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Original Article

# Fremantle Back Awareness Questionnaire in Chronic Low Back Pain (Frebaq-I): Translation and Validation in the Indian Population

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## Abstract

**Background:** The Fremantle Back Awareness Questionnaire (FreBAQ) has been found to possess adequate psychometric properties in low back pain (LBP) patients worldwide. The aim of this study was to translate the questionnaire into a classical Indian language (Odiya) and validate in the Indian population (FreBAQ-I). **Materials and Methods:** The English edition of the FreBAQ was transformed into Indian classical language (Odiya). One hundred adult patients with chronic LBP were recruited for psychometric evaluation using Rasch analysis. Demographic parameters, clinical characteristics like pain, Oswestry Disability Index, and Beck's depression inventory were assessed along with responses to the study questionnaire. **Results:** The FreBAQ-I correlated well with intensity of pain ($r = -0.19$, $P = 0.04$), duration of the LBP ($r = 0.35$, $P < 0.001$), depression score ($r = 0.25$, $P = 0.012$), but not statitistically with disability ($r = 0.06$, $P = 0.49$). The fit statistics was neither excessively positive nor negative, and the average agreeability measure of the study participants progressed as presumed across the different categories. Internal consistency of the FreBAQ-I version was found to be good with a person reliability of 0.54 and Cronbach's alpha of 0.91. **Conclusions:** Patients with greater disturbed body perception are addressed adequately by the questionnaire. All nine items are essential and adequate, which makes the survey complete, although item 2 was found to be endorsed more often. Overall, the FreBAQ-I has suitable psychometric properties in Indian populations with chronic LBP.

**Keywords:** *Altered perception, chronic, Indian, low back pain, modified Fremantle questionnaire*

## Introduction

Patients with chronic low back pain (LBP) develop back-specific altered body perceptions. These malperceptions are known to contribute to the disease, hence might offer a potential target for treatment if measured.[1,2] Psychometrics refers to measuring one's mental abilities and capacities and is the answer to assess these altered perceptions.[3] The Fremantle Back Awareness Questionnaire (FreBAQ) was developed as a reliable tool measuring back-specific body perception.[4-6] However, this has not been evaluated and validated in the Indian context.

Therefore, the present study was planned to establish the psychometric ability of the questionnaire in the Indian context.

## Materials and Methods

### Translation of the questionnaire

The English edition of the FreBAQ was transformed into Indian classical language – Odiya, utilizing a forward–backward process.[4] Two native Odiya speakers translated the original questionnaire into the Odiya language. The differences were cleared after discussion among them. This version of translation was back translated by a person well versed with both Odiya and the English languages. The back-translated text was then sent to the developer of the original questionnaire, which was checked and approved. The provisional Odiya version of the survey was then administered to ten native Odiya speakers attending a pain clinic for LBP. Their inputs were inculcated with the formation of the final version (FreBAQ–I), which was put into evaluation for the

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purpose of the study. The study was recorded with the Indian clinical trials registry (CTRI/2018/02/011772 dated February 8, 2018).

## Assessment of the questionnaire

### *Participants*

Patients for the study were pooled from four different outpatient departments, namely pain clinic, orthopedics, neurosurgery, and physical medicine. Patients with chronic low backache (duration >3 months) aged between 18 and 70 years were included for the study purpose. The exclusion criteria were those with red flag signs, known psychiatric illness, and those who refused to participate. The study was approved by the institute ethics committee. Consent was obtained from all the participants for inclusion in the study in written form.

### *Procedure*

Demographic parameters such as age, sex, body mass index, marital status, and profession and clinical characteristics like duration and severity of pain, Oswestry disability index,[7] and presence of depression (Beck's depression inventory)[8] were assessed. Pain intensity was measured utilizing on a visual analog scale (VAS) having 0–10 points, where "0 = no pain" and "10 = worst pain imaginable." In addition, all the participants were evaluated for the FreBAQ-I.

### *Sample size*

As previously recommended, a sample of 100 participants was fixed to do Rasch analysis (RA) to ensure stable item calibration within − 0.5 logits with 95% confidence.[9]

### *Rasch analysis*

The translated version of the questionnaire was analysed under the following elements.

### *Targeting*

RA is described as a probabilistic model where targeting refers to the ability of the questionnaire items to target the specific population with perceptual disturbances. It means persons with higher bodily disturbance should be more agreeable than those with lower perception disturbance. Similarly, items indicating a greater disturbance in the questionnaire are to be lesser endorsable than those indicating smaller disturbance.[10]

### *Category order*

There were five categories of responses such as never, rarely, occasionally, often, and always. Curves for category probability were drawn to find out the scale function. Each curve was expected to have a distinct, separate peak and clear threshold, representing the point at which the possibility of favoring one category is similar to that of supporting another. Disordered threshold values are possible when a class is either underutilized or respondents use the types differently (e.g., participants were finding it challenging to differentiate between two groups).

