ORIGINAL RESEARCH

Turkısh translatıon and valıdatıon of the Oslo Sports Trauma Research Center (OSTRC) Questıonnaıres

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Abstract

Background

Exposure to repetitive activities and heavy workloads makes athletes vulnerable to overuse injuries in time. Well-timed detection of these injuries is crucial to maintaining their sports career healthily. The Oslo Sports Trauma Research Centre questionnaires for Overuse Injury (OSTRC-O) and Health Problems (OSTRC-H) are universally used as valid and reliable tools in athlete health screening. We aimed to make them available to Turkish athletes and assess their psychometric properties.

Methods

The questionnaires were adapted to Turkish based on systematic guidelines. Seventy-two athletes were recruited from various sports branches. The internal consistency, reproducibility, and validity of the questionnaires were checked. Their total scores were compared with the scores of the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) and the Nottingham Health Profile (NHP) for concurrent validity. Thirty-three participants were screened for six weeks to detect score changes and calculate effect sizes.

Results:

The Cronbach alpha values of the OSTRC-O and OSTRC-H were very high (.90 and .91, respectively). Test-retest reliability was excellent for both questionnaires (.98, p<.01). There was a moderate correlation between OSTRC-O and OSTRC-H scores with CMDQ and NHP (p<.01). The area under the curve (AUC) values were higher than .70 for all scales. The effect size values were moderate for all scales.

Conclusions

Turkish versions of the OSTRC-O and OSTRC-H questionnaires are valid and reliable tools for Turkish-speaking athletes in different sports branches.

Keywords: Athlete health, overuse injury, outcome measure, validity, reliability

Introduction

Sport, which provides physical, mental, psychological, and social gains, may also cause various injuries and physical damage. All athletes are vulnerable to acute trauma or cumulative injuries throughout their sporting life[1,2]. While acute injuries require immediate treatment, detection, and interest, treatment of overuse injuries is typically disregarded. However, they are as effective as acute injuries on performance and time loss[3]. Moreover, they sometimes precipitate acute trauma. Thus, screening the health levels of athletes and investigating whether they have overuse injuries is essential both to prevent acute trauma and improve health and performance[3,4]. There is no valid and reliable subjective measurement tool to perform this screening for athletes in Turkish currently. However, the valid and reliable "Oslo Sports Trauma Research Centre Overuse Injury Questionnaires (OSTRC)" developed by Clarsen et al. to fill this gap are available in English[5]. These scales are widely used to assess the injury risk of athletes, monitor injuries and follow the rehabilitation process[6,7]. They are used to determine injury risk by asking athletes to rate the symptoms, performance, and activity limitations they experienced. This data helps sports clubs track and manage injuries[7]. In addition, it has enabled many prevalence studies investigating health problems in large heterogeneous groups or surveillance studies to the follow-up of sports injuries in certain sports branches[7-9]. OSTRC surveys are recognized as an effective tool for tracking the health and performance of athletes[10]. To be used in sports-health research in our country, we aimed to adapt the OSTRC-Overuse (OSTRC-O) and the OSTRC-Health (OSTRC-H) Questionnaires into Turkish.

Methods

Prior to the study, permission was obtained from the authors who developed the questionnaires. Then, ethical approval was acquired from the Gazi University Clinical Research Ethics Committee (Number: E-77082166-604.01.02-27936). Questionnaires were adapted into Turkish according to systematic translation rules. A pilot study was conducted with twenty participants to ensure the accuracy of meaning and comprehensibility of the translated questionnaires. Finally, the validity and reliability of the new tools were investigated.

Translation and Cross-Cultural Adaptation Process

The method described by Beaton et al. was used for the translation and cultural adaptation of the health questionnaires[11].

Table 1. Demographics of the Athletes

			Pretest phase	Validation phase	Responsiveness phase	
					At the beginning	End of the 6 weeks
Total participants n			20	72	38	33
Gender n (%)		Female	10 (50)	33 (45,8)	0	0
		Male	10 (50)	39 (54,2)	38 (100)	33 (100)
Age (years) (Mean ± SD)			21.3 ± 3.78	21.22 ± 2.31	22.92 ± 3.75	22.96 ± 3.80
Sports duration(years) (Mean ± SD)			9.85 ± 3.49	8.84 ± 4.80	8.55 ± 4.15	8.72 ± 4.41
Dominant side n (%)		Right Sided	15 (75)	65 (90.3)	34 (89.5)	30 (90.9)
		Left Sided	5 (25)	7 (9.7)	4 (10.5)	3 (9.1)
Sport type		Volleyball	4 (20)	22 (30.6)	6	5
		Handball	7 (35)	13 (18.1)	-	-
		Soccer	7 (35)	21 (29,2)	21	18
		Tennis	2 (10)	11 (15,3)	11	10
		Basketball	-	3 (4.2)	-	-
		Wrestling	-	1 (1.4)	-	-
		Runner	-	1 (1.4)	-	-
Present Injury n (%)		Yes	7 (35)	22 (30.6)	11 (28.9)	9 (27.3)
		No	13 (65)	50 (69.4)	27 (71.1)	24 (72.7)
Previous Injury n (%)		Yes	6 (30)	28 (38.9)	12 (31.6)	10 (69.7)
		SNo	14 (70)	44 (61.1)	26 (68.4)	23 (30.3)

