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ORIGINAL ARTICLE

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Adaptation of the Bath Ankylosing Spondylitis Functional Index to the Turkish population, its reliability and validity: functional assessment in AS

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Abstract The aim of this study was to adapt the Bath Ankylosing Spondylitis Functional Index (BASFI) to the Turkish population and investigate the reliability and the validity of the Turkish version. Seventy-six patients with ankylosing spondylitis (AS) were included in the study. The functional status of the patients was assessed by using the adapted Turkish version of the BASFI twice, at recruitment and 24 h later. For validity analysis, patients were also assessed by the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) evaluating disease activity, the Bath Ankylosing Spondylitis Global Score (BAS-G) indicating effect of the disease on patient's well-being, physician's assessment of the disease activity and pain intensity. Spinal mobility was assessed by the Bath Ankylosing Spondylitis Metrology Index (BASMI). Erythrocyte sedimentation rate (ESR) and serum C-reactive protein (CRP) levels of the patients were also recorded. The lumbar region and the sacroiliac joints were assessed by Stoke Ankylosing Spondylitis Spine Score (SASSS) and the hip joints were assessed by Bath Ankylosing Spondylitis Radiology Index hip (BASRI-h). The internal consistency was 0.89 (Cronbach's alpha), which showed a high reliability for the Turkish version of the BASFI. Test-retest reliability was good, with a high intraclass correlation coefficient between the two time points (ICC = 0.93). Significant correlations were detected between the BASFI and the BASDAI, BAS-G, doctor's global assessment, and general pain intensity ($r = 0.62$, $p < 0.001$; $r = 0.47$, $p < 0.001$; $r = 0.55$, $p < 0.001$; $r = 0.47$, $p < 0.001$, respectively). The adaptation of the BASFI to the Turkish population was successful and it was found to be reliable and valid among Turkish patients. Thus, studies using the Turkish BASFI can be compared with international studies.

Keywords Adaptation · Ankylosing spondylitis · Functional index · Reliability · Validity

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Introduction

Ankylosing spondylitis (AS) is a chronic and progressive disease and unfortunately there are no definite measures to evaluate the outcome. Changes in clinical, laboratory, and radiological findings between visits do not in general correlate with the improvements or deteriorations [1, 2, 3]. Clinical findings may yield some information, but a consensus on what type of measurements should be used and how much they reflect the patient's status is not established. Laboratory findings are proven to be uncorrelated with the status of the patient. Radiological findings are important in terms of the long-term outcome, but are not correlated with rapid disease progress. Even if frequent X-rays were useful in evaluating the progress of the disease, the excessive cost and potential health hazards outweigh the benefits [1]. The lack of clear-cut measures in evaluating the status of the patient makes it difficult to assess the effectiveness of all treatment modalities. To tackle this problem, the Assessment in Ankylosing Spondylitis (ASAS) [4] group, a group of experts dealing with AS, has recommended a core set to be used in clinical trials involving patients with AS. Here, the level of functional impairment has been proposed to

be one of the main items to be evaluated. Ideally, the level of functional impairment should be measured using a method that is simple, reproducible, specific to the disease, and sensitive to changes.

Currently, the methods used for assessing the functional status in patients with AS are the Bath Ankylosing Spondylitis Functional Index (BASFI) [5], Dougados Functional Index (DFI) [6], Health Assessment Questionnaire for Spondyloarthropathy (HAQ-S) [7], and the Revised Leeds Disability Questionnaire (RLDQ) [8].

To our knowledge, none of these indices had so far been adapted to and evaluated in the Turkish population. This study aimed to adapt the BASFI, chosen for its reported superiority over the other indices [5, 9, 10, 11], to the Turkish population and evaluate its reliability and validity for this population.