### *Uni-dimensionality*

The advantage of RA is its scope for testing the dimensionality of the scale rather than testing the instrument as a whole.[11] In addition, RA provides a clue of the "item difficulty" grading of the questionnaire.

We used Rasch residual principal component analysis (PCA) to evaluate the unidimensionality of the measure scale. The PCA permits assessment of the primary Rasch dimension. Unidimensionality of a range is validated when the Rasch dimension explains 40% of the variance of the data along with the first contrast of Rasch residual and the eigenvalue of the first contrast should be ≤2.0.[11]

Item fit statistics were used to examine the unidimensionality. These are Chi square based statistics reported as mean squares (in logits), with a presumed value of 1 logit. Excessive large fit residuals (>1.4 logits) suggest a major difference between the observed and expected performance. In contrast, excessively small fit residuals (<0.6 logits) imply that the thing is behaving too predictably.[12]

The PCA residual correlation matrix was visually scrutinized to identify groups of things that would suggest a second dimension. An estimated eigenvalue >2.0 for the PCA of residuals was considered pointing toward the second dimension.[13,14]

### *Internal consistency*

Cronbach's alpha and person reliability are the two measures used to evaluate consistency or reliability in RA.[15,16] Person reliability defines the discriminative ability of the scale at different levels, and as the value increases, the level of discrimination increases, which is independent of sample size. A least amount of 0.7 was recommended for a cluster of respondents, and a minimum value of 0.85 was advised for discrete participants. Cronbach's alpha was also used to compare to that of the original study findings.[5]

### *Person fit*

Patients with outfit residuals >1.5 logits were evaluated for a poor fit. Fisher's exact test and Student's *t*-test were used for each item of the FreBAQ-I to compare the poor fit versus better fit in the model.[17]

### *Item functioning*

The questionnaire items are expected to work similarly for all participants of comparable agreeability. Differential item functioning (DIF) is the method to identify bias in items or confounding factors (other than the construct). We examined DIF across six subgroups: sex, age (18–60 years, >60 years), job status (no work vs. at work), pain during motion (VAS ≤5 vs. >5), duration of pain (≤1 year vs. >1 year), and disability (≤5 vs. >5). DIF was verified applying a Mantel–Haenszel Chi-square test ($P$ = 0.01 for each of the items).

DIF was further explored if an issue resulted in a statistically significant difference of >0.5 logits between the subgroups.[18]

A "logit" scale is used to express the individual item difficulty on a linear scale, which extends from negative to positive infinity.

## Results

### Sample characteristics

A total of 100 participants were recruited over a period of 6 months (Feb 2018 - July 2018). The demographic profile of patients is shown in Table 1 and Figure 1. The frequency of responses of the study participants to every nine items of the questionnaire is presented in Table 2.

### Relationship to clinical status

The FreBAQ-I correlated signifantly with pain intensity ($r = -0.19$, $P = 0.04$), duration of the low backache ($r = 0.35$, $P < 0.001$), depression score ($r = 0.25$, $P = -0.012$), but not with disability ($r = 0.06$, $P = -0.49$) [Table 3].

### Rasch analysis (Fremantle Back Awareness Questionnaire-I)

#### *Targeting*

The relationship between different questionnaire items and person logit ratings is depicted in Figure 2, and the enforceability thresholds for each of the items are shown in Table 4. The mean person endorsebility was – 0.83 ± 0.49 (−2.24–0.16) logits compared to a default item endorsebility average of 0 ± 0.43 (−1.02–0.42) logit. Person agreeability shifts to the left compared to items endorsability, which indicates that persons having low scores were not well addressed by the scale. Item 2 was the easiest to endorse, followed by items 4 and 9. Item 3 was found to be the most difficult to endorse.

Ten participants of a hundred (10%) scored 0 for all the items, but none scored full points on all the items of the questionnaire.

#### *Category order*

The fit statistics were neither excessively positive nor negative, and the average agreeability measure of study participants progressed as expected along with the different rating categories. Hence, the category structure was found to be adequate, although the first category (rarely) was found to be less often utilized probably due to the difficulty in differentiating "rarely" from "occasionally" [Figure 3].

