Evaluation of the Greek version of the Bath Ankylosing Spondylitis Functional Index: Reliability, Validity, and Factor Analysis

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Abstract

Objective

To translate the Bath Ankylosing Spondylitis Functional Index (BASFI) into Greek, and validate its psychometric properties for the Greek patient population. Also, to assess the degree to which questions in the scale did address common themes, using confirmatory factor analysis.

Methods

BASFI has been translated into Greek (BASFI-GrV), applied to 61 patients with ankylosing spondylitis, and validated as follows: a) Cronbach's alpha for the estimation of the internal consistency. b) Spearman's correlation coefficient for the assessment of test-retest reliability. c) Spearman's correlation coefficient for the assessment of concurent validity against the Hospital Anxiety and Depression Scale (HADS). d) Factor analysis.

Results

The results showed the following: a) The BASFI-GrV demonstrated good internal consistency (alpha: 0.75). b) Test-retest scores produced no significant difference ($p = 0.07$). Spearman's ρ correlation coefficient for test-retest was high on average ($r = 0.91$, $p < 0.001$), and ranged from 0.56 to 0.94 for each item. c) Spearman's ρ between BASFI-GrV and HADS was 0.43 ($p < 0.001$). d) Factor analysis identified three factors with Eigen values ranging from 1.01 to 4.71, explaining totally 67.9 % of the variance.

Conclusion

Our findings indicate that BASFI-GrV is a valid and reliable questionnaire that can be used to evaluate the functional status of Greek patients with ankylosing spondylitis.

Key words
Arthritis, rehabilitation, spine.

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Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease of the sacroiliac joints and spine that may be associated with characteristic extraspinal lesions. Due to the progressive stiffness of the spine, a considerable number of patients with AS develop severe deteriorations in function (1). Although the clinical findings may yield valid information concerning disease activity and progress, a consensus on what type of measurements should be used and how much they reflect the patient's status is not fully established (2, 3). Because the lack of clear-cut measures in evaluating the status of the patients makes it difficult to assess the effectiveness of all treatment modalities, the Assessment in Ankylosing Spondylitis Working Group (ASAS), a group of experts dealing with AS, has recommended a core set to be used in clinical trials involving patients with AS (4). One of the instruments that has been recommended in the literature review (3), and by the ASAS Group for measuring physical function is the Bath Ankylosing Spondylitis Functional Index (BASFI) (4). Developed by Dr. Andrew Calin (5), it was one of the first self-report functional status measures, and has become one of the dominant instruments in many disease areas. It is widely used throughout the world and has become a *de facto* mandated outcome measure for clinical trials in seronegative arthritis (4). The BASFI consists of eight questions on daily activities and two additional questions that assess patients' ability to cope with everyday life (5). Each question is answered on 10-cm horizontal visual analogue scale (VAS). The VAS has no distinguishing marks except the words "easy" and "impossible" at either end of the line to indicate the direction of the severity. The mean of the ten scales results in the BASFI score (0-10), with higher scores indicating more severe impairment (5). The BASFI satisfies the criteria for the design of a functional index. It is quick and easy to complete, and is reliable and sensitive to change across the spectrum of the disease (5). It has been shown to be more discriminative and responsive compared with other instruments (5-8), and has been shown to be reliable and valid in different languages and contexts (9-13).

Since in patients with rheumatic conditions, the clinical or research need for functional evaluation, frequently arises, it is necessary to demonstrate the reliability and validity of this instrument in other languages and cultures. To our knowledge, BASFI has not been translated and evaluated for the Greek population. For this reason, we proceeded with the translation of the questionnaire into Greek, designated Greek version of BASFI (BASFI-GrV). We assessed the psychometric properties of the Greek version by enrolling patients with ankylosing spondylitis.

The purposes of this study were to assess: 1) the reliability of the BASFI-GrV in a Greek patient population with ankylosing spondylitis, 2) the validity of this instrument in those patients, and 3) to assess the degree to which questions in the scale did address common themes, using confirmatory factor analysis.

