Clin Rheumatol (2010) 29:781–788
DOI 10.1007/s10067-010-1431-5

BRIEF REPORT

# Psychometric evaluation of the Moroccan version of the Bath Ankylosing Spondylitis Functional Index (BASFI) and Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) for use in patients with ankylosing spondylitis

**Samira Rostom · Karima Benbouaaza · Bouchra Amine · Rachid Bahiri · Yousra Ibn Yacoub · Sanae Ali Ou Alla · Redouane Abouqal · Najia Hajjaj-Hassouni**

Received: 12 June 2009 / Revised: 14 December 2009 / Accepted: 10 March 2010 / Published online: 10 April 2010


**Abstract** The objectives of this study are to translate, adapt in the Moroccan cultural context, and validate in patients with ankylosing spondylitis (AS) the Bath Ankylosing Spondylitis Functional Index (BASFI) and Bath Ankylosing Spondylitis Disease Activity Index (BASDAI). The cross-cultural adaptation of the BASFI and BASDAI was obtained in accordance with the guidelines for translation of the health status measures. Eighty-five patients with AS were included in the study. The test–retest reliability and the internal consistency were analyzed, and both questionnaires were assessed for external construct validity. Structural validity was analyzed with correlation matrix. Twenty-four-hour test–retest reliability was good: BASFI intraclass correlation coefficient (ICC)=0.96 (confidence interval (CI) at 95%, 0.93–0.97), BASDAI ICC=0.93 (CI at 95%, 0.90–0.95). Cronbach's alpha was 0.90 for the BASFI and 0.86 for BASDAI. The construct validity of the instruments was evaluated. The BASFI showed a strong validity when correlating its results with Schober's test ($r$=−0.56), occipital wall distance ($r$=0.46), chest expansion ($r$=−0.46), BASDAI ($r$=0.54), Bath Ankylosing Spondylitis Metrology Index ($r$=0.70), Bath Ankylosing Spondylitis Global Score (BAS-G; $r$=0.58), Bath Ankylosing Spondylitis Radiology Index ($r$=0.61), and the radiological changes in sacroiliac joints ($r$=0.54). A good correlation was observed between the BASDAI and the spinal pain ($r$=0.53), the number of nocturnal awakenings ($r$=0.57), the morning stiffness ($r$=0.65), the enthesic index ($r$=0.47), the BAS-G ($r$=0.53), the BASFI ($r$=0.54), and the erythrocyte sedimentation rate ($r$=0.41; for all $p$<0.001). The correlation matrix showed an intermediate correlation between items. The Moroccan version of the BASFI and the BASDAI showed adequate reliability and validity. These instruments can be used in the clinical evaluation of Moroccan and Arabic-speaking patients with AS.

**Keywords** Ankylosing spondylitis · Disease activity · Functional index · Moroccan version · the Bath Ankylosing Spondylitis Disease Activity Index · the Bath Ankylosing Spondylitis Functional Index

S. Rostom (✉) · K. Benbouaaza · B. Amine · R. Bahiri · Y. Ibn Yacoub · S. Ali Ou Alla · N. Hajjaj-Hassouni
Department of Rheumatology, El Ayachi hospital, University Hospital,
11000 Sale, Morocco
e-mail: rostomsamira2003@yahoo.fr

R. Abouqal
Laboratory of Biostatistics, Clinical Research and Epidemiology, Faculty of Medicine and Pharmacy,
Rabat, Morocco

## Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease that can lead to a functional disability and deterioration of quality of life. The assessment of AS in different settings for disease control, symptom modification, and clinical record keeping is currently done through endpoints emphasizing disease activity and function. Currently, there are three instruments that are reliable, valid, and sensitive to change that have been recommended by the AS Assessment (ASAS) Working Group to measure such domains. Of these, the Bath Ankylosing Disease Activity Index (BASDAI) measures disease activity while the two others, the Bath Ankylosing Spondylitis Functional Index (BASFI) and the Dougados Functional Index, measure functioning [1–3]. They have been selected by

ASAS in the international consensus for the use and evaluation of efficacy of anti-tumor necrosis factor alpha [4]. For clinical use, self-report of health by patients needs cultural adaptation. Therefore, these instruments were translated into many languages and cultures. Thus, it was necessary to adapt these indices to the Moroccan linguistic and cultural context. The use of the same instrument has the advantage of allowing comparison between international trials in different countries. The aim of this study was to develop the Moroccan version of the BASFI and the BASDAI and to evaluate their validity and reliability.

