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Cross-Cultural Adaptation and Validation of the Italian Version of the Athletes Disability Index

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SUMMARY

Background. Assessment of the functional disability of patients with LBP is essential in both research and clinical care and can guide treatments and decisions about return to sports activity. Several questionnaires have been developed to measure functional status and levels of disability in patients with LBP, but none of them can provide an effective assessment of disability in athletes regarding their sports and exercise activities. Based on a qualitative study, in 2017 Zamani *et al*. have proposed a new questionnaire entitled "Athletes Disability Index" (ADI) for the evaluation of LBP functional disability of athletes. The measurement properties (construct validity and reliability) have been tested according to COSMIN checklists. The aim of the present study is to translate, culturally adapt and validate the ADI in Italian; verify its validity, reliability and make it usable by various healthcare professionals, especially in the sports field.

Materials and methods. The original English version underwent a translation process based on international guidelines. The internal consistency of the ADI scale was assessed using Cronbach's alpha, while the reliability was assessed by calculating the Intraclass Correlation Coefficient (ICC). The construct validity of the questionnaire was assessed using the Pearson Correlation Coefficient to determine the association between the ADI scale and the Italian version of the Oswestry Disability Index (ODI), by Roland and Morris Disability Questionnaire (RMDQ) and the Visual Analogue Scale (VAS).

Results. Cronbach's (α) was 0.897 and ICC was 0.960. The Pearson Correlation Coefficient showed statistically significant correlations between the ADI and the ODI, the RMDQ and the VAS, with a $p < 0.01$.

Conclusions. The study produced statistically significant results, demonstrating that the Italian version of the ADI is a valid and reliable tool for assessing the level of disability in sports patients suffering from Low Back Pain. An intercultural validity and reliability study is also recommended in other languages.

KEY WORDS

Low back pain; sport; PROMs; rehabilitation; sport physiotherapy.

INTRODUCTION

Low back pain (LBP) is defined as pain localized between the lower margin of the costal arch up to the lower gluteal folds, which may or may not be associated with paresthesias, dysesthesias and strength deficits of the lower limbs (1). Low back pain can present in acute, subacute, and chronic forms. Acute low back pain refers to an episode that persists for less than 6 weeks; subacute low back pain means

a persistent episode between 6 and 12 weeks; and chronic low back pain an episode that persists for 12 weeks or more. Non-specific low back pain means an episode not attributed to a specific, recognizable, and known pathology (infection, tumor, osteoporosis, ankylosing spondylitis, fractures, inflammatory process, radicular syndrome or cauda equina syndrome) (1).

Back pain is a common disorder among athletes, with a prevalence even higher than in the general population (2, 3). The importance of physical activity in the treatment of low back pain is generally accepted. However, it has been suggested that increased physical activity is both a preventive factor and a possible risk factor for low back pain. There is evidence of an association between high physical workloads and back injuries. For example, occupational exposure, strenuous workloads, frequent lifting, bending, and twisting, and extreme sporting activities are well-known risk factors for low back pain (3).

Assessment of the functional disability of patients with LBP is essential in both research and clinical care and can guide treatments and decisions about return to sports activity. Several questionnaires have been developed to measure functional status and levels of disability in patients with LBP such as Oswestry Disability Index (ODI) (4), Roland-Morris Disability Questionnaire (RMDQ) (5), and Quebec Back Pain Disability Scale (QBPDQ) (6). None of these tools can provide an effective assessment of disability in athletes with respect to their sport and exercise activities. To this end, d'Hemecourt *et al.* proposed the Micheli Functional Scale (MFS) for the evaluation of pain and functional capacity in young athletes (14). Based on a qualitative study, Zamani *et al.* (7) have proposed a new questionnaire entitled "Athletes Disability Index" (ADI) for the evaluation of LBP functional disability of athletes (2, 7).

The Athletes Disability Index (ADI) contains 12 questions, each question has 4 possible choices, and each item is rated from 0 to 3 points, higher values indicate a more serious condition. The points obtained for each individual question are added to obtain a final score which can vary from 0, highest functional level and therefore absence of difficulty in the activities listed above to a maximum of 36 points, lowest functional level. Finally, to calculate the athlete's level of disability, which is indicated as a percentage, the total score is divided by 36 and multiplied by 100 (2).