Material and methods

Scale translation

BASFI questionnaire was translated into Greek by a bilingual Greek native speaker who was a college teacher of English with an English language university degree and by a Greek native health professional. The Greek translation of BASFI was translated back into English by a bilingual Greek native speaker who was a college teacher of English with an English language university degree and had no access to the original text. We confirmed the accuracy of the translation and refined some expressions that seemed appropriate for a better understanding. The final Greek version of the scale, as agreed by the translators and the authors designated BASFI-GrV, was applied to Greek patients with ankylosing spondylitis.

Subjects and administration

The approval of the study protocol was given by the institutional ethics committee. The patients (n. = 67) were referred by their rheumatologist to the physical therapy department of "Papageorgiou" general hospital. Participants

were referred with the diagnosis of ankylosing spondylitis and we assessed the eligibility of the patients for the trial. Patients with cognitive and language impairment were excluded from the study. Finally, 61 subjects were recruited to the study (four refused to participate and two had a language barrier), and were instructed how to complete the questionnaires.

The participants were given a baseline copy of BASFI-GrV in addition to a copy of the Hospital Anxiety and Depression Scale (HADS) (14, 15). They were also asked to provide demographic information and details of their age, gender, medication, and symptom duration. Patients were followed-up by postal questionnaires 4 to 6 days after their initial outpatient appointment and these follow-up questionnaires contained the BASFI-GrV and HADS. They were instructed to complete them and return them by mail. The response rate at baseline was 91%.

Table I. Characteristics of the subjects.

Parameter	Subjects (N = 61)
Age (mean, SD, range)	46.6, 11.5, 21-70
Gender (male, female)	38, 23
Disease duration in years (mean, SD, range)	13.8, 7.6, 2-30
Medication (yes, no)	42, 19
Pain (VAS) (mean, SD)	4.1, 2.3
ESR (mm/h)	36.2, 25.6

SD: standard deviation; VAS: visual analogue scale. ESR: Erythrocyte sedimentation rate.

Table II. Cross sectional differences among subjects on BASFI-GrV scale (N = 61).

Parameter	n	Mean	SD	F	*p*
Age:				2.1	.20
< 45	34	3.8	2.1		
> 45	27	4.6	2.0		
Gender:				.92	.34
Males	38	3.9	2.2		
Females	23	4.5	1.9		
Medication:				5.81	.01*
Yes	42	3.7	2.3		
No	19	5.1	1.2		

SD: standard deviation. *Significantly different (α = .05).

Reliability analysis

The reliability of a scale is the extent to which it measures the outcome of interest in a reproducible and consistent fashion. We used internal consistency and test-retest methods to assess reliability (16). Internal consistency is a measure of the extent to which items on a scale give consistent responses (16). We used Cronbach's alpha, a widely used method based on correlation between items making up a scale.

The test-retest reliability of a scale is a measure of its repeatability during an interval when no change in a subject's health is expected (17). If the subject's health does not change between test and retest the difference in scores should not differ significantly from zero (17). We assessed the level of test-retest reliability using Spearman's correlation coefficient.

We used confirmatory factor analysis (18) to assess the degree to which questions in the scale did address common themes. Using the patterns of inter-correlations among item responses, factor analysis groups items that appear to measure discrete factors. We used the principal component analysis as an extraction method. Factors were retained in the analysis if their Eigen value, a measure of how much variation can be explained by the factor, exceeded 1 (19). We used the varimax method of rotation as an aid to the interpretability of the model.

To judge whether the sample had a suitable factorial structure, (*i.e.*, whether correlation between variables can be explained by other variables), we used measures of sampling adequacy. The Kaiser-Meyer-Olkin measure compares correlation and partial correlation coefficients; if values lie below 0.5, the factor analysis should be reconsidered or the item rejected. Bartlett's Test of Sphericity shows if the correlation matrix is or is not an identical matrix (20), and Determinant shows if the data permit factor analysis (20).