## Patients and methods

A prospective study was conducted from June 2007 to December 2008. The outpatients who fulfilled the modified New York criteria were included. They all were Moroccan; they spoke Moroccan Arabic, as their first language, dialectal Arabic. They gave their agreement to participate in the study. The study protocol was approved by the local ethics committee. Two visits, with at least 24-h to 1-week test–retest, were done for each patient. No modification of the treatment was authorized between the two visits.

The criteria of exclusion were an age lower than 18 years or the presence of severe comorbidity.

The social demographic data (age, sex, educational level, …) as well as clinical, biological, and radiological data relating to the AS (spinal pain and stiffness, number of nocturnal awakenings, number of painful and swollen joints, total enthesitis count, morning stiffness, erythrocyte sedimentation rate (ESR), radiological changes in the sacroiliac joints) were collected for each patient. During the first visit, we also evaluated the following parameters for each patient:

BAS-G [4] Bath Ankylosing Spondylitis Global Score
BASMI [5] Bath Ankylosing Spondylitis Metrology Index
BASRI [6] Bath Ankylosing Spondylitis Radiology Index

### Original questionnaires

The BASFI is a quick, simple, relevant, and sensitive to change questionnaire. It is comprised of ten items [2]. Each item is graduated from 0 to 10 (0=easy, 10=impossible). The first eight items reflect activity relating to the functional ability of patients, and the two additional questions assess the patient's ability to cope with everyday life.

The BASDAI is a six-item self-administered questionnaire that measures symptoms such as fatigue, spinal pain, pain, and/or swelling of the peripheral joints, localized tenderness, and morning stiffness during the last week [3]. Questions are presented in the form: "how would you describe the overall level of…." It also measures the severity and duration of stiffness (0 to 2 h or more). The first five items are answered on 0–100-mm visual analog scales (VAS) with "none" anchored at one extreme and "very severe" at the other.

### Translation–adaptation

The Moroccan version of these instruments was obtained, in accordance with the guidelines for this process, in order to preserve equivalence between the original and the target version [2, 7–10]. The translation of BASFI and BASDAI was made in several steps: First, BASDAI and BASFI were translated into Moroccan language separately by two bilingual Moroccan teachers of English (translation $T_1$ and translation $T_2$). They were made aware of the objectives underling the material to be translated to obtain a better idiomatic and conceptual translation rather than simple literal equivalence. They produced a $T_{1-2}$ version which was back translated by two groups of bilingual back translators (back translation $BT_1$ and $BT_2$). They produced a $BT_{1-2}$ version. All the translations were compared during a meeting. The multidisciplinary committee of experts was made up of a sociologist, an expert in linguistics, the translators, the back translators, a monolingual, and two rheumatologists. It produced the pre-final version, which was submitted into the pretest.

### Acceptability

The acceptability of the questionnaire was tested by analyzing the percentage of refusals, the missing data, percentage of discordances, and the items which were difficult to understand.

### Psychometric properties and statistical analysis

#### *Construct validity*

Structural validity was tested by the study of the correlation matrix which represented the correlation between different items. It was a strong correlation if $r$ was higher than 0.60; moderate correlation if $r$ was between 0.30 and 0.60; small correlation if $r$ was lower than 0.30 [11, 12]. The correlation was obtained with Spearman's coefficient.

For assessing external construct validity, the BASFI was compared with clinical, biological, and radiological variables that can evaluate functional status [2, 7, 8]. The correlation between these parameters was given as Spearman's correlation coefficient ($r$); the values of this coefficient were

interpreted in the following way: Excellent correlation if $r$ was equal to or higher than 0.91, good correlation if $r$ was between 0.90 and 0.71, moderate correlation if $r$ was between 0.70 and 0.51, poor correlation if $r$ was between 0.50 and 0.31, and small or absent correlation if $r$ was lower or equal to 0.30 [11–13].