#### *Unidimensionality*

Table 4 depicts the fit statistics for all the nine items in the questionnaire. The item with slightly excessive positive infit statistics (1.50) was ninth, and the curve suggested the misfit is probably due to a low score given by those individuals with a high level of perceptual impairment. PCA of residuals revealed that the variance of the first contrast was 2.24 eigenvalue units; 67.2% of the raw variance was explained by measures. Visual inspection of the PCA correlation matrix suggested that items 5, 2, and 4 could possibly constitute a second dimension. Two of these items (items 5 and 2) address reduced proprioception, and item 4 indicates body size and shape. It was also found that items 4 and 5 were interdependent, as a positive correlation was established in the local dependence assessment ($r = 0.42$).

#### *Internal consistency*

It was found to be suitable with a Pearson's reliability (0.54) and Cronbach's alpha (0.91).

#### *Person fit*

As no association was found on age ($P = 0.99$), gender ($P = 0.99$), response to therapy ($P = 0.035$), pain severity ($P = 0.30$), functional disability ($P = 0.09$), and depression ($P = 0.76$) in between those who fit as against those who did not suit to the Rasch model, no further analysis was required.

#### *Differential item functioning*

We did not obtain any DIF for age, sex, job, VAS, and duration of pain.

**Table 1: Demographic and clinical status of the study participants**

| Variables | Outcome |
|---|---|
| Male:female | 1:1 |
| Age (mean±SD) | 42.72±11.59 |
| Married (%) | 85 |
| BMI (kg/m$^2$), mean±SD | 26.62±3.34 |
| Response to therapy (%) | 52 |
| Average duration of backache (months), mean±SD | 41.81±30.16 |
| Average pain score, mean±SD | 7.07±1.1 |
| Disability score, mean±SD | 18.87±7.83 |
| Depression score, mean±SD | 15.47±4.82 |

SD – Standard deviation; BMI – Body mass index

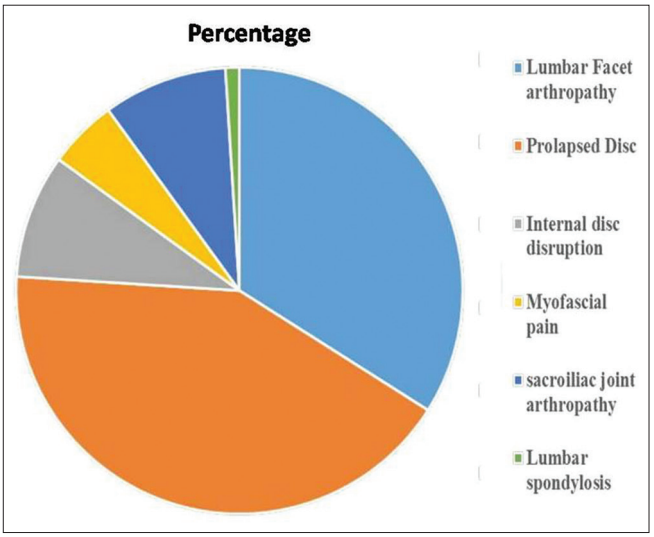


**Figure 1: Item-person threshold map showing the relationship between Fremantle Back Awareness Questionnaire-I items and person logit ratings**

**Table 2: Frequency of responses to each item**

| Item | Never (N) | Rarely (N) | Occasionally (N) | Often (N) | Always (N) | Median score | Mean score |
|---|---|---|---|---|---|---|---|
| Item 1 | 52 | 19 | 24 | 3 | 2 | 0 | 0.84 |
| Item 2 | 22 | 12 | 33 | 23 | 10 | 2 | 1.87 |
| Item 3 | 65 | 23 | 5 | 7 | 0 | 0 | 0.54 |
| Item 4 | 23 | 43 | 15 | 19 | 0 | 1 | 1.30 |
| Item 5 | 48 | 28 | 13 | 6 | 5 | 1 | 0.92 |
| Item 6 | 57 | 17 | 19 | 3 | 4 | 0 | 0.80 |
| Item 7 | 73 | 5 | 15 | 3 | 4 | 0 | 0.60 |
| Item 8 | 63 | 11 | 15 | 11 | 0 | 0 | 0.74 |
| Item 9 | 62 | 10 | 10 | 15 | 3 | 0 | 0.87 |
| Total | | | | | | 8 | 8.51 |

**Table 3: Correlation between total Fremantle Back Awareness Questionnaire I score and clinical variables**

| Clinical feature | Correlation coefficient | *P* |
|---|---|---|
| Pain | −0.197 | 0.049* |
| Disability | 0.069 | 0.495 |
| Depression | 0.250 | 0.012* |
| Duration of disease | 0.355 | <0.001* |

*$P \leq 0.05$ = significant

## Discussion

The FreBAQ-I was utilized to evaluate its psychometric properties in a sample of the Indian population with chronic LBP. We found it to possess a suitable internal consistency with a minor deviation from unidimensionality. Ten of a hundred participants scored 0 in all the items reflecting floor effect in our population. As there was no DIF for age, sex, job, VAS, and duration of pain, etc., no meaningful impact is expected upon the practical application of the translated Indian version of the questionnaire.