SD: Standart Deviation

Table 2. Outcome Scores

Scale	Subsections	Scores Mean ± SD
OSTRC-O	Participation	4.57 ± 7.45
	Modified training/competition	4.36 ± 7.94
	Performance	4.13 ± 8.15
	Pain	4.55 ± 6.06
	TOTAL	17.39 ± 27.16
OSTRC-H	Participation	4.57 ± 7.45
	Modified training/competition	4.13± 7.69
	Performance	3.92 ± 8.15
	Pain	4.10 ±5.74
	TOTAL	16.68 ± 27.47
CMDQ		8.89 ± 13.57
NHP	Pain	1.61 ± 5.21
	Physical Mobility	2.35 ± 5.34
	Emotional Reactions	8.82 ± 15.55
	Sleep	12.03 ± 23.19
	Energy Level	12.06 ± 27.41
	Social Isolation	10.71 ± 20.87
	Section 1	45.30 ± 68.84
OSTRC-O (Re-test)	TOTAL	17.39 ± 27.11
OSTRC-H (Re-test)	TOTAL	16.5 ±26.98

OSTRC-O Oslo Sports Trauma Research Centre Overuse Injury Questionnaire

OSTRC-H Oslo Sports Trauma Research Center Questionnaire on Health Problems

CMDQ Cornell Musculoskeletal Discomfort Questionnaire

NHP Nottingham Health Profile

Table 3. Correlation values of the questionnaires

	OSTRC-O		OSTRC-H	
	r	p	r	p
CMDQ	0.72	< 0.01	0.63	< 0.01
NHP	0.54	.< 0.01	0.57	<0.01

OSTRC-O Oslo Sports Trauma Research Centre Overuse Injury Questionnaire

OSTRC-H Oslo Sports Trauma Research Center Questionnaire on Health Problems

**CMDQ** Cornell Musculoskeletal Discomfort Questionnaire

NHP Nottingham Health Profile

Table 4. Floor and ceiling effects of OSTRC-O and OSTRC-H

		OSTRC-O		OSTRC-H	
WEEKS	Participants	Floor efects (worst status)	Ceiling efects (best status)	Floor efects (worst status)	Ceiling efects (best status)
	n	n (%)	n (%)	n (%)	n (%)
1	72	30 (41.7)	1 (1.4)	34 (47.2)	1 (1,4)
2	38	18 (47.36)	0	23 (60.5)	0
3	35	18 (51.42)	0	21(60)	0
4	33	16 (48.5)	0	18 (54.54)	0
5	33	17 (51.5)	0	15 (45.45)	0
6	33	19 (57.6)	0	18 (54.54)	0
Total	244	118 (48.36)	1(0.4)	129 (52.86)	1(0.4)

OSTRC-O Oslo Sports Trauma Research Centre Overuse Injury Questionnaire

OSTRC-H Oslo Sports Trauma Research Center Questionnaire on Health Problems

Figure 1. ROC curves and the AUC values of the scales
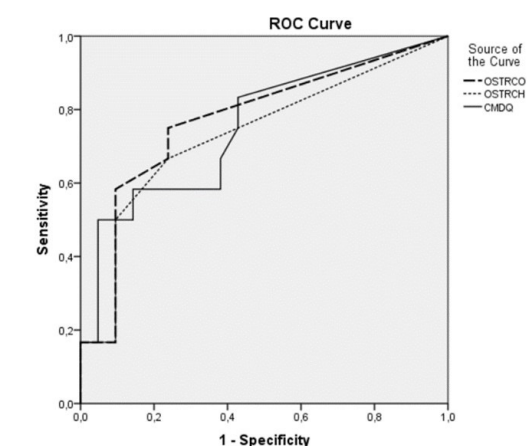
Area Under the Curve

