Original Article

Validity and Reliability of the Oslo Sports Trauma Research Center (OSTRC) Questionnaire on Overuse Injury and Health Problem in Thai Version

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Background: The Oslo Sports Trauma Research Center (OSTRC) questionnaires on overuse injury and health problem were developed to register overuse injury and health problems. However, this questionnaire has not been translated or validated in Thai.

Objective: To develop the original edition of the OSTRC Questionnaire on overuse injuries and health problems into Thai language and to examine the validity and reliability of the adapted scale.

Materials and Methods: The development of the questionnaire followed the steps of translation, which included forward translation, translation merging, backward translation, and critique by the researcher, health professionals, speech professionals, athletes, and the translators for semantic and conceptual equivalence. A cohort of 65 Thai athletes were recruited. Cross-sectional surveillance data were used to record overuse injury and health problem. Throughout the 12-week surveillance period, all participants were assigned to complete the questionnaire within three days after receiving a questionnaire by e-mail. Robustness and reliability process was seen in the 57 athletes who completed their 12 weeks of surveillance period.

Results: The OSTRC on overuse injuries and health problems Thai version (OSTRC-OT and HT) showed a high internal consistency. Cronbach's α of the OSTRC-OT for ankle, knee, and hip regions was 0.919, 0.973, and 0.976, respectively, and the OSTRC-HT was 0.959 and an excellent test-retest reliability with intraclass correlation coefficient of the OSTRC-OT for ankle, knee, and hip regions at 0.994, 0.970, and 0.991, respectively, and the OSTRC-HT at 0.970; all p-values<0.001. Known-groups validity, the severity scores of the OSTRC-OT for ankle, knee, and hip regions, and the OSTRC-HT scores were statistically significant different between injury and non-injury groups.

Conclusion: The validity and reliability of both questionnaires, the OSTRC-OT and the OSTRC-HT were at an excellent level. Moreover, the OSTRC-OT and OSTRC HT have an excellent ability to separate athletes who have an injury and health problem for those who do not.

Keywords: Questionnaire, Sport, Overuse injury, Health problem

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Prevention of injury and illness in athletes are essential aspects of sports medicine due to injuries and illnesses that affect the physical fitness and performance of athletes and the success of the athletes. The study by Raysmith and Drew[1] showed that the amount of time-loss in athletic training was found to negatively impact the success in athletes who missed more than 20% of the training compared to those who did not. In 2013, Hägglund et al[2] reported that a sport season with lower injury burden, which include injury rates and injury severity, and higher compete availability of the athlete were found to be associated with high league final ranking and increased average scores per league match.

In the sport injury literature, "Sequence of Prevention Model" has been used to formulate a sports injury prevention program. This model comprised of four essential stages. Stage I define and describe the incidence, severity, and scope of the problem by injury surveillance method, Stage II identify the factors and mechanisms of the injury to determine the risk factors for sports injuries, Stage III create tools that can be used in sports injury prevention protocol based on the known risk factors and the mechanism of sports injuries, and Stage IV evaluate the tools created from

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the previous three steps by applying to actual use with injury surveillance[3].

Injury surveillance systems are essential for monitoring and tracking physical symptoms and injuries. However, the information gathered will include more errors if the injury surveillance was not accurately and adequately implemented. To evaluate truly burden of overuse injury problem, the Oslo Sports Trauma Research Center (OSTRC) questionnaire on overuse injury and health problems was developed to use as an injury or illness assessment consisting of four key questions related to physical and health of athletes[4,5]. The OSTRC questionnaire had been translated and validated in other languages, including German, Danish, and Norwegian[6-8] in which there were no major disagreement in the translation and acceptable for use in their population. However, the questionnaire has not been translated into Thai. Therefore, an instrument that demonstrates good reliability and validity to assess the overuse injury and health problem in Thai athletes is needed. The objective of the present study was to develop the Thai version of the OSTRC questionnaire on overuse injuries and health problems and evaluate its validity and reliability.

Materials and Methods

Questionnaire

The OSTRC questionnaire on overuse injury and health problem developed by Clarsen et al[9] was translated and adapted to the Thai culture. These questionnaires are tools for injury and illness registration with four essential questions used to assess the severity. Scores in each symptom range from 0 to 100. The range of values in each question is from 0 to 25, with 0 representing no problem and 25 representing the maximum problem level in each question. Therefore, questions 1 and 4 are scored 0-8-17-25, and questions 2 and 3 are scored 0-6-13-19-25.