Validity analysis

Validity of a scale is satisfactory if it demonstrates the measures that it was designed to measure. We assessed the validity of the BASFI-GrV in terms of its concurrent validity. Concurrent validity, comparing a measuring tool with a measurement standard, was assessed against the HADS. The HADS is designed to detect the presence and severity of relatively mild mood disorder likely to be found in non-psychiatric hospital out-patients. It is intended both as a screening device and to chart progress over time (14). The scale consists of 14 items, seven of which relate to depression and seven to anxiety. Each item provides four response categories in terms of frequency or severity. The scale is self-completed. There is less evidence of the reliability of the HADS than of its validity. The authors report satisfactory internal consistency (14). Subsequent evidence has confirmed the validity of the HADS when tested against other measurements of anxiety and depression (14). We hypothesised that the BASFI-GrV score at baseline would be positively correlated with both the anxiety and depression domains of the HADS questionnaire. We assessed the level of concurrent validity using Spearman's correlation coefficient.

Results

Descriptive statistics of subjects are presented in Table I. Cross sectional

differences among subjects on BASFI-GrV scale are presented in Table II. Mean scores and SD of all BASFI-GrV scales are presented in Table III.

Cronbach's alpha for the sample was 0.75. Comparison between test-retest scores produced no significant difference ($p = 0.05$) with a mean of 0.24 and SD 0.94. Spearman's correlation coefficients for test-retest was high on average ($r = 0.91$, $p < 0.001$), and in each of the 10 items was as follows: item 1: $r = 0.87$, item 2: $r = 0.77$, item 3: $r = 0.72$, item 4: $r = 0.85$, item 5: $r = 0.62$, item 6: $r = 0.80$, item 7: $r = 0.94$, item 8: $r = 0.82$, item 9: $r = 0.78$, item 10: $r = 0.56$.

All values of sample adequacy tests allowed further analysis. The Kaiser-Meyer-Olkin test was 0.82. Bartlett's Test of Sphericity was 271.9 ($p < 0.001$) and Determinant value was 0.003. Three factors were identified with Eigen values ranging from 1.01 to 4.71 (Table IV), explaining totally 67.9 % of the variance. The items were spread across three factors (A, B, and C). Factor A contains items 1, 2, 3, 4 and 8; Factor B contains items 5, and 6; Factor C contains items 5, 9, and 10.

The BASFI-GrV was positively correlated with all HADS domains at the .05 level. Spearman's correlation coefficient between the two scale scores was 0.43 ($p < 0.001$), providing an index of acceptable concurrent validity.

Table III. Mean scores and SD on BASFI-GrV scale (n = 61).

Item number (Q)	mean	SD
Q1	3.7	2.7
Q2	3.8	2.7
Q3	4.0	2.6
Q4	4.2	2.6
Q5	5.9	7.6
Q6	5.0	6.2
Q7	4.7	6.6
Q8	4.4	3.2
Q9	4.1	2.4
Q10	4.3	2.2
Total	4.1	2.1

SD: standard deviation.

Table IV. Factor analysis - factor loading coefficients.

Item number	Factor A	Factor B	Factor C
Q1	0.85		
Q2	0.84		
Q3	0.79		
Q4	0.81		
Q5			0.78
Q6		0.47	
Q7		0.83	
Q8	0.62		
Q9			0.54
Q10			0.71

Discussion

In this study, we investigated the reliability and validity of the Greek version of BASFI questionnaire in a Greek population of patients with ankylosing spondylitis. The results indicate that the BASFI-GrV can be used to evaluate the functional status in a Greek patient population, as it satisfies conventional psychometric criteria, and has similar psychometric properties to the other versions of the scale. The Greek version of BASFI was applied to a group of patients with mild functional disability (BASFI total score mean 4.1 in a 0-10 scale), and proved to be easy to administer. The translation did not require any major cultural adaptation because the cultural similarity of the two societies containing the patient populations is high. Most items could be translated with vocabulary equivalence. Emphasis was given to the selection of words easily conceivable from patients with a lower cultural and educational level in order to avoid deteriorated understanding.

The observed differences in total BASFI scores among parameters (Table II) probably underlie the true differences between patients with different age, gender, and the use or not of medication. The only characteristic in which a difference was recorded is the "use of medication". Indeed, as it is expected, patients that do not use medication have greater values of disability scores.