The rating scales were administered remotely, using the Google Forms platform. All participants were sent a single link which included the personal data sheet followed by the scales, respectively we had: the ADI, the ODI, the RMDQ and finally the VAS.

The objective of the present study is to translate, culturally adapt and validate the ADI in Italian. The ADI has not yet been validated in other languages.

METHODS

Authors certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research. All procedures followed were in accordance with the ethical standards of the Responsible Committee on Human Experimentation (Institutional And National) and with the Helsinki Declaration of 1975, as revised in 2008. Informed permitted was obtained from all participants for being included in the study.

Translation and cultural adaptation

Once authorization for translation was requested and consent was obtained from the author, the original version was subjected to a translation process based on the guidelines "Guidelines for the process of cross-cultural adaptation of self-report measures" by Beaton *et al.* (8) and "Principles of good practice for the translation and cultural adaptation process for patient reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation" by Wild *et al.* (9).

The translation process began with the first phase (Forward - Translation), where specific cultural adaptations were not necessary, because the scale itself is extremely simple and conceptually applicable to the population.

Translation was carried out, then the Italian version was translated again into English by two bilingual translators. The original version and the back-translation were compared to verify that there were no discrepancies, resulting in overlap.

Subsequently, three scales were selected to be used as "gold standards" to be administered together with the ADI scale, to have a comparison that demonstrated their effectiveness (ODI, RDQ and VAS). Retest was performed where the scale was administered to a group of patients together with the gold standards. One week after the first administration, a re-administration was proposed to the same patients; from this process it was seen that the items were easily understandable and no particular suggestions for possible modifications emerged.

Study design and eligibility criteria

This is a translation and validation study. After translating and culturally adapting the ADI from the original language to the Italian language, its validity and reliability was tested in professional and amateur athlete patients with LBP.

The study was conducted by a group of physiotherapists from the La Sapienza University of Rome and professionals from the Department of Aerospace Medicine of the Italian Air Force of the Aero-medical Diagnostic, Therapeutic and Rehabilitation Center, between August and October 2021.
Based on standards for the selection of health status measurement was followed checklist instrument (COSMIN), to evaluate the reliability and construct validity of the culturally adapted scale (10, 11).
Patients who met the following inclusion criteria were included in the study: age between 18 and 50 years, patients suffering from Low Back Pain, competitive or amateur athletes, ability to read and write Italian, having given consent to the treatment of sensitive data. Non-athlete patients and patients unable to understand and answer the questionnaire were excluded.

Data collection

The rating scales were administered remotely, using the Google Forms platform. All participants were sent a single link which included the personal data sheet followed by the scales, respectively we had: the ADI, the ODI, the RMDQ and finally the VAS. Each patient gave consent to the processing of sensitive data, before completing the rating scales, in total respect of privacy.
The ADI scale, together with the comparison scales seen previously, was administered to 100 patients, of which 40 also carried out the re-test (**table I**). This means that after a week and in the absence of treatment, 40 patients filled out only and exclusively the ADI again, in order to know its reliability.
The collected data were cataloged in specific tables, using an Excel file, and used to carry out the descriptive and inferential statistical analysis of the sample under study.
The ADI contains 12 questions, each question has 4 possible choices, and each item is rated from 0 to 3 points, higher values indicate a more serious condition. The points obtained for each individual question are added to obtain a final score which can vary from 0, highest functional level and therefore absence of difficulty in the activities listed above to a maximum of 36 points, lowest functional level. Finally, to calculate the athlete's disability level, which is indicated as a percentage, the total score is divided by 36 and multiplied by 100.

Other questionnaires

ODI

The Oswestry Disability Index (ODI) was first published in 1980. This questionnaire evaluates the disability caused by pain or problems at the thoracic and lumbar level of the spine. There have been several reviews over time, the latest produced a questionnaire consisting of 10-point items. The first item investigates the intensity of the pain, the others evaluate how much the pain can affect daily life activities. Each item has a score ranging from 0 (no pain/problem) to 5 (maximum pain/problem). The total score is obtained by adding the scores of the 10 items, then dividing by the maximum total score achievable and finally multiplying by 100%, so as to obtain a percentage scale, the value of which varies from 0% (no disability) to 100% (maximum disability). Only one missing answer is allowed. The questionnaire is completed in approximately 5 minutes, and the final score is calculated in less than 1 minute. The psychometric properties of the original version of the ODI have been tested in a wide variety of clinical conditions, demonstrating a satisfactory degree of internal consistency, reproducibility, and validity (4).