Test Result Variable(s)	Area
CMDQ	,752
OSTRCO	,772
OSTRCH	,734

OSTRC-O Oslo Sports Trauma Research Centre Overuse Injury Questionnaire
OSTRC-H Oslo Sports Trauma Research Center Questionnaire on Health Problems
CMDQ Cornell Musculoskeletal Discomfort Questionnaire

First, two native Turkish speakers, one from the medical sector and the other from outside the field, translated the original scale into Turkish. Two translation drafts were created. The amalgamated work was translated back to English by two independent professional bilingual translators via a translation company. The new documents and the original version of the questionnaires were compared based on semantic equivalence. The working commission agreed there was sufficient consistency between the translated and the original versions. A comprehensibility form was created by adding 'I understood', 'I partially understood', and 'I did not understand' options to each question on the Turkish version of the questionnaire. This questionnaire was applied to 20 Turkish-speaking athletes. They were asked to indicate the confusing parts, if any, and specify their suggestions. They did not remark on any equivocacy or obscurity but made some suggestions. The commission assessed the significance of the proposals, evaluated their relevance, and agreed on the final version of the questionnaires (Appendix 1).

Subjects

A total of 72 athletes aged between 18 and 35 year, who can understand and speak Turkish fluently, from various sports branches were included in our study.

There were no exclusion criteria as with the development study. Informed consent was obtained from all athletes.

Testing Protocol

Sports teams in various branches were visited, and volunteer athletes were evaluated face-to-face by a physical therapist. The demographics of the participants were recorded. All participants were administered the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), Nottingham Health Profile (NHP), OSTRC-O, and OSTRC-H questionnaires. The OSTRC-O OSTRC-H and CMDQ questionnaires were repeated weekly for six weeks for 38 athletes.

Questionnaires

The CMDQ is used to ascertain musculoskeletal problems experienced in the last week during work life. Participants marked the frequency, discomfort, and interference categories for 20 different regions on the body map diagram. The total score of the questionnaire is between 0 (best condition) and 90 (worst health status)[12]. The questionnaire was adapted into Turkish in 2011[13].

The NHP is a generic health questionnaire consisting of 6 sub-parameters (pain, physical mobility, emotional reactions, sleep, energy level, social isolation) and 38 items. Participants marked yes or no for each item. The total score ranges from 0 to 600, and the total score is inversely proportional to the quality of life[14]. The Turkish version is available[15].

The first version of the OSTRC questionnaire was developed in 2013. [5]. It was updated several times and revised into two separate questionnaires assessing general health and overuse syndrome involving all joints. Recent versions -updated in 2020- were used in this study[4,16].

The OSTRC-O queries sports participation, training volume, sports performance, and pain for a selected body location, e.g., knee, taking into account the last seven days. The OSTRC-H is applied to determine the effects of general health problems on the same parameters. Other properties of these questionnaires are similar. Both questionnaires consist of four questions. Each question has four options, and scoring is 0-8-17-25, respectively. A severity score is between 0-100 points. Higher points show worse health conditions[16].

Statistical Analysis

Statistical analyses were performed with the Statistical Package for Social Sciences Program (version 22.0 SPSS for Windows; Inc, Chicago, IL). Variables were checked for normality using visual (histograms, probability plots) and analytical (Shapiro-Wilk test) methods. The quantitative variables are given as the mean and standard deviation (SD). For all calculations, $p < .05$ was considered significant.

Reliability was analyzed by internal consistency and test-retest methods[17,18]. Cronbach alpha value was determined for internal consistency, and values between .70 and .90 were considered sufficient. Test-retest reliability was examined with a one-week interval using the intra-class correlation coefficient (ICC). ICC values were classified as low (<.40), moderate (.40-.70), good (.70-.90), and excellent (>.90)[19].

The validity of the scale was evaluated in terms of construct validity, content validity and concurrent validity[20].

Content validity was verified with reports of participants at the end of the sixth week. Construct validity checked with factor analysis. First, the Kaiser-Meyer-Olkin (KMO) test was used to measure the adequacy of the sample, and the Bartlett test of sphericity was used to evaluate the factored data[21]. A KMO value less than .5 was considered poor, between .5-.6 was acceptable, between .6-.8 was good, and higher than .8 was considered excellent sampling adequacy[22]. The latent factor structure of the scale was determined by the principal extraction method and compared with original structure. To evaluate the concurrent validity, total OSTRC scores were compared with the total scores of the CMDQ and NHP. As all variables were nonparametric, the Spearman correlation coefficient method was used.