Materials and methods

Methods

The BASFI was adapted to the Turkish population using recent guidelines for cross-cultural adaptation [12]. The index was at first translated from English to Turkish by each author and then merged in group discussion. In addition, an independent translation was solicited from a native English-speaking language specialist. Next the authors compared this translation with their own and found the two texts to be semantically very similar, requiring just a few minor modifications in the authors' original translation. As a final verification, the resulting Turkish text was translated back to English by a native English-speaking language specialist, and compared with the original English text, convincing the authors that the adaptation to Turkish was adequate.

Patients

The Turkish version of the BASFI (please see the Appendix) was tested on 76 consecutive patients who were admitted to our hospital and diagnosed with AS using the European Spondyloarthropathy Study Group (ESSG) criteria [13]; all of the patients fulfilled the modified New York criteria [14]. Demographic and disease history information for each patient was obtained using a questionnaire upon recruitment.

Assessments

The functional status of the patients was assessed using the Turkish version of the BASFI [5]. The BASFI consists of eight questions relating to the functional anatomy of the patients and two additional questions that assess the patients' ability to cope with everyday life. Each question is answered on a 10-cm horizontal visual analogue scale (VAS). The VAS has no distinguishing marks, the only guidelines being the words "easy" and "impossible" at either end of the line to indicate the direction of severity. The mean of the 10 scales gives the total BASFI score (0–10). To assess reproducibility, the BASFI was completed again 24 h later, at about the same time of the day.

Patients additionally were assessed by more global tests: the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [15] evaluating disease activity, the Bath Ankylosing Spondylitis Global Score (BAS-G) [16] indicating effect of the disease on patient's well-being, and physician assessment of the disease activity and pain intensity. In these global indices, 100-mm horizontal VAS were used ranging from "none" to "very severe" (0–100). The Turkish version of the BASDAI has been adapted and found to be valid and reliable for the Turkish population [17].

Spinal mobility was assessed by the Bath Ankylosing Spondylitis Metrology Index (BASMI) measurements [18]. The BASMI consists of five measurements evaluating the mobility in the cervical, thoracic, and lumbar region. The measurements included the degree of cervical rotation, wall to tragus distance, lumbar side flexion, lumbar flexion, and intermalleolar distance. Each of the measurements was scored between 0 and 2 (0 = mild disease, 1 = moderate disease, and 2 = severe disease) and at the end, a total BASMI score was calculated (0–10). Erythrocyte sedimentation rate (ESR) and serum C-reactive protein (CRP) levels of the patients were also recorded.

Lateral lumbosacral and an anteroposterior pelvis radiographs of the patients were assessed and given a consensus score by the authors. The lateral view of the region between T12-S1 and the sacroiliac joints were assessed by Stoke Ankylosing Spondylitis Spine Score (SASSS) [19], and the hip joints were assessed by Bath Ankylosing Spondylitis Radiology Index hip (BASRI-h) [20]. In the assessment of the spine, SASSS was preferred instead of BASRI because of less X-ray exposure.

Statistics

Reliability of the Turkish version of the BASFI was tested by internal consistency and test-retest reliability. Internal consistency of the instrument was given as Cronbach's alpha [21]. Test-retest reliability was assessed by intraclass correlation coefficient [22]. Difference between two time points was evaluated by Wilcoxon's signed ranks test. External construct validity was determined by testing for expected associations between the adapted instrument and other valid measures through the process of convergent construct validity [23] and association between instruments was calculated by using Spearman's correlation coefficient. The agreement between BASFI scores at

two time points was assessed by using the Bland and Altman approach [24].

Results

Characteristics of the patients

The mean age of the patients was 40.4 years (SD 9.1) and 64 (84.2%) of them were male. The demographic and clinical data of the patients are presented in Table 1.

In the radiological assessment of the lumbar region by SASSS, the scores ranged between 13 and 72. In 48 (63.2%) patients, the score was less than or equal to 30, in 22 (28.9%) patients between 31 and 48, and in 6 (7.9%) more than 48. There was mild to severe hip involvement in all of the patients except 2 (2.6%) patients. Hip score was 1 in 17 (22.4%) patients, 2 in 19 (25.0%), 3 in 18 (23.7%), and 4 in 20 (26.3%) patients.