RMDQ

The Roland Morris Disability Questionnaire (RMDQ) is made up of 24 items, which consist of simple statements about daily life, to which the patient can answer: "yes", if the corresponding proposition indicates a situation in which the subject actually reflects himself thinking about his lower back pain; "no", if the proposition does not correspond to your situation; or, the patient may not respond at all, if the proposed sentence describes a situation in which the patient actually reflects himself, but not because of his lower back pain, but rather because of any comorbidities. Each "yes" indicated by the patient constitutes a point, therefore, the final score on the scale has a range from 0 to 24 points: the higher it is, the more it indicates a worse situation.

Table I. Mean and standard deviation of the descriptive characteristics of the population sample.

Descriptive analysis	Age	Weight	Height	BMI
Average	29.47	67.49	171.62	22.79
Std deviation	8.49	11.48	8.81	2.66
Minimum	18	47.0	154	16.52
Maximum	50	92.0	190	30.47

Furthermore, the score is divided as follows by the authors:

- If the "yes" are from 0 to 9: Sub-acute or chronic low back pain with low disability.
- If the "yes" are from 10 to 13: Sub-acute or chronic low back pain with medium disability.
- If the "yes" are from 14 to 24: Sub-acute or chronic low back pain with high disability, management by an expert specialist team.

The RMDQ investigates only and exclusively the patient's current situation and takes approximately 5 minutes to complete (5, 12)

VAS

The Visual Analogue Scale (VAS) is a continuous scale composed of a horizontal (HVAS) or vertical (VAS) line, usually 10 centimeters (100 mm) long, anchored by two verbal descriptors, one for each extreme symptom. For pain intensity, the scale is most commonly anchored at "no pain" (score 0) and "pain as bad as it could be" or "worst pain imaginable" (score 100 [100 mm scale]). The scale is self-administered. The interviewee is asked to place a line perpendicular to the VAS line at the point representing the intensity of the pain. Using a ruler, the score is determined by measuring the distance (mm) on the 10 cm line between the "no pain" anchor and the patient's mark, providing a range of scores from 0 to 100. A higher score indicates greater intensity of pain. This scale takes less than a minute to complete (13).

Statistical analysis

A statistical analysis was performed to evaluate the internal consistency, reliability, and validity of the questionnaire, following the COSMIN checklist.

The internal consistency of the ADI scale was assessed using Cronbach's alpha, which should take on a value between 0.700 and 0.900, so that there is homogeneity between the items within the total scale. Reliability was assessed by calculating the Intraclass Correlation Coefficient (ICC), which, to be statistically significant, must take on a value greater than 0.70. Furthermore, to evaluate the agreement between test and retest, the mean difference and 95% limits of agreement were plotted using the Bland-Altman plot. The construct validity of the questionnaire was assessed using the Pearson Correlation Coefficient to determine the association between the ADI scale and the Italian version of the ODI, the RMDQ and the VAS. The level of significance is given by a P-value less than or equal to 0.05. All statistical analyses were performed using IBM – SPSS version 25.00.

RESULTS

Internal consistency and reliability

Internal consistency was examined through Cronbach's Alpha (α) to verify the homogeneity between the items of the scale. Cronbach's Alpha is 0.897, and as previously mentioned (10, 11), since this value is higher than 0.700, it demonstrates that the ADI scale has excellent internal consistency, and excellent interrelationship between the items. As can be seen from **table II** all items, except the ninth for which Cronbach's alpha does not decrease, are actually relevant to the scale. In fact, if one of them were eliminated, the value of Cronbach's Alpha would tend to decrease, thus reducing the internal consistency of the scale. To evaluate the reliability between tests and re-tests, 40 patients of the 100 included in the study filled out the ADI again after one week only. Test-retest reliability was particularly good with an Intraclass Correlation Coefficient (ICC) of 0.960 (95%CI 0.925-0.979). Also in this case, the value is higher than 0.7, demonstrating excellent stability of the instrument. Furthermore, like the original version of the scale, the ICC was calculated item by item and the range of values assumed by the 12 questions is between 0.73 and 0.96 (**tables III** and **IV**). The Bland-Altman plot of the ADI is presented in **figure 1**. The mean difference in ADI scores between test and re-test is 0.287 (SD 6.12; 95% limits of agreement = -1.6810 to 2.2365).