*Reliability*

Reliability was analyzed by internal consistency and reproducibility. The internal consistency was appreciated by Cronbach's coefficient alpha. The more it is approximate to 1, the better it is. A high value of this coefficient (≥0.70) was usually regarded as satisfactory [13, 14]. Reproducibility test–retest was appreciated by intraclass correlation coefficient (ICC). The ICC is a quantitative test. A value higher than 0.80 is usually regarded as satisfactory [13].

Statistical analysis was carried out using the SPSS for windows version 13 (SPSS, Chicago, IL, USA).

## Results

Patients' characteristics

Eighty-five Moroccan patients suffering from AS were recruited. Sixty-two men (73%) and twenty-three women were included, with a mean age of 35.5 years. The duration of their illness was variable, ranging between 2 and 26 years. A severe form of AS was noted (hip disease in 54% with functional disability (BASFI>4) in 58.8%. An active form was noted in 63.5% cases [BASDAI>4] (Table 1).

Final version of the Moroccan BASFI and BASDAI

Globally, the cross-cultural adaptation of the BASFI did not present any difficulties during the translation process. However, some modifications were necessary to adapt to the Moroccan cultural context:

The examples "sock aid" and "helping hand" from items 1 and 3 were deleted from the Moroccan version because these instruments were neither known nor used by the majority of the Moroccan patients. Figure 1 represents the final version of the BASFI.

The cross-cultural adaptation of the BASDAI did not lead to any difficulties during the translation process. No items were modified or simplified. The Moroccan Arabic version of the BASDAI is represented in Fig. 2.

Acceptability

Acceptability, evaluated by the rate of response, was 100%. All items were comprehensible, and no missing data were noted.

**Table 1** Demographic and clinical data for 85 patients with AS

| Parameters | *n* (%) | Mean±SD | Extremes |
|---|---|---|---|
| *N* of patients | 85 | | |
| Male | 62 (73) | – | – |
| Female | 23 (27) | – | – |
| Mean age in years (range) | – | 35.5±10 | 19–64 |
| Mean disease duration in years (range) | – | 10.5±12 | 2–26 |
| Education level | | | |
| Illiterate | 16 (18.8) | – | – |
| Primary | 19 (22.3) | – | – |
| High school | 38 (44.7) | – | – |
| University | 12 (14.1) | – | – |
| Hip disease | 46 (54) | – | – |
| Total prosthesis of hip | 11(13) | – | – |
| Erythrocyte sedimentation rate (mm/h) | 34–35 | 2–110 | |
| OWD | – | 10±20 | 0–43 |
| Schober's test (cm) | – | 12.2±2 | 10–15 |
| Chest expansion (cm) | – | 3.2±2.5 | 0–5 |
| Finger to floor distance (cm) | – | 22.3±39 | 0–78 |
| BASFI>4 | 50 (58.8) | – | – |
| BASDAI>4 | 54 (36.5) | – | – |

*N* number of patients, *n* number of cases, *OWD* occiput–wall distance


**Fig. 1** Moroccan Arabic version of BASFI

## Psychometric properties

### *Structural validity*

There was moderate correlation between different items of the BASFI and the BASDAI (Table 2).

### *External construct validity*

There is statistically significant correlation between the BASFI and the BASDAI, the BAS-G, the BASMI, the BASRI, the Schober's test, the chest expansion, the finger ground distance, the occipital wall distance, the spinal pain, the radiological