Correlations of the OSTRC-O and OSTRC-H change scores with CMDQ change score separately were assessed throughout the six weeks in terms of the effect size (ES) for responsiveness[23]. The values below .20 point are considered weak, between .20 and .50 moderate, between .50 and .80 good, and above the .80 strong effect size. Receiver Operating Characteristic (ROC) curve test based on the area under the curve (AUC) was used to define the performance of these assessment tools. AUC values of .70 and higher are considered sufficient effects[24]. Additionally, floor and ceiling effects of OSTRC questionnaires were calculated according to the proportion of the scores equivalent the worst status and the best status, respectively[18].

Results

Translation, Adaptation, and Comprehensibility

In the translation step, all words were thoroughly negotiated. Some of them were controversial. For example, the term "instability" is "instabilite" in Turkish and is widely used in scientific areas, but it is may not well known to the public. The "modified, symptom and problem" terms are similar, too. Committee members evaluated the opinions of pre-test participants about these words. The committee concluded that it would be appropriate to translate "instability" as "stabilizasyon eksikliği" and to translate the word "modified" as "modifiye edilmiş" and add an explanation in parentheses as "yeniden düzenlenmiş, değiştirilmiş". There was no need to change the "semptom" and "problem" words. Thus, the final version was successfully created by making minor changes.

Subjects

In sum, 72 athletes (33 females and 39 males, age 21.22 ± 2.31 years) participated in this study. Demographics of the athletes are presented in Table 1. Outcome scores are included in Table 2. Within 6 weeks, 12 participants reported 15 injuries (5 ankles, 4 knees, 4 shoulders, 1 low back, and 1 elbow).

Reliability

The Cronbach alpha values for the OSTRC-O and OSTRC-H were found as .90 and .91, respectively. Test-retest reliability was conducted with 38 athletes in a one-week interval and found to be .98 for both questionnaires.

Validity

In the development study, the validity of the questionnaires was examined in terms of the face validity method since there was no gold standard measurement in this regard. Four questions were asked to athletes at the end of the six weeks follow-up. These questions were "1. Do you think that the 1st survey includes questions about the sport you participated in? 2. Was the questionnaire difficult to fill out? 3. Do you want to change or add any questions? And 4. Is

the web-based technique suitable?" 5. We repeated the same method to compare the results as in studies about the other versions. The participants stated that the questions were simple and related to their sports participation, reflected the change in their health status, and both face-to-face and online applications were appropriate. These responses prove the OSTRC-O and OSTRC-H questionnaires assess the intended properties.

KMO measure of sampling adequacy was .752 for OSTRC-O and .779 for OSTRC-H. The Barlett chi-square value was 254.784 and 274.286, respectively (p<.001). These findings show that we have reached suitable and sufficient sample sizes for factor analysis. Factor analysis revealed that a single factored structure defines 77.129% and 79.849% of the total variance, respectively.

Additionally, correlations of OSTRC-O and OSTRC-H scores with CMDQ and NHP were evaluated with the Spearman correlation coefficient for concurrent validity. Moderate positive correlations were found between them (p<0.01) (Table 3). In addition, there was an excellent positive correlation between the OSTRC-O and OSTRC-H scores (.97; p<.001).

Responsiveness

To assess the responsiveness, in the first step, severity change scores of OSTRC-O and OSTRC-H were correlated with the CMDQ severity change score. As with the correlation of the baseline scores, there was also a moderate correlation during the six-week timeline (.581 and .526). To show the effect values of these three measurement tools, the ROC curve was drawn, and the AUC values were checked. The ROC curve showed sufficient specificity and sensitivity. AUC values were higher than .70 for all scales (Figure 1.). Then, ES was calculated with the Cohen d values and found to be .28 for OSTRC-O, .21 for OSTRC-H, and .38 for CMDQ.

Floor and Ceiling Effects

The floor proportions were between 41.7 and 57.6 for OSTRC-O, 47.2 and 60.5 for OSTRC-H. The ceiling proportions of both of them were between 0-1.4 for each period (Table 4).

Discussion

Sports participation is becoming increasingly common around the world as its physical, mental, and social benefits are discovered. Many people participate in sports at various levels (elite, professional, amateur, recreational)[25,26]. Today, despite improving conditions, the risk of sports injuries remains serious[27,28]. Thus, monitoring the health conditions of athletes and revealing changes is extremely important. This may not always be possible by using objective screening and diagnostic methods for large populations. Time-saving subjective assessment tools are useful at this point. In this regard, the OSTRC questionnaires are very practical tools, and are widely used around the world[8,29]. Their Swedish, German, Danish, Japanese, Spanish, Brazilian, and Thai versions are available[30-36]. We also created their Turkish versions. The translation phase was conducted following international translation standards, as in other versions. With the feedback of the participants, questionnaires were adapted into Turkish successfully. The pretest phase was completed with twenty people, and the validation phase was completed with seventy-two people. The study planned to follow thirty-eight athletes from soccer, volleyball, and tennis branches for

six weeks, who accepted participation in the responsiveness study. However, five participants dropped out during this period. Three athletes left due to COVID-19 infection, one soccer player had an ACL operation, and another left the study. The responsiveness phase was completed with 86.84% participation (33 athletes).