Validity

To calculate the validity of the ADI, in addition to the latter, the ODI, the RMDQ and the VAS were also administered, comparing their respective total scores. The correlation between the scores of the ADI, ODI, RMDQ and VAS, reported in **table V**, was possible thanks to the calculation of the Pearson Correlation Coefficient. It can be observed that the correlation of the ADI with the ODI is 0.774, with the RMDQ 0.645 and with the VAS 0.738. From this it can be deduced that the ADI has scores that correlate in a statistically significant manner with the ODI, the RMDQ and the VAS, with a $p < 0.01$.

DISCUSSION

The objective of the present study is to create an Italian version of the "Athletes Disability Index" that has good validity and reliability. This study produced an Italian version of the ADI that is linear and consistent with the original English version. The statistical tests carried out demonstrated good reliability and validity of the instru-

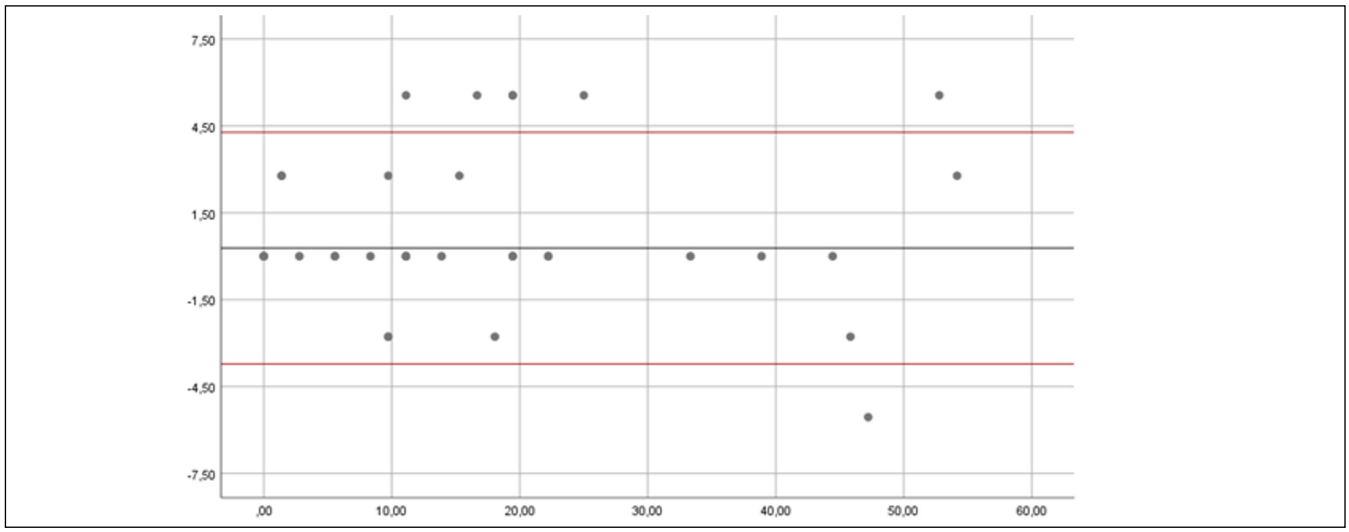


Figure 1. Bland-Altman plot of the ADI for test and re-test scores.
The average of the test and re-test is shown on the x-axis, the difference between test and re-test is shown on the y-axis.

Table II. Internal consistency.