The patients completed the Turkish version of the BASFI in a very short time and informed us of no difficulty in understanding and completing the questionnaire.

Reliability

The internal consistency of the Turkish version of the BASFI was good at both day 1 and day 2, with Cronbach's alpha value of 0.89 and 0.92, respectively. Test-retest reliability was also good, with a high intraclass correlation coefficient (ICC) between the two time points (ICC = 0.93). The median BASFI scores for 76 patients on two occasions were 3.05 (range: 0.04–7.90) and 3.39 (range: 0.14–8.39), respectively, and the total BASFI scores did not show any difference on two occasions ($p = 0.74$). The test-retest reliability of the individual items is presented in Table 2.

Validity

The distribution of the total BASFI score is presented in Fig. 1. Approximately 80% of the scale was used by the patients. The correlation between the total BASFI and the single BASFI items varied between $r = 0.53$ and $r = 0.78$; the weakest correlations were detected for the items climbing 12–15 steps ($r = 0.53$, $p < 0.001$) and standing unsupported ($r = 0.59$, $p < 0.001$). The correlations between the single items varied between $r = 0.18$, $p = 0.12$ and $r = 0.71$, $p < 0.001$.

Significant correlations were detected between the BASFI and the BASDAI, BAS-G, doctor's global assessment, and general pain intensity ($r = 0.62$, $p < 0.001$; $r = 0.47$, $p < 0.001$; $r = 0.55$, $p < 0.001$; $r = 0.47$, $p < 0.001$, respectively). Although the BASFI showed weak negative correlation with the measurements of lumbar flexion ($r = -0.38$, $p = 0.001$) and weak positive correlation with cervical rotation ($r = 0.28$, $p = 0.013$), there was a moderate correlation between the total BASMI score and the BASFI ($r = 0.43$, $p < 0.001$).

The index weakly correlated with the morning stiffness, ESR, CRP, and the radiological assessments. The correlation coefficient between the BASFI and BASRI-h was $r = 0.30$, $p = 0.009$, and the sacroiliac joint assessment with SASSS $r = 0.27$, $p = 0.020$. No significant correlation was observed between the functional index and the assessment of lateral lumbar radiographs with SASSS ($r = 0.05$, $p = 0.65$). The correlations of the BASFI with clinical and laboratory assessments are presented in Table 3. The BASFI did not correlated with either the age or the disease duration of the patients. For total BASFI scores, a 95% range of agreement was −1.6 and 1.6. Of the 76 patients, 72 were within the 95% limits of agreement and the differences were not related

Table 1 Demographic and clinical data of 76 patients. *SD* standard deviation, *min* minimum, *max* maximum

Variable		Mean ± SD	Median (min–max)
Age (years)		40.4 ± 9.1	40 (22–67)
Sex			
Male	*n* (%)	64 (84.2)	
Female	*n* (%)	12 (15.8)	
Education			
Basic	*n* (%)	27 (35.5)	
Advanced	*n* (%)	24 (31.6)	
University	*n* (%)	25 (32.9)	
Duration (years)		10.3 ± 6.8	10 (0.1–25)
Morning stiffness (min)		28.9 ± 40.1	10 (0–180)
Pain intensity (cm)		3.5 ± 2.0	3.5 (0–10)
Cervical rotation			
Right (°)		45.4 ± 19.6	45 (0–90)
Left (°)		46.0 ± 18.3	45 (0–90)
Tragus-wall distance (cm)		15.1 ± 5.7	14 (6–30)
Lumbar flexion (cm)		17.6 ± 2.1	17 (14–25)
Intermalleolar distance (cm)		86.8 ± 22.0	93.5 (23–118)
BASMI total score		5.3 ± 1.3	5 (2–9)
ESR (mm/h)		33.3 ± 24.3	30 (2–115)
CRP (mg/l)		21.9 ± 23.6	12.5 (1–135)