Translation and adaptation of OSTRC into Thai

The translation and adaptation of the questionnaire was conducted based on the guidelines for the process of cross-cultural adaptation of self-report measures[10]. This process consists of five stages, 1) translation, 2) synthesis, 3) back-translation, 4) an expert committee discussion, and 5) a pretest.

The translation and adaptation procedure in the present study was as follows:

Stage 1: Forward translation: Two independent translators (T1 and T2) with Thai as their native language translated the OSTRC English questionnaire into Thai. T1 was a knowledge-based translator whereas T2 was a general translator.

Stage 2: Synthesis of the forward translation: The two translations (T1 and T2) and the researcher combined the results of both translations, which resulted in one synthesized version of the translation (T12), and a written report carefully documenting the synthesis process, each of the issues addressed, and how they had resolved discrepancies.

Stage 3: Back translation: Thai translated version (T12) was translated back into English by two other translators whose primary language was English and fluent in Thai (BT1 and BT2). Both translators were blinded to the original English questionnaire and the concepts involved in the research. There was no medical knowledge base for these translators.

Stage 4: Expert committee: The expert committee consisted of the researcher, health professionals, athletes, and the translators (forward and backward translators). The role of the expert committee was to review all translations and all reports of the questionnaire (T1, T2, T12, BT1, and BT2) and to take decisions on all discrepancies and composed a pre-final version of the questionnaire. At this stage, the expert panel assessed the content validity of this preliminary version.

Stage 5: Test of the pre-final version: In this stage, 15 athletes who had the same characteristics of the participants of the study were included to test the pre-final version of injury surveillance. The researcher assessed the reliability, validity, and psychometric properties of the pre-final Thai version questionnaire. After an injury surveillance period, the researcher interviewed the athletes who were participating in the surveillance opinion of the survey. Internal consistency was evaluated by Cronbach's α coefficient while test-retest reliability was performed using intraclass correlation coefficients (ICC) at 2-week interval. The pre-final version protocol was done as same as injury surveillance protocol.

Stage 6: Submission of documentation: Submission of documentation to the developers for appraisal of the adaptation process.

All translations and written reports were submitted by the researchers to the developer for record keeping of the translated version.

Participants

Participants were recruited from Mahidol University between September and October 2018.

Inclusion criteria:

1) Athlete engaged in the training program for

at least three days per week.

2) Athlete who can be contacted on social media (email, Facebook, Line) to answer the questionnaire.

3) Athlete between 15 and 30 years old.

Exclusion criteria:

1) Athlete who has lost contact with the research assistants for more than four weeks.

2) Athlete with severe injuries (cannot practice or compete for four weeks or more).

3) Athlete who did not complete the surveillance for 12 weeks.

Injury surveillance protocol

A cross-sectional surveillance data was used to record overuse injury and health problem. Throughout the 12-week injury and illness surveillance period, the OSTRC questionnaire on overuse injury and health problems in Thai version were sent weekly to the participants by email and the participants were asked to respond within three days after receiving a questionnaire. Participants who did not respond within three days were re-contacted by the researcher requesting that questionnaire be returned as soon as possible. However, the participants who did not respond within four weeks were excluded from the data collection and analysis.

All injury and illness conditions of the participants were confirmed and recorded by the medical team to assess the known-groups validity of the questionnaire. The medical team who diagnosed participants with or without injury and health problem did not know the questionnaire results. Every two weeks, the researcher retested the questionnaire by sending the questionnaire to all participants about 48 hours after the first response.

Ethical approval

The study was approved by the Ethics Committee of Mahidol University (approval no. 0517.0138/00501).

Statistical analysis

Sample size calculation: The sample sizes for consistency and reliability were calculated based on the results of previous studies for cross-cultural adaptation translation of OSTRC overuse and health problems (Hirschmüller, Jorgensen). For internal consistency analysis, the sample size was determined using the formula of Bonett[11]. The developers defined a significance level of 0.05 and power of test of 0.90 to detect the difference between Cronbach's α under the null hypothesis of 0.50 and Cronbach's α under the alternative hypothesis of 0.80, at least, a sample of 28 participants, each responding to 13-item questionnaire, were required. For test-retest reliability, the sample size calculation using nQuery Advisor 6.0 for confidence interval (CI) method with the ICC of 0.70, confidence level of 0.95, number of measurements of 2, and distance from correlation to limit of 0.14, a sample of 52 participants were required. A 20% adjustment for non-response rate was added and the final sample size was 63.