	Cronbach's alpha of the ADI	Average if the item is deleted	Variance if the item is deleted	Correct item-total correlation	Cronbach 's alpha if the item is deleted
	0.89				
Item 1		4.92	21.97	0.78	0.88
Item 2		5.36	25.20	0.60	0.89
Item 3		5.07	23.16	0.65	0.89
Item 4		5.17	23.54	0.75	0.88
Item 5		5.33	24.61	0.64	0.89
Item 6		5.19	25.07	0.58	0.89
Item 7		5.34	24.51	0.51	0.89
Item 8		5.46	24.51	0.66	0.87
Item 9		5.73	27.33	0.45	0.89
Item 10		5.37	24.52	0.64	0.89
Item 11		5.48	24.29	0.72	0.88
Item 12		5.71	26.57	0.51	0.89

ment, thus highlighting the usefulness and validity of the ADI in the evaluation and measurement of disability in athletes suffering from Low Back Pain. Internal consistency was assessed by calculating the value of Cronbach's Alpha, a result equal to 0.897 which is statistically significant as it is higher than 0.7. Furthermore, as reported in **table III**, all the items (except the ninth) are actually relevant: if one of them were eliminated, the value of Cronbach's Alpha would tend to decrease, reducing the internal consistency of the rating scale. Based on what has been said, the Italian version of the ADI demonstrates good internal consistency, presenting a value of α highly comparable with the original version (α = 0.91). Retest reliability was assessed by calculating the Intraclass Correlation Coefficient (ICC) which, as reported in **table IV**, takes a value of 0.960. Furthermore, taking into consideration the original version, the ICC was calculated

Table III. Stability: intraclass correlation coefficient (ICC) between test and retest.

	Correlation between classes	95% Confidence Interval	
		Lower limit	Upper limit
Medium measurements	0.96	0.92	0.98

Table IV. ICC for each item.

Item	ICC (r)	95%CI
1	0.87	0.76-0.93
2	0.73	0.48-0.86
3	0.85	0.71-0.92
4	0.89	0.79-0.94
5	0.94	0.89-0.97
6	0.92	0.85-0.96
7	0.77	0.56-0.88
8	0.94	0.89-0.97
9	0.89	0.79-0.94
10	0.85	0.72-0.92
11	0.85	0.72-0.92
12	0.96	0.93-0.98

Table V. Validity: Pearson correlation coefficient between the ADI, the ODI, the RDQ and the VAS.

Pearson correlation	ADI	ODI	RMDQ	VAS
ADI	1	0.77	0.65	0.74
ODI	0.77	1	0.67	0.63
RDQ	0.65	0.67	1	0.65
VAS	0.7	0.63	0.65	1

item by item assuming a minimum value of 0.73 and a maximum value of 0.96. These values appear to be highly comparable with the data of the original version (ICC between 0.74 and 0.94). Taking into consideration the ICC values, it is possible to say that the Italian version of the ADI has excellent stability, and this indicates that after repeated measurements, the instrument offers comparable results. Construct validity was assessed by comparing the scores of the ADI with those of the ODI, RDQ and VAS, calculating the Pearson Correlation Coefficient. All correlations were statistically significant with a $p < 0.01$; from this, we deduce that the Athletes Disability Index correlates well with Oswestry Disability Index, the Roland-Morris Disability Questionnaire and with the SEA. However, as noted in the original version (2), the ODI and RDQ questionnaires classify the majority of study subjects in the minimal disability level. This is most likely the result of their concentration on less daily activities. intense. The ADI, on the other hand, evaluates sporting activity in addition to less physically demanding daily life activities, therefore demonstrating a broader categorization of the subject's disability levels, ranging from mild to very high disability. None of the existing LBP disability questionnaires assess sport-related activities such as stretching exercises, resistance exercises, technical skills, and change of direction.

CONCLUSIONS

The study produced statistically significant results, demonstrating that the Italian version of the ADI has excellent psychometric properties, and this makes it a valid and reliable tool for assessing the level of disability in sports patients suffering from Low Back Pain. The questionnaire proved to be short, easy to understand and administer, representing a useful tool both in research and clinical practice, being able to guide treatments and decisions about returning to sporting activity. Compared with available LBP disability questionnaires, the ADI can better examine the disability of athletes with low back pain, who have difficulty in sports and exercise, because LBP disability questionnaires were developed for the general population and are not able to accurately assess levels of disability in athletes with LBP. Therefore, when disability in sports and exercise activities is significant ADI may be more beneficial.

FUNDINGS

None.

DATA AVAILABILITY

Data are available under reasonable request to the corresponding author.

CONTRIBUTIONS

AO, FM: conceptualization, data curation, formal analysis, writing – original draft. FM: formal analysis. FC, AM, CV, FS: writing – review & editing.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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