Table 2 Intraclass correlation coefficients of the items at two occasions within 24 h. *ICC* intraclass correlation coefficient, *CI* confidence interval

	ICC (95% CI)	*p*
Putting on socks	0.91 (0.86–0.94)	< 0.001
Bending forward	0.76 (0.65–0.84)	< 0.001
Reaching up	0.82 (0.73–0.88)	< 0.001
Getting out of the chair	0.78 (0.67–0.85)	< 0.001
Getting up off the floor	0.87 (0.80–0.91)	< 0.001
Standing unsupported	0.81 (0.72–0.88)	< 0.001
Climbing 12–15 steps	0.83 (0.74–0.89)	< 0.001
Looking over shoulder	0.83 (0.74–0.89)	< 0.001
Demanding activities	0.84 (0.76–0.89)	< 0.001
A full day's activities	0.80 (0.70–0.87)	< 0.001
Total score BASFI	0.93 (0.90–0.96)	< 0.001

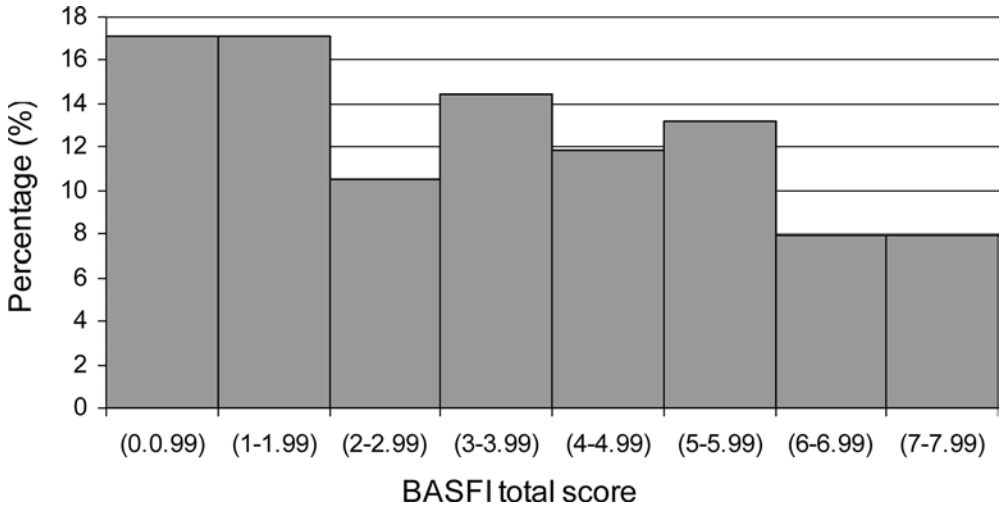

Fig. 1 The distribution of the total BASFI scores

Table 3 Spearman's correlation coefficient between BASFI and clinical, laboratory, and radiological assessments

	BASFI total score	
	r	*p*
BASDAI	0.62	< 0.001
BAS-G	0.47	< 0.001
BASMI	0.43	< 0.001
Morning stiffness	0.27	0.018
Pain intensity	0.47	< 0.001
ESR	0.24	0.034
CRP	0.26	0.020
Doctor's assessment	0.55	< 0.001
BASRI-h	0.30	0.009
SASSS (lumbar region)	0.05	0.65
SASSS (sacroiliac joint)	0.27	0.02

to the BASFI scores (Fig. 2). In conclusion, the agreement between BASFI scores at two time points was acceptable.