Mean (SD) and median (range) were used to describe quantitative data, while number and percentage were used to describe qualitative data. In comparing baseline characteristics, overuse injury, and health problem between athletes with injury and non-injury groups, independent sample t-test was used for quantitative data and Pearson chi-square, Fisher's exact test or Yates' continuity correction test were used for qualitative data, as appropriated. The ICC was used to assess the test-retest reliability of OSTRC-OT and OSTRC-HT. Values greater than 0.75 were considered good to excellent agreement[12].

Known-groups validity was evaluated using Mann-Whitney U test comparing severity scores and health problem score. Receiver operating characteristic (ROC) curve and area under the ROC curve (AUC) were used to evaluate the performance of the questionnaires. Therefore, an AUC of 0.5 suggested no discrimination, such as the ability to classify athletes with injury or non-injury, 0.51 to 0.7 was considered poor, 0.71 to 0.8 was considered an acceptable, 0.81 to 0.9 was considered excellent, and greater than 0.9 was considered outstanding[13]. A ROC curve analysis of the severity scores and health problem score was also performed to identify the optimal cut-off value for the judgment of injury or health problem status, using clinical diagnosis as a gold standard.

The sensitivity, specificity, and accuracy with their corresponding 95% CI were calculated. In the present study, the sensitivity was defined as the ability of a questionnaire to detect the injury or health problem status when it was truly present, whereas specificity was the probability of a questionnaire to exclude the injury or health problem status in patients who did not, with clinical diagnosis as a gold standard[14].

Data were prepared and analyzed using PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA). All tests were two-sided and p-value of less than 0.05 was considered to indicate statistical significance.

Results

Participant's characteristics

Sixty-five athletes engaged in the training program for at least three days per week were recruited in the study. After injury surveillance, eight athletes withdrew because of two severe injuries, and six personal reasons. Therefore, 57 athletes finished the 12 weeks of injury surveillance. Participants were more male, 45 (78.9%) and the median age was 20 years (range 18 to 27 years). Of the 57 athletes, 20 (35.1%) were football players, 13 (22.8%) were basketball players, 8 (14.0%) were taekwondo players, and the rest were players of five different sports, which were tennis, athletics, sepak takraw, volleyball, and rowing players, as shown in Table 1. Potential participant's characteristics such as gender, age, body mass index [BMI], and type of sport, were not significantly different between injury and non-injury groups, however, the results are not shown in detail.

Table 1. Participants characteristic data

Variable	Participants (n=57); n (%)
Age (years); mean±SD	20.9±2.1
Median (min-max)	20 (18 to 27)
Sex: male	45 (78.9)
BMI (kg/m^2); mean±SD	21.5±2.6
Median (min-max)	21.2 (17.1 to 29.8)
Type of sport	
Football	20 (35.1)
Basketball	13 (22.8)
Tennis	5 (8.8)
Taekwondo	8 (14.0)
Athletics	4 (7.0)
Rowing	2 (3.5)
Sepak takraw	3 (5.3)
Volleyball	2 (3.5)

BMI=body mass index; SD=standard deviation

Translation and adaptation

There was no problem in the language translation of the questionnaire in both forward and backward translation process. However, all suggestions from the expert committee were taken into consideration and based on that, slight changes were made in this process.

Consistency

The internal consistency (IC) of the OSTRC questionnaire on overuse injury and health problem Thai version (OSTRC-OT and OSTRC-HT) were determined in 57 participant's injury surveillance. The results showed the excellent internal consistency of the three body regions and the health problem scores of the OSTRC-OT and OSTRC-HT. Cronbach's α of the OSTRC questionnaire on overuse injury Thai version such as ankle, knee, and hip regions, was 0.919, 0.973, and 0.976, respectively. While Cronbach's α of the OSTRC questionnaire on health problem Thai version was 0.959.

Cronbach's α coefficient if the item deleted was used to determine the effect on Cronbach's α if any further single item was removed. Cronbach's α value was the change in the acceptable range in both OSTRC-OT and OSTRC-HT. If deleted, no item had a Cronbach's α greater than Cronbach's α of all items except question 1 of health problem, which very slightly larger than 0.959, which indicates that no item disproportionately affected the overall reliability. The results about inter-item correlation, item-total correlations, and effect of removing an item on internal consistency are shown in Table 2.