Sports injuries can occur acutely during competition and training, or they can occur gradually as a result of repeated exposure. In this context, it is necessary to be aware that the follow-up of acute and overuse injuries is different from each other[37]. Overuse injuries are difficult to follow, as their onset and symptoms may change over time. OSTRC questionnaires are especially prominent in the follow-up of overuse injuries. Monitoring these injuries in Turkish-speaking athletes highlights this study.

Cronbach's alpha values for previous versions of the OSTRC questionnaire were determined as .91, .92, .86, .73, and .93 in the original study, German, Danish, Japanese and Brazilian versions, respectively[5,33-36]. Internal consistency coefficients were found to be .88 and .91 for OSTRC-O, and .93 and .95 for OSTRC-H in Spanish and Thai versions of updated forms[30,31]. We also found very high internal consistency for the Turkish version as in the other studies. In addition to these results, the reliability of the scales was checked with the test-retest reliability method and found to be very high (ICC = .98 for both). All the other versions had high-level internal consistency (.86-.97)[30-36]. These values prove the time invariance of scores for the same medical conditions and the reproducibility of these questionnaires.

The answers obtained from the participants at the end of 6 weeks supported the view that these questionnaires are convenient and practical tools for the target population that can distinguish changes in their health status.

The results of the factor analysis showed that the questions were not grouped within themselves, and the single structure that emerged explained the variance examined at a high rate. These results are in line with the existing structure of the original OSTRC questionnaires. This structural feature overlaps with the original version and shows that the adapted scales have good construct validity.

In addition, evaluating concurrency validity with other relevant health quality measures was thought to contribute to the validation analysis. By examining the scope and content of many scales, the decision was made to use the CMDQ and the NHP questionnaires[12,14]. OSTRC-O is used to identify overuse injuries -a musculoskeletal problem- specific to a problematic body region. CMDQ, on the other hand, is a tool that reveals musculoskeletal disorders involving all body regions. Even though the direct usage purposes are not the same, it was considered a potential problem that may contribute to the severity score of both scales. Similarly, the NHP questionnaire, which provides a multidimensional general health assessment, and the OSTRC-H, which investigates the effects of sports-related musculoskeletal injuries on general health, may be related. As a result of the analyses, there was a moderate correlation between these scales. The fact that the NHP has a more general perspective than the OSTRC questionnaires explains the moderate correlation. In parallel, the moderate correlation with the CMDQ, which reveals musculoskeletal injuries in all body regions, was expected, as the OSTRC questionnaires are sport-related and specific to only a single affected site. These findings show our approach was correct. In addition,

the findings of the same level of correlation between the severity change scores during the six-week duration indicate that the results were not due to chance.

For OSTRC-O and OSTRC-H, the floor effects were considerably high (48.36 and 52.86, respectively), while the ceiling effects were quite low (0.4 for both). The questionnaires presented a considerable floor effect due to healthy participants. This is a natural and expected result, as these scales are applicable to both injured and healthy athletes. Similar results were found in other version studies investigating the floor-ceiling effect[30,36].

The effect size was moderate for all scales. During the 6-week follow-up, only 12 of the 33 participants reported moderate-to-mild injuries. All of them were mild-to-moderate injuries and did not cause playtime loss. Since these did not cause a significant change in the general health status of the athletes, there were no extensive changes in the scale points. Therefore, it may not accurately reflect the effect sizes of the scales. Responsiveness analysis will give more accurate results during the follow-up of athletes with injuries above a certain level or monitoring the consequences of interventions to athletes with the same pathology.

Another limitation of our study was that our follow-up period was shorter than in other studies[5,30-36]. We were able to follow the athletes for six weeks, as the health status of the COVID-19 infected athletes was affected, and drop-out rates increased. However, this situation was not considered to affect our results since our target population was not a group with a specific pathology.

Conclusion

In the present study, the OSTRC-O and OSTRC-H questionnaires, which are useful in revealing sports injuries, were successfully adapted into Turkish. The Turkish versions of the questionnaires were also determined to have high validity and reliability. These tools can be used safely and practically for the detection and monitoring of the health status of Turkish-speaking athletes.

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