Discussion

Ankylosing spondylitis limits the mobility of the spine and other joints and leads to increasing functional impairment. The level of functional impairment is accepted as an important outcome parameter besides clinical measurements, laboratory and radiological changes, which were found to be insufficient to monitor the patients with AS [4]. Physical function can be quantified by using self-administered questionnaires and indices. The use of many functional indices both for clinical assessment and trials has been increasing in re-

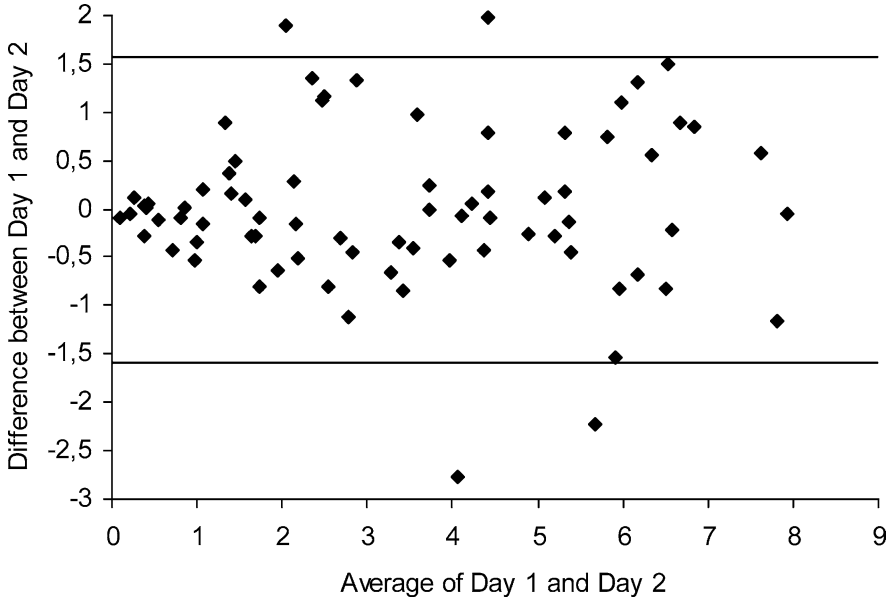

Fig. 2 Bland and Altman plot

cent years. These indices must be tested in several countries to be sure that cultural or language differences do not interfere with results of the assessments so that the trials in which these indices are used can be easily compared. Here, in this study the BASFI was chosen to be tested and the results of this study, so far, indicate that the Turkish BASFI has satisfactory reliability and validity and can be used in Turkish patients with AS.

The original BASFI was proved to be valid and reliable among English patients [5]. Furthermore, it was found to be reliable and valid in Swedish [2], Finnish [11], and German patient populations [25] as well. The Turkish version showed a good reliability with Cronbach's alpha coefficient of 0.89 and test-retest reliability was also proved to be good over 24 h for the BASFI total and individual items.

The distribution of the BASFI total score ranged between 0.04 and 7.90 indicating that 79% of the Turkish BASFI scale was used, compared to 83% in the Swedish version [2] and 95% in the English version [5]; and the median of the total BASFI score was a low value as was the case in the other two studies [2, 11]. Our study group mainly consisted of outpatients by chance, who are supposed to be in better functional status. This may be the reason for the low median score observed in our patient group. To evaluate the consistency between what the patients can really do and the patients' perception of their functional level was not within the context of this study so patients were not observed or assessed in order to determine their functional abilities.

The correlation between the total BASFI and the single BASFI items varied between 0.53 and 0.78, and the weakest correlations were between the total score and the items about climbing 12–15 steps and standing unsupported. In the Swedish study [2], there was also a weak correlation between BASFI total score and the item about standing unsupported. Cronstedt et al. suggested that this may indicate somewhat poor internal consistency. In fact, in our study, statistical analysis yielded good internal consistency of the single items. In this study group, hip involvement was surprisingly high. Thus, this may affect the ratings of items about climbing steps and standing unsupported, but may not affect the total score unless there is severe involvement.