Reliability

Test-retest reliability in 57 participants was performed using ICC at 2-week intervals. No major intra-individual conflict was seen in the test-retest response on the first and the second completed questionnaires. The OSTRC questionnaire on overuse injury showed magnificent reliability with the ICC for ankle, knee, and hip regions of 0.994 (95% CI 0.989 to 0.996, $p<0.001$), 0.970 (95% CI 0.950 to 0.982, $p<0.001$), and 0.991 (95% CI 0.985 to 0.995, $p<0.001$), respectively. The OSTRC questionnaire on health problem also showed magnificent reliability with the ICC of 0.970 (95% CI 0.950 to 0.982, $p<0.001$).

Validity

From the literature review, it was found that known-groups validity of cross-cultural adaptation of the OSTRC overuse questionnaire and health problems have not been proven. In the present study, Mann-Whitney U test was performed for known-groups validity. The athletes who did not come to visit the clinical team for diagnosis of injury or health problem were excluded from these analyses. The results showed that the OSTRC-OT of the ankle, knee, and hip regions, and the OSTRC-HT scores were high in the group of injury, with the median severity score 26, range 8 to 94, median severity score 26,

Table 2. Inter-item and item-total correlations and effect of removing items on internal consistency

Questionnaire	Inter-item correlation matrix			Item-total correlation	Cronbach's alpha if item deleted
	Question 1	Question 2	Question 3		
Overuse injury					
Ankle					
• Question 1	-			0.829	0.894
• Question 2	0.787	-		0.836	0.893
• Question 3	0.688	0.747	-	0.791	0.905
• Question 4	0.794	0.756	0.765	0.850	0.884
Knee					
• Question 1	-			0.936	0.968
• Question 2	0.891	-		0.949	0.961
• Question 3	0.919	0.973	-	0.956	0.958
• Question 4	0.919	0.893	0.879	0.920	0.971
Hip					
• Question 1	-			0.915	0.975
• Question 2	0.885	-		0.962	0.962
• Question 3	0.885	0.937	-	0.932	0.970
• Question 4	0.909	0.957	0.895	0.952	0.965
Health problem					
• Question 1	-			0.851	0.961
• Question 2	0.805	-		0.924	0.940
• Question 3	0.814	0.935	-	0.922	0.940
• Question 4	0.848	0.880	0.869	0.912	0.945

range 12 to 82, median severity score 26, range 14 to 74 and median severity score 27, range 12 to 88, respectively, as compared to the non-injury group with median severity score 10, range 6 to 20, median severity score 6, range 6 to 14, median severity score 6, range 6 to 18 and median severity score 14, range 14 to 26, respectively. Mann-Whitney U test demonstrated a statistically significant difference in OSTRC-OT for the ankle, knee, and hip regions, and OSTRC-HT severity scores between athletes with injury and non-injury ($p<0.001$, <0.001, 0.001, and 0.002, respectively) (Table 3).

Performance of the questionnaire

The AUC of the OSTRC-OT on ankle, knee, and hip problems was 0.947 (95% CI 0.887 to 1.000, $p<0.001$), 0.989 (95% CI 0.959 to 1.000, $p<0.001$), and 0.973 (95% CI 0.911 to 1.00, $p=0.002$), respectively, while the AUC of the OSTRC-HT was 0.846 (95% CI 0.718 to 0.974, $p=0.002$) as shown in Figure 1.

Table 3. Known-groups validity of OSTRC questionnaire on overuse injury and health problem in Thai version (OSTRC-OT and OSTRC-HT)

Questionnaire score	Injury	Non-injury	p-value
Overuse injury			
Ankle	(n=29)	(n=14)	<0.001**
• Mean±SD	33.8±18.9	11.1±5.7	
• Median (min-max)	26 (8 to 94)	10 (6 to 20)	
Knee	(n=23)	(n=5)	<0.001**
• Mean±SD	35.8±19.2	6.3±4.4	
• Median (min-max)	26 (12 to 82)	6 (6 to 14)	
Hip	(n=15)	(n=5)	0.001**
• Mean±SD	33.5±17.2	10±5.6	
• Median (min-max)	26 (14 to 74)	6 (6 to 18)	
Health problem	(n=35)	(n=8)	0.002**
• Mean±SD	39.1±21.5	18.5±6.2	
• Median (min-max)	27 (12 to 88)	14 (14 to 26)	