Its reliability as determined by Cronbach's alpha coefficient had a value close to the reliability value of the similar studies (9-13). More specifically, internal consistency (Cronbach's alpha) in Swedish versions was 0.86 (9), in Finish versions was 0.94 (11), in German versions was 0.81 (10), in Spanish versions was 0.68 (intraclass correlation coefficient) (12), and in Turkish versions was 0.91 (13). We also collected data from test-retest comparisons consistent to the data from the original scale ($r = 0.89$, $p < 0.001$) (5), and correlation coefficients ranged from 0.62 to 0.94 over the ten items. Between test-retest comparisons, no significant differences were produced. This agreement demonstrates the ability of the scale to give consistent results during the 4-6 days reference period of the questionnaire.

The data from the factor analysis suggest that the instrument is not unidimensional; it has been identified three domains with equal weights with minimal overlap among the identified factors. Items 6 and 8 demonstrated moderate overlap mainly between Factors A and B. Finally, item 9 demonstrates significant overlap between all three domains. To our knowledge, there is no published data concerning factor analysis of the scale. Our factor analysis demonstrated domain forming as follows: Factor A contains items 1, 2, 3, 4, and 8 that address issues of function related to spinal mobility. Factor A explains 47% of the variance, over half of the totally explained variance, showing an impressive attribution to defining disability. Factor B contains items 6 and 7 that are related to specific functional issues, stairs and standing. Factor C contains items 5, 9, and 10.C that are related mainly to more general functional activities, such as sports exercising, and everyday activities. The values for Cronbach's alpha indicate that overall the scale shows a level of homogeneity consistent with a single scale score, an overall arthritis "severity" measurement.

Anxiety and depression in rheumatological patients are closly linked to motor disability. It is quite frequent in those patients to record distress exacerbating caused by decreased functioning (21), therefore a comparison of BASFI-GrV scores with HADS scores could be an index of concurrent validity. The results of our study provide support for the concurrent validity of HAQ-GrV. In the similar studies, the validation parameters used, included measurements

of disease activity, mobility, general influence of the disease, and laboratory values. The results reflected significant correlations, although some skepticism arises due to limitations of some of the parameters like acute phase reactants, in clinical ankylosing spondylitis trials (22).

Our study resulted in the generation of a validated Greek version of BASFI questionnaire which was proved to have psychometric properties analogous to the original and the other similarly tested European versions. We found BASFI-GrV to be a valid and reliable questionnaire that can be used to evaluate the overall functional status of Greek patients with ankylosing spondylitis.

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APPENDIX

The Greek version of Bath Ankylosing Spondylitis Functional Index (BASFI-GrV).

Οδηγίες. Βάλε ένα σημάδι πάνω σε κάθε γραμμή παρακάτω που να δηλώνει το επίπεδο της δυνατότητάς σου, για κάθε μια από τις παρακάτω δραστηριότητες κατά τη διάρκεια της τελευταίας εβδομάδας.

(1) Να φοράς τις κάλτσες σου ή εφαρμοστά ρούχα με βοήθεια ή βοηθήματα.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(2) Να σκύβεις με τη μέση σου μπροστά να σηκώσεις ένα στυλό από το πάτωμα χωρίς βοήθημα.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(3) Να φτάνεις σε ένα ψηλό ράφι χωρίς βοήθεια ή βοηθήματα.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(4) Να σηκώνεσαι από μια καρέκλα τραπεζαρίας χωρίς μπράτσα χωρίς να χρησιμοποιείς τα χέρια σου ή άλλη βοήθεια.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(5) Να σηκώνεσαι από το πάτωμα χωρίς βοήθεια από την πλάτη σου.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(6) Να στέκεσαι χωρίς υποστήριξη για 10 λεπτά χωρίς ενόχληση.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(7) Να ανεβαίνεις 12-15 σκαλιά χωρίς να πιάνεις την κουπαστή ή κάποιο βοήθημα βάδισης, με ένα πόδι σε κάθε σκαλί.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(8) Να κοιτάζεις πίσω από τον ώμο σου χωρίς να στρίβεις το σώμα σου.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(9) Να κάνεις σωματικά απαιτητικές δραστηριότητες (π.χ. ασκήσεις φυσικοθεραπείας, κηπουρική ή σπορ).

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ

(10) Να κάνεις τις δουλειές όλης της ημέρας, είτε είναι στο σπίτι είτε είναι στη δουλειά.

ΕΥΚΟΛΟ _____ ΑΔΥΝΑΤΟ