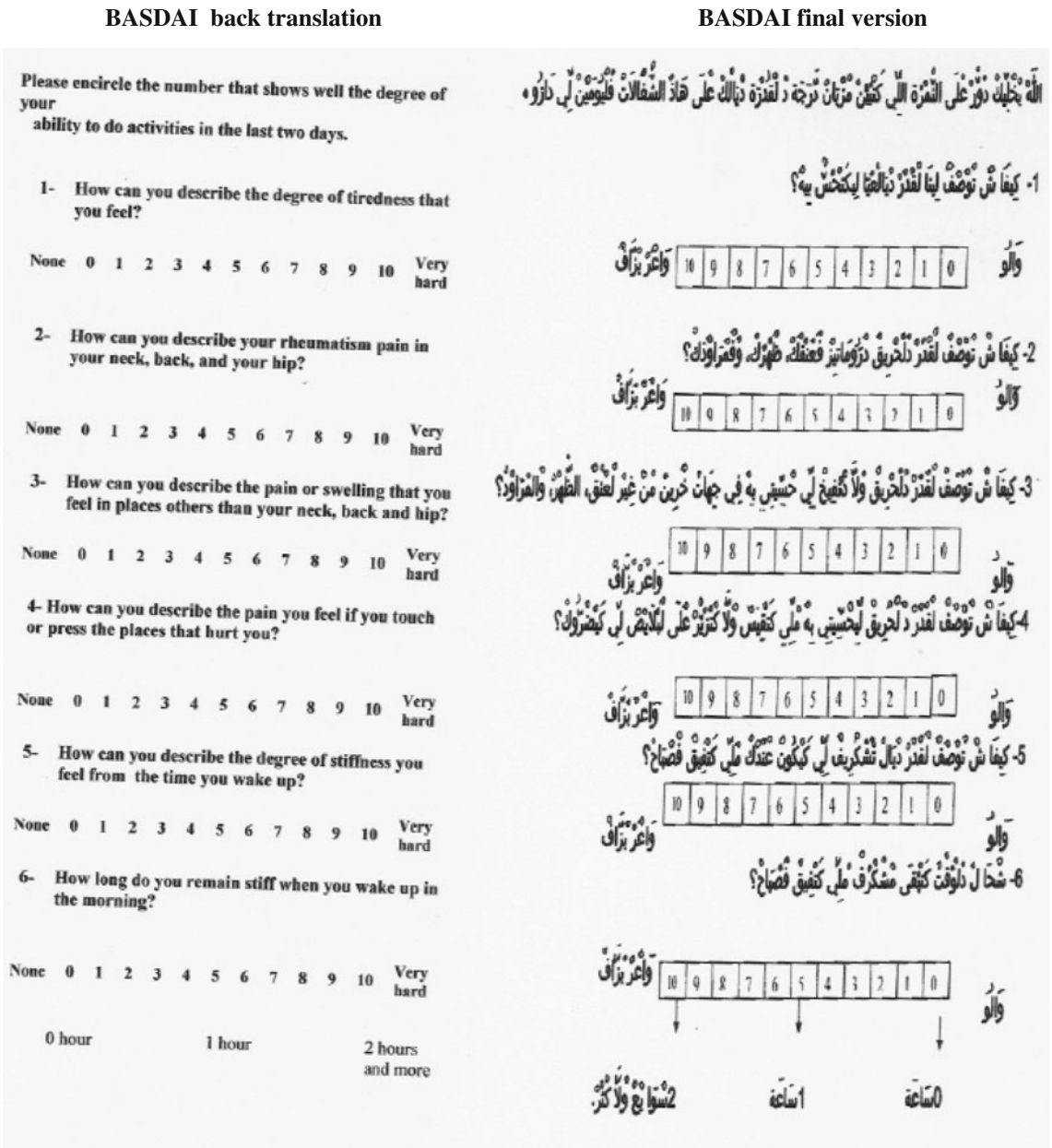


**Fig. 2** Moroccan Arabic version of BASDAI

changes in sacroiliac joints, and ESR. No correlation was observed between BASFI and enthesitis index (Table 2). BASDAI was correlated with the number of nocturnal awakenings, the morning stiffness, the VAS of the activity, the spinal pain, the painful joints index, the enthesitis index, the BAS-G, the BASFI, erythrocyte sedimentation rate, and the BASMI. No correlation was noted between the BASDAI, the BASRI, and the number of swollen joints (Table 2).

*Reliability*

Internal consistency measured by the Chronbach's alpha was 0.90 for the BASFI and 0.86 for the BASDAI.