SD=standard deviation

** Significant at 0.01 level

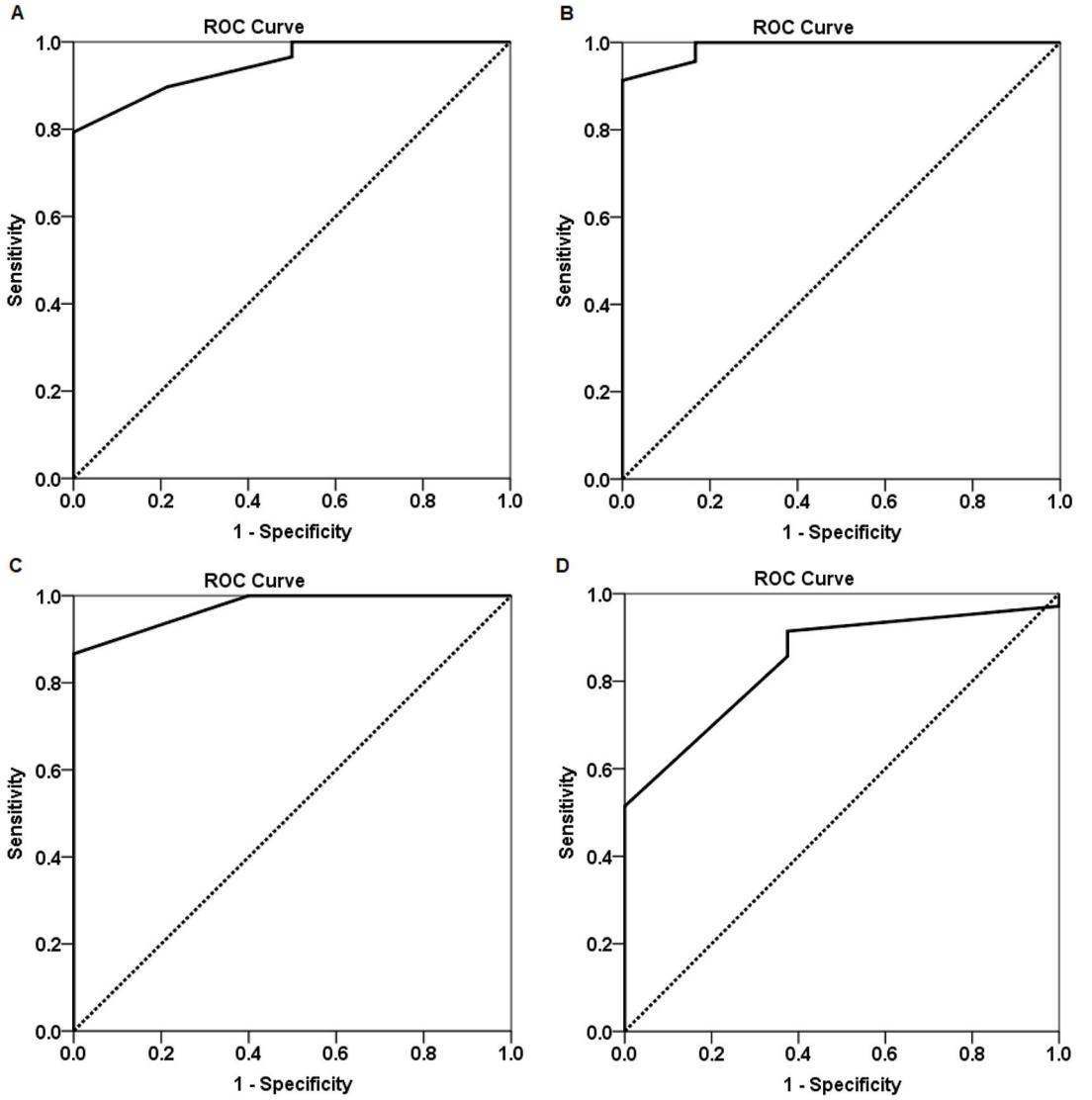

Figure 1. Receiver operating characteristic (ROC) curve and the area under the curve (AUC) for the OSTRC questionnaire on overuse injury: A; ankle problem, B; knee problem, and C; hip problem. D; The ROC curve and the AUC for the OSTRC questionnaire on health problem.