We found a positive association between FreBAQ-I and depression and the duration of the illness but a negative association with the intensity of pain. This probably reflects a participant who is in severe pain is unable to concentrate on the altered perception; rather, he/she appreciates the alteration only when pain reduces. It is only when pain is reduced, other issues are unmasked. This probably also reflects the timing for the evaluation of altered body perception. Similarly, Janssens *et al*. did not observe any significant relationship between VAS intensity and a score of the Dutch version of the questionnaire.[19]

Depression has been found to be a common accompaniment of chronic LBP and even so in patients with altered body perception. Further, psychosocial factors have been found to be associated with onset, maintenance, and treatment for chronic LBP.[20] Similar to these findings, we observed an association between depression and study participants with chronic LBP.

Unlike the Japanese version, both the English version and the Indian version showed a direct relation of the

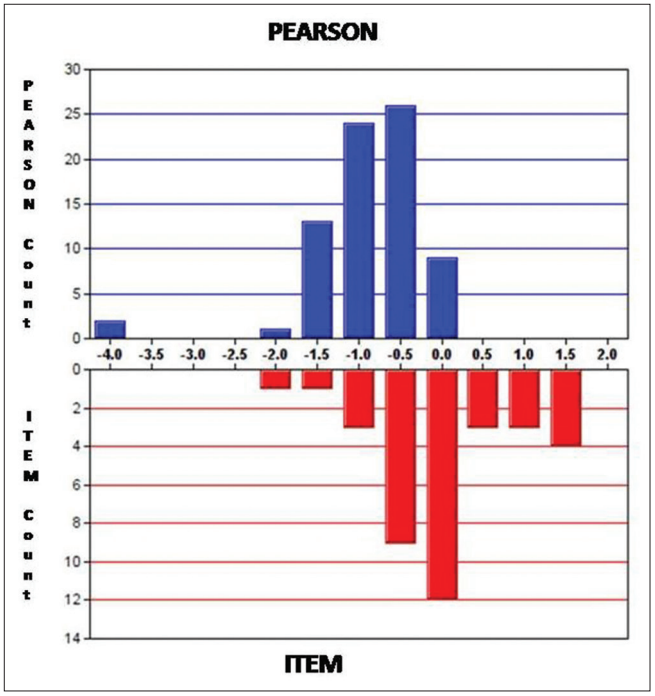


**Figure 2: Category order showing average agreeability measures of the respondents resulting in neither excessive positive nor negative fit statistics, suggesting the category structure is adequate**

questionnaire results with a duration of the LBP. In all probabilities, this is implicating as the duration of the disease increases, chances of altered back perception are higher.

Surprisingly, we did not observe any significant relation with a disability, probably reflecting altered body perception is not simply a function of disability. The major reason leading to disability seen in patients with chronic low backache without any red flags is the pain itself. It reflects the study population with higher scores for altered body perception was not experiencing much pain. This might explain the lack of relationship between questionnaire scores and disability.

The RA model is centered on the postulation that, to measure on the basis of a test item, a researcher must

**Table 4: Average item endorsability thresholds, including fit statistics**

| Item | Measure (logit) | SE | Mean square | |
|---|---|---|---|---|
| | | | Infit | Outfit |
| 2 | −1.02 | 0.11 | 0.63 | 0.66 |
| 4 | −0.37 | 0.11 | 0.55 | 0.55 |
| 9 | 0.01 | 0.11 | 1.50 | 1.41 |
| 1 | 0.06 | 0.11 | 1.06 | 1.04 |
| 5 | 0.06 | 0.11 | 1.02 | 0.89 |
| 6 | 0.15 | 0.12 | 0.97 | 1.04 |
| 8 | 0.29 | 0.12 | 1.31 | 1.23 |
| 7 | 0.40 | 0.13 | 1.30 | 1.12 |
| 3 | 0.42 | 0.13 | 0.85 | 0.89 |

SE – Standard error

consider the difficulty of each of the items along with a variable and the ability level of a test taker or a participant in this case with respect to the variable. The model suggested by Rasch specifies that when a respondent answers an item, the possibilities are two: answering correctly and not responding correctly.[21] This relationship is to be expressed as the natural log of the probability of participant answering correctly the test item divided by the likelihood of the same respondent not answering the test item appropriately. Therefore, the Rasch mathematical model uses a single variable, the position of the respondent or participant, along with the variable and the position of each of the test items satisfying along with the variable. In the current context, we are interested in evaluating the performance of each test item of the translated version of the questionnaire (FreBAQ-I) to define the variable i.e., altered body perception.[10] The RA suggested some limitations of the questionnaire. It showed persons having low scores were not addressed well by the survey, probably speaks in favor of the tool and its validity. Item 2 which was "I need to focus all my attention on my back to make it moves the way I wish to" was found to be the easiest one to endorse followed by item 4 which was "when performing everyday tasks, I don't know how much my back is moving" and item 9 ("my back feels lopsided or asymmetrical"). On the other hand, item 3, which was "I feel as if my back moves involuntarily without my control," was found to be the most difficult one to endorse.

Any questionnaire per standard error has two ends: one easy where it starts and ends slowly with increasing difficulty. Similarly, of nine items in the FreBAQ-I, some are on the easy end and some are on the difficult end of the continuum. It is normally expected that, regardless of the ability of the respondents, this easy and difficult should stand true for all the participants. When items do not fit this model of assumption, they tend to measure different variables rather than one. As the intention is to address only one variable, the items misfitting the model must be removed and replaced with appropriate questions. In a RA, identification of issues which do not contribute to

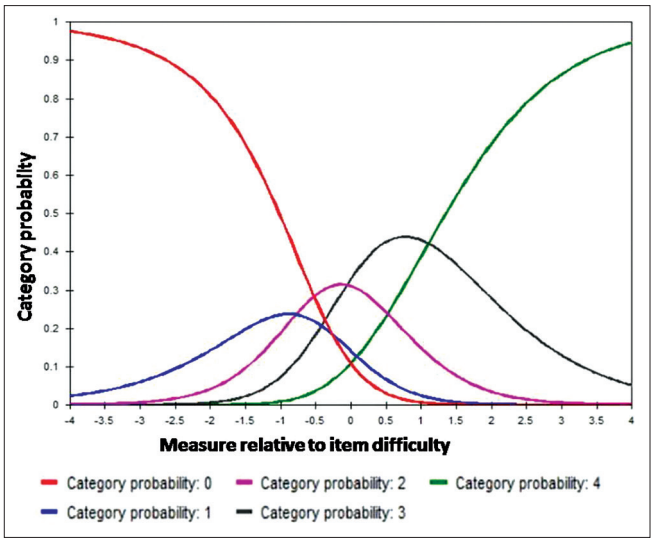


**Figure 3: Graphical representation showing item characteristic curve**

the assessment for which questionnaire is meant can be accomplished by utilizing "fit statistics."[22]

There are five categories in the questionnaire likely "never," "rarely," "occasionally," "often," and "always." While evaluating the types of a survey or scale, the category items must be clearly ordered so as to make the respondent clear about the responses to be given. However, as people might respond to the same question differently, the category order and fit statistics are utilized to assess how close we are to the intended ordering. In the given study, we found neither too high positive not too high negative fit statistics, implicating an adequate agreeability measure of the study participants. However, participants found it hard to differentiate "rarely" from "occasionally." The item found to be showing slightly excessive positive infit statistics (1.50) was ninth, and the item-specific curve hinted the misfit is probably due to a low score given by those individuals with a high level of perceptual impairment.

The evaluation of the questionnaire also includes all the nine items that must fit the scale individually and independently. In contrast to other researchers, we found item nine to possess more positive infit statistics. Although we agree to the notion that back enlargement is quite more common than the feeling of shrunken, we did not obtain any difference in items 7 and 8, probably because our population understood the difference clearly. In contrast, item nine was not felt appropriate as although back pain is unilateral, they less often felt their back to be asymmetrical. Items probably perform differently in different population and the role of duration of backache and underlying pathology cannot be ruled out. Midline pathology is less likely to create an altered lopsided back perception than a unilateral pathology. The majority of our study population had axial pathology such as a prolapsed disc, spondylosis, and internal disc disruption rather than facet arthropathy or

sacroiliitis, which are often sided in nature [Figure 3]. This is probably one area, which still needs to be explored.

Similarly, there should not be any interdependence between the questionnaire items so that they do not affect each other. In contrast to other study findings, we found items 4 and 5 were interdependent ($r$ = 0.42) and very likely influenced each other. This is possible as both the items are addressing proprioception acuity. Again