Test–retest reliability measured by the ICC was 0.96 (confidence interval (CI) at 95%=0.93–0.97) for the BASFI (Table 3) and 0.93 (CI at 95%=0.90–0.95) for the BASDAI (Table 4).

## Discussion

Physical function and disease activity are important outcome measures in AS clinical trials. The ASAS working group has recommended the use of the BASFI for the domain of physical function in core sets for medical treatment. The BASDAI evaluates the domain of disease

**Table 2** External construct validity of the BASFI and the BASDAI

| Variables | Spearman ($r$) coefficient | $p$ |
|---|---|---|
| BASFI | | |
| SI (cm) | −0.56 | 0.001 |
| Finger ground distance (cm) | 0.62 | 0.001 |
| OWD (cm) | 0.46 | 0.001 |
| Chest expansion (cm) | −0.46 | 0.001 |
| Enthesitis index | 0.25 | NS (0.019) |
| Spinal pain | 0.33 | 0.002 |
| BASRI | 0.61 | 0.001 |
| BASMI | 0.70 | 0.001 |
| BAS-G | 0.58 | 0.001 |
| BASDAI | 0.54 | 0.001 |
| SI | 0.54 | 0.001 |
| ESR (mm/h) | 0.37 | 0.001 |
| BASDAI | | |
| VAS activity | 0.65 | 0.001 |
| Number of nocturnal awakenings | 0.57 | 0.001 |
| Morning stiffness | 0.65 | 0.001 |
| Enthesitis index | 0.47 | 0.001 |
| Spinal pain | 0.53 | 0.001 |
| Number of painful joints | 0.43 | 0.001 |
| ESR | 0.41 | 0.001 |
| BASG | 0.53 | 0.001 |
| BASFI | 0.54 | 0.001 |
| BASRI | 0.15 | NS (0.16) |
| BASMI | 0.36 | 0.001 |
| Number of swollen joints | 0.12 | NS (0.24) |

*NS* not significant, *OWD* occiput–wall distance, *SI* sacroiliac, *ESR* erythrocyte sedimentation rate, *VAS* visual analogical scale

**Table 3** Reliability of the BASFI measured with the intraclass correlation coefficient

| Items | ICC | IC at 95% |
|---|---|---|
| Putting on socks | 0.96 | 0.93–0.97 |
| Bending forward | 0.96 | 0.93–0.97 |
| Reaching up | 0.98 | 0.97–0.98 |
| Getting out of the chair | 0.97 | 0.96–0.98 |
| Getting up of the floor | 0.97 | 0.95–0.98 |
| Standing unsupported | 0.92 | 0.88–0.95 |
| Climbing 12 to 15 steps | 0.95 | 0.92–0.97 |
| Looking over your shoulder | 0.95 | 0.93–0.97 |
| Doing physically demanding activities | 0.97 | 0.95–0.98 |
| Doing a full day's activities | 0.90 | 0.81–0.94 |
| Overall score | 0.96 | 0.93–0.97 |

activity in ASAS recommendations. The aim of the standardization of these tools is that the results of an evaluation of disease progression and treatment effects become comparable among different studies in different countries and cultures. This study is a trial for the standardization of the BASFI and the BASDAI to suit the Moroccan and Arabic culture. The cross-culturally adapted

**Table 4** Reliability of the BASDAI measured with the intraclass correlation coefficient

| Items | CCI | IC at 95% |
|---|---|---|
| Tiredness | 0.92 | 0.87–0.94 |
| Spinal pain | 0.94 | 0.91–0.96 |
| Peripheral joint pain | 0.91 | 0.86–0.94 |
| Local tenderness | 0.88 | 0.80–0.91 |
| Intensity of morning stiffness | 0.95 | 0.92–0.97 |
| Duration of morning stiffness | 0.95 | 0.92–0.96 |
| Overall score | 0.93 | 0.90–095 |

versions of the BASDAI and the BASFI produced in this study maintained all the properties of the original English language versions of the instruments. The BASFI was translated into several languages. After the French version [13], several countries translated and validated this instrument: Sweden [14], Germany [15], Finland [16], Spain [17], and recently Turkey [18] and the Romania [19]. The BASDAI was translated into French [20], Swedish [21], German [22], Spanish [23], and Turkish [24] languages. The BASFI and BASDAI were recently translated into classical Arabic but are not adapted to our local idioms and cultural context [12].