Performance of the OSTRC questionnaire on over-use injury and health problem Thai version for evaluating the cut-off value of the severity score into injury and non-injury groups

Severity scores of OSTRC-OT questionnaires at a cut-off value of 20, the OSTRC-OT had sensitivity on the ankle, knee, and hip paths of 79.3% (95% CI 61.6 to 90.2), 82.6% (95% CI, 62.9 to 93.0), and 86.7% (95% CI 62.1 to 96.3), respectively. The severity scores of OSTRC-OT at a cut-off value of 20 had specificity on ankle, knee, and hip paths of 100.0% (95% CI 78.5% to 100.0%), 100.0% (95% CI 56.6 to 100), and 100% (95% CI 56.6 to 100), respectively. The OSTRC-HT with a cut-off value of severity score at 25 yielded sensitivity of 85.7% (95% CI 70.6 to 93.7). For OSTRC-OT, athletes with injury had severity score greater than 20 significantly greater than in the non-injury group, while for OSTRC-HT, athletes with injury had severity score greater than 25 was significantly greater than those who did not.

Additionally, by using substantial problem criteria of OSTRC-OT for the ankle, knees, and hip paths, the sensitivity of this questionnaire for each path was 27.6% (95% CI 14.7 to 45.7), 34.8% (95%

Table 4. Diagnostic performance of the OSTRC questionnaire on overuse injury and health problem Thai version for evaluating the cut-off value of the severity score into injury and non-injury, or health problem and no health problem groups

Questionnaire	Sensitivity		Specificity		Accuracy		p-value[a]
	No./total	% (95% CI)	No./total	% (95% CI)	No./total	% (95% CI)	
Overuse injury							
Ankle >20	23/29	79.3 (61.6 to 90.2)	14/14	100 (78.5 to 100)	37/43	86.0 (72.7 to 93.4)	<0.001**
Ankle substantial	8/29	27.6 (14.7 to 45.7)	14/14	100 (78.5 to 100)	22/43	51.2 (36.8 to 65.4)	0.039*
Knee >20	19/23	82.6 (62.9 to 93.0)	5/5	100 (56.6 to 100)	24/28	85.7 (68.5 to 94.3)	0.001**
Knee substantial	8/23	34.8 (18.8 to 55.1)	5/5	100 (56.6 to 100)	13/28	46.4 (29.5 to 64.2)	0.281
Hip >20	13/15	86. 7 (62.1 to 96.3)	5/5	100 (56.6 to 100)	18/20	90.0 (69.9 to 97.2)	0.001**
Hip substantial	5/15	33.3 (15.2 to 58.3)	5/5	100 (56.6 to 100)	10/20	50.0 (29.9 to 70.1)	0.266
Health problem >25	30/35	85.7 (70.6 to 93.7)	5/8	62.5 (30.6 to 86.3)	35/43	81.4 (67.4 to 90.3)	0.010**
Health problem substantial	12/35	34.3 (20.8 to 50.8)	8/8	100 (67.6 to 100)	20/43	46.5 (32.5 to 61.1)	0.082

CI=confidence interval

[a] Fisher's exact test or Yates' continuity correction test for comparison of proportions of overuse injury and health problem between athletes with injury and non-injury, * Significant at 0.05 level, ** Significant at 0.01 level

CI 18.8 to 55.1), and 33.3% (95% CI 15.2 to 58.3), while the sensitivity of OSTRC-HT was 34.3% (95% CI 20.8 to 50.8). The specificity of OSTRC-OT questionnaire on the ankle, knee, and hip were 100% (95% CI 78.5 to 100), 100% (95% CI 56.6 to 100), and 100% (95% CI 56.6 to 100) and, the specificity of OSTRC-HT questionnaire was 100% (95% CI 67.6 to 100). The developers found that severity scores based on substantial problem criteria of both OSTRC-OT and OSTRC-HT were not different between athletes with injury and non-injury group except for ankle path (Table 4).

Discussion

The OSTRC questionnaires on overuse injury and health problem Thai language (OSTRC-OT and HT) have the potential to register the injury and health problem validly and reliably. There are two reasons for this.

