38 (28.3%)	18 (13.5%)		134 (100%)
ASES-Pain	48.6 (3.6)	32.3 (10.8)	21.6 (13.8)	<0.001	40.3 (13.08)
ASES-Function	48.1 (4.9)	42.07 (7.6)	28.6 (8.5)	<0.001	43.7 (9.06)
ASES-Total	96.8 (6.06)	73.4 (14.3)	50.3 (19.7)	<0.001	83.9 (20.2)
DASH	1.6 (5.3)	9.7 (18.4)	27.6 (12.2)	<0.001	7.4 (14.3)
DASH-Sports	1.6 (5.4)	21.5 (15.2)	62.5 (27.8)	<0.001	15.4 (24.5)

P-values indicate the results of the ANOVA test. Data represented in points; Mean and (SD), SD, standard deviation. DASH; the Disabilities of the Arm, Shoulder, and Hand, ASES; the American Shoulder and Elbow Surgeons Evaluation Form.

Table 3. Subgroup analysis of disability and functional activity status scores in athletes with or without previous injury.

	Athletes with injury history (N=33)	Athletes without injury history (N=101)	p	All participants (N=134)
ASES-Pain	24.5 (14.3)	45.5 (7.2)	< 0.001	40.3 (13.08)
ASES-Function	33.3 (10.4)	47.2 (5.1)	< 0.001	43.7 (9.06)
ASES-Total	57.8 (20.1)	92.4 (10.8)	< 0.001	83.9 (20.2)
DASH	19.9 (14.6)	3.3 (11.7)	< 0.001	7.4 (14.3)
DASH-Sports	45.4 (29.7)	5.7 (11.1)	< 0.001	15.4 (24.5)

p values indicate the results of the ANOVA test. ASES: The American Shoulder and Elbow Surgeons Evaluation Form.
DASH: The Disabilities of the Arm, Shoulder, and Hand.

Table 4. Subgroup analysis of disability and functional activity status scores in athletes with various sport types.

	Volleyball Mean (SD)	Handball Mean (SD)	Tennis Mean (SD)	Basketball Mean (SD)	Swimming Mean (SD)	Water Polo Mean (SD)	p
ASES-Pain	40.3 (13.08)	24.5 (14.3)	45.5 (7.2)	39.6 (12.8)	41.9 (13.7)	37.2 (21.9)	0.82
ASES-Function	43.7 (9.06)	33.3 (10.4)	47.2 (5.1)	42.1 (10)	43.4 (11.9)	41.9 (13.7)	0.30
ASES-Total	83.9 (20.2)	57.8 (20.1)	92.4 (10.8)	81.6 (19.8)	85.3 (25.5)	79.2 (35.6)	0.46
DASH	7.4 (14.3)	19.9 (14.6)	3.3 (11.7)	10.4 (14.4)	8.1 (15.8)	13.2 (22.8)	0.10
DASH-Sports	15.4 (24.5)	45.4 (29.7)	5.7 (11.1)	19.5 (25.9)	17.8 (32.1)	27.2 (45.4)	0.29

p values indicate the results of the ANOVA test. ASES: The American Shoulder and Elbow Surgeons Evaluation Form.
DASH: The Disabilities of the Arm, Shoulder, and Hand.

Table 5. Correlations between duration of sports participation and the American Shoulder and Elbow Surgeons Evaluation Form (ASES), the Disabilities of the Arm, Shoulder, and Hand (DASH).

	r (p)
ASES-Pain	-0.028 (0.75)
ASES-Function	-0.004 (0.96)
ASES-Total	-0.037 (0.67)
DASH	0.115 (0.18)
DASH-Sports	0.026 (0.76)

contributor to the re-injury risk. Interestingly, regardless of having previous injury history or current arm pain, the athletes had lower upper extremity health profile. Additionally, although the years in competition were greater in the athletes who reported current pain on their arm, the duration of professional sports participation did not reveal any effect on upper extremity health profile. On the other hand the high prevalence of shoulder-related problems (23.1%) was reported among Turkish overhead athletes who participate various sports types. Athletes with a painful shoulder reported that spiking and weight training aggravated the painful shoulder. Pathologies commonly seen in the study group were the overuse injuries including rotator cuff tendinopathies. Therefore, injury prevention programs should be developed based on our findings and integrated in regular sports training programs for overhead athletes starting from early sports career.

Concerning upper extremity disorders, the DASH scoring system and the ASES form have widely been used in Turkish-speaking population.[10-12] The findings of this study showed that throwing athletes with arm trouble had poor results in terms of disability and functional status. Although these scores are likely to be very useful in screening athletes for potential functional impairment in the upper extremities, these scales are only used for the general population and do not incorporate the specific needs of athletes such as spiking. The more sport-specific

questionnaires should be developed and validated for in Turkish-speaking population. Clinically, the athletes often do not have restrictions activities of daily life; however, they often notice the symptoms during high levels of athletic activity such as training or competitions.[18]

Limitations

There are some limitations of the current study. The study population was recruited from the athletes engaging different overhead throwing sports, such as volleyball, handball, and basketball, the findings of the current study might only present the health profile of the combined group and not be representative for individual sports types.

Conclusion

In conclusion, this study identified the upper extremity health profile in Turkish overhead throwing athletes and the effect of sports participation, sports type, and previous injury on the health profile. The interfering upper extremity problems were present in a substantial number of competitive overhead throwing athletes.

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