The Moroccan version of the BASDAI did not require any major cultural adaptation in the translation process, and in many other countries, a simple literal translation was necessary [14–18].

The statistical analyses of the Moroccan version of the BASFI showed a strong reliability. Our result was comparable with the French [15], Finnish [18], Swedish [21], German [22], Turkish [24], and Rumanian [19] versions. ICC ranged between 0.82 [21] and 0.99 [18]. The reliability of this instrument in the Spanish version was acceptable (ICC=0.68). Cronbach's alpha was satisfactory in our study (alpha=0.90); this data was comparable with the data of the literature where alpha ranged between 0.81 [17] and 0.94 [18]. The structural validity was appreciated only in the Swedish, French, Turkish, and Moroccan versions with a statistically significant correlation between items ($p<0.001$), showing the homogeneity of items and one-dimensional context of the measured phenomenon by the BASFI which is the functional status. The most important parameters measured to assess external construct validity in all versions were Schober's test, finger ground distance, occipital wall distance, and chest expansion. A statistically significant correlation was found for all these parameters. The reliability of the BASDAI was excellent in our version; it joined the data of the original, Swedish, and Turkish versions. Structural validity was studied in the Turkish, Swedish, French, and our version. A statistically significant correlation between items was noted with strong correlation between items 2 (the spinal pain), 3 (peripheral pain), 5, and 6 (intensity and duration of the morning stiffness). Indeed, these items constitute the main clinical indicators of the evaluation of the activity in AS. The parameters used for the assessment of the external construct validity were different from one study to another [21–24]. However, we noted a preferential use of the following variables: the number of nocturnal awakenings, the morning stiffness, analogical visual scale of pain, the erythrocyte sedimentation rate with a statistically significant correlation between the BASDAI, and the various parameters in the other studies [25].

## Conclusion

The Moroccan version of BASFI and BASDAI are both reliable and valid; they can be self-administered to Arabic AS patients to evaluate their functional disability and disease activity.

**Disclosures** None

## References


1. van der Heijde D, Calin A, Dougados M, Khan MA, van der Linden S, Bellamy N (1999) Selection of instruments in the core set for DC-art, SMARD, physical therapy, and clinical record keeping in ankylosing spondylitis. Progress report of the ASAS working group. Assessments in Ankylosing Spondylitis. J Rheumatol 26(4):951–954
2. Calin A, Garett S, Tenkinson T, Kenedy LG, Whelack H (1994) A new approach to defining functional ability in AS: the Bath Ankylosing Spondylitis Functional Index. J Rheumatol 2:2281–2285
3. Garrett S, Jenkinson T, Kennedy LG, Whitelock H, Gaisford P, Calin A (1994) A new approach to defining disease status in ankylosing spondylitis: the Bath Ankylosing Spondylitis Disease Activity Index. J Rheumatol 21(12):2286–2291
4. Jones SD, Steiner A, Garrett SL, Calin A (1996) The Bath Ankylosing Spondylitis Patient Global Score (BAS-G). Br J Rheumatol 35:66–71
5. Jenkinson TR, Mallorie PA, Whitelock HC, Kennedy LG, Calin A (1994) Defining spinal mobility in ankylosing spondylitis. The Bath AS Metrology Index(AS). J Rheumatol 21:1694–1698
6. MacKay K, Mack C, Brophy S, Calin A (1998) The Bath Ankylosing Spondylitis Radiology Index (BASRI): a new, validated approach to disease assessment. Arthritis Rheum 41:2263–2270
7. Guillemin F, Bombardier C, Beaton D (1993) Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Epidem 46:1417–1432
8. Guillemin F (1995) Cross cultural adaptation and validation of health status measures. Scand J Rheumatol 24:61–63
9. Pouchot J, Larbre JP, Lemelle I, Guillemin F, Prieur AM (2002) Validation of the French version of the Childhood Health Assessment Questionnaire (CHAQ) in juvenile idiopathic arthritis. Jt Bone Spine 69:468–481
10. Faucher M, Poiraudeau S, Lefevre-Colau MM, Rannou F, Fermanian J, Revel M (2003) Assessment of the test–retest reliability and construct validity of a modified Lequesne index in knee osteoarthritis. Joint Bone Spine 70:521–525
11. Schwartz D. Méthodes statistiques à l'usage des médecins et des biologistes. Ed Flammarion, 4ème Edition. Collection «statistique en biologie et en médecine», 1, Paris 1995: 20–42
12. El Miedany YM, El Gafary M, Ahmed I (2003) Cross-cultural adaptation and validation of an arabic health assessment questionnaire for use in rheumatoid arthritis patients. Joint Bone Spine 70:195–202
13. Claudepierre P, Sibilia J, Goupille FRM, Wendling D, Chevalier X (1994) Evaluation of a french version of the Bath Ankylosing Spondylitis Functional Index in patients with spondylarhtropathy. J Rheumatol 21:2281–2285
14. Cronstedt H, Waldner A, Stenstrom CH (1999) The Swedish version of the Bath Ankylosing Spondylitis Functional Index. Reliability and validity. Scand J Rheumtol 28:1111–1119