Firstly, the stability of the OSTRC-OT and HT were evaluated by the test-retest process. As OSTRC-OT and HT had excellent reliability with ICC ranged from 0.936 to 1 and 0.959 to 0.981, respectively. The previous translation and adaptation of the OSTRC questionnaire used a different test interval retest period from 48 to 72 hours to two weeks as recommended by Streiner et al[15]. However, the characteristic of the OSTRC questionnaire assesses injury and health problem condition on a weekly basis[9]. The appropriate time interval for evaluated stability of the OSTRC questionnaire should be within one week. However, the short interval retest must consider the memory effect and recall bias[15]. Secondly, the evidence should prove that the OSTRC questionnaire Thai language could separate athletes who have an injury problem from athletes who did not. Known-groups validity and ROC curve of the OSTRC-OT and HT showed quite an excellent ability to discriminate athletes who have injury or health problems. The OSTRC questionnaire on overuse injury and health problem is a new option for injury registration, especially on overuse injury registration.

From the literature review, there was no report about the criterion validity such as the predictive validity, concurrent validity, and known-groups validity of the OSTRC questionnaire about excessive injuries and health problems[16]. Even so, in the original version, Clarsen et al (2014)[4] has two reasons that prevented direct comparison data between the OSTRC questionnaire on overuse injury registration methods and standard registration method. First, the data from the OSTRC questionnaire on overuse injury registration methods and standard registration method cannot be directly compared because of the difference between the process of data collection and injury definitions. Second, the ways to present injury rate and severity in that each method are different[5]. Nevertheless, in the present study, it is not a direct comparison of the injury surveillance result because the participant who have to meet the physician is a participant who has an overuse or a health problem condition from a questionnaire response. Moreover, the AUC represents the OSTRC questionnaire with outstanding discrimination (AUC above 0.9).

The comparison of screening criteria between substantial problem criteria and an optimal cut-off

value of severity scores at 20 for OSTRC-OT and 25 for OSTRC-HT is used to separate the athletes who have injuries and health problems from those who do not. The developers considered two aspects, sensitivity, and specificity. The present study found that both the substantial problem criteria and an optimal cut-off value of severity scores have an excellent ability to only capture injured or health problem athletes. However, substantial problem criteria had low ability to capture all injuries or health problems on athletes compared with the optimal cut-off value of severity scores. In practice, sports medicine and coach can use the data from the OSTRC questionnaire to manage individual training programs for the athlete.

Limitation

Firstly, due to the limitation of population, the developers did not assess the pre-evaluation assessment for all participants. However, the developers still investigated the injury and health problem within the study period. Secondly, if the athletes reported any physical complain, the developers could not provide immediate medical assessment due to many physical and social barriers.

For known-groups validity, the sample size was limited due to some athletes were unable to come for clinical evaluation, however, the present study still had adequate power (>99%) to detect statistically significant differences in OSTRC-OT and OSTRC-HT severity scores between athletes with injury and non-injury. Additionally, in the present study, all physical complaints that response from athletes were confirmed and classified to have symptoms or no symptoms by the medical team, but if the athletes had a symptom of the physical problem and did not report to the researcher, that data will be lost. However, the researchers had organized an orientation for all participants to realize the importance of injury tracking and the benefit of providing accurate information to prevent data loss due to unresponsive participants suggesting that this procedure was used to reduce selection bias for including athletes in the clinical diagnosis process.

Conclusion

Based on the results of the present study, it was found that the validity and reliability of both questionnaires (OSTRC-OT and OSTRC-HT) were at an excellent level. Moreover, the OSTRC-OT and OSTRC-HT have an excellent ability to separate athletes who have an injury and health problem from those who do not. The optimal cut-off value of the OSTRC-OT for ankle, knee, and hip regions and the OSTRC-HT, which makes the specificity, sensitivity, and accuracy of the level severity scores, were 20 and 25, respectively. The OSTRC-OT and OSTRC-HT provide a useful measure of overuse injury and health problem and is a simple and easily accessible for diagnostic problems encountered in daily practice as well as in research settings.

What is already known on this topic?

There are excellent questionnaires developed to register overuse injuries and health problems in sport, however these questionnaires need to be studied for the Thai environment.

What this study adds?

The Thai version of the OSTRC (OSTRC-OT and OSTRC-HT) have an excellent ability to separate athletes with injury and health problem from those without.

The optimal cut-off values of severity scores of both OSTRC-OT and OSTRC-HT have an excellent ability to capture injuries or health problems in athletes.

Conflicts of interest

The authors declare no conflict of interest.

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