Indeed, disease activity may affect the functional status of the patient. Also, the relation between the functional status and the patients' self-assessments was also emphasized in other studies [10, 18]. Thus, the moderate correlations observed between the BASFI and the BASDAI, pain intensity, and BAS-G in this study further strengthen the validity of the index. Similar relations were observed in other studies as well [26, 27].

In our study, the functional index did not correlate with the age of the patients. This was similar in the Finnish study [11]; they estimated that aging was not the basic concern in a disease-specific functional index.

The BASFI showed a moderate correlation with the BASMI. It was not surprising since the clinical measurements do not reflect the functional status exactly in patients with AS. The same result was also observed in Cronstedt et al.'s study [2]. They suggested that it did not indicate a poor validity, but indicated the need for different type of measures in patients with AS. On the contrary, the BASFI correlated well with the clinical measurements in the Finnish study [11]. Although clinical measurements are useful in clinical trials in AS, it should not be forgotten that measurements are sometimes insensitive and there may be interrater differences [3]. Moreover, the changes in the clinical measurements have little effect on the overall functioning of the patient with AS. Similarly, weak correlations were found between the Turkish BASFI and ESR, CRP levels, and radiological changes. It is related to the fact that laboratory parameters and radiological changes have little immediate effect on the functional status.

Sensitivity to change is a very important property for a functional index. To evaluate the sensitivity to change was not within the context, which may be a limitation of the study. Calin et al. proved the BASFI to be sensitive to detect the functional improvement in the patients with AS after 3 weeks of physiotherapy and showed its sensitivity to change [5].

In conclusion, the adaptation of the BASFI to the Turkish population was successful and it was found to be reliable and valid among Turkish patients. Since functional evaluation is essential for the patients with AS, the Turkish BASFI can be used in either monitoring the patients or in clinical trials in the Turkish population so that the results may be compared with other international studies as well.

Take home message

The Turkish BASFI was found to be reliable and valid among Turkish patients and it can be used both for research purposes and in clinical practice so that the data can be compared with those of patients from other countries.

Appendix : **BASFİ**

Geçen hafta boyunca aşağıda belirtilen işleri yaparken ne derece zorlandığınızı çizgi üzerinde işaretleyiniz.

Çizgi işi yapmaktaki zorluk derecesini göstermektedir. Belirtilen işi kolaylıkla yapabiliyorsanız çizginin başını, hiç yapamıyorsanız çizginin sonunu işaretleyiniz. İşi yaparkenki zorlanma derecesine göre çizgi üzerindeki uygun noktayı işaretleyiniz. Bir işi yaparken yardımcı cihaz kullanıyorsanız 'yardımla' yapıyorsunuz demektir.

1)Yardımsız çorap giymek

kolaylıkla yapıyorum yapamıyorum

2) Belinizden öne eğilerek yerden kalemi yardımsız almak

kolaylıkla yapıyorum yapamıyorum

3)Yardımsız yüksek bir rafa uzanmak

kolaylıkla yapıyorum yapamıyorum

4) Kolluksuz bir sandalyeden tutunmadan kalkmak

kolaylıkla yapıyorum yapamıyorum

5) Sırtüstü yatarken yardım almadan yerden kalkmak

kolaylıkla yapıyorum yapamıyorum

6) Rahatsızlık duymadan 10 dakika süreyle desteksiz ayakta durmak

kolaylıkla yapıyorum yapamıyorum

7) Tutunmadan veya yardımcı cihaz (baston gibi) kullanmadan 12-15 basamak (1 kat) çıkmak (her basamağı tek adımla çıkmak)

kolaylıkla yapıyorum yapamıyorum

8) Gövdenizi çevirmeden omuzunuzdan geriye bakmak

kolaylıkla yapıyorum yapamıyorum

9) Bedenen çalışmak (egzersiz, spor, ev işleri,bahçe işleri yapmak gibi.)

kolaylıkla yapıyorum yapamıyorum

10) Evde veya işte günlük işlerin tamamını yapmak

kolaylıkla yapıyorum yapamıyorum

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