15. Ruof J, Sangha O, Stucki G (1999) Evaluation of German version of the Bath Ankylosing Spondylitis Functional Index (BASFI) and Dougados functional index (D-FI). Z Rheumtol 58:218–225
16. Hecnikkila S, Viitanen JV, Kautianen H et al (2000) Evaluation of the Finnish versions of the functional indices: BASFI and DFI in spondylartropathy. Clin Rheumtol 19:464–469
17. Cariel MH, Londono JD, Gutierrez E, Pacheco-Tena C et al (2003) Translation, cross-cultural adaptation and validation of the Bath Ankylosing Spondylitis Functional Index (BASFI), the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and the Dougados functional index (DFI) in Spanish speaking population with spondylartropathy. Clin Exp Rheumatol 21:451–458
18. Karatepe AG, AkkocY AS, Akkoc N (2005) The Turkish versions of the Bath Ankylosing Spondylitis and Dougados Functional Indices: reliability and validity. Rheumatol Int 25:612–618
19. Udrea G, Ciobanu C, Mihai C, Stoica V, Suteanu S, van der Heijde D, van der Linden S (2004) Evaluation of a Romanian version of the Bath Ankylosing Spondylitis Functional Index (BASFI) in patients with AS. Rom J Intern Med 42:199–209
20. Claudepierre P, Sibilia J, Goupille P et al (1997) Evaluation of a French version of the Bath Ankylosing Spondylitis Disease Activity Index in patients with spondylarhtropathiy. J Rheumatol 24:1954–1958
21. Cronstedt H, Waldner A (1999) Stenstrom CH The Swedish version of the Bath Ankylosing Spondylitis Disease Activity Index. Reliability and validity. Scand J Rheumtol 111:10–16
22. Brandt J, Westhof G, Rudwaleit M, Listing J, Zink A, Braun J, Sieper J (2003) Adaptation and validation of the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) for use in Germany. Z Rheumtol 62:264–273
23. Karatepe AG, Akkoc Y, Akar S et al (2005) The Turkish version of the Bath Ankylosing Spondylitis Disease Activity Index: reliability and validity. Rheumatol Int 25:280–2844
24. El Miedany Y, Youssef S, Mehanna A et al (2008) Defining disease status in ankylosing spondylitis: validation and cross-cultural adaptation of the Arabic Bath Ankylosing Spondylitis Functional Index (BASFI), the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), and the Bath Ankylosing Spondylitis Global score (BASG). Clin Rheumatol 27(5):605–612
25. Wei JC, Wong RH, Huang JH, Yu CT, Chou CT, Jan MS, Tsay GJ,1– Chou MC, Lee HS (2007) Evaluation of internal consistency and re-test reliability of Bath ankylosing spondylitis indices in a large cohort of adult and juvenile spondylitis patients in Taiwan. Clin Rheumatol 26(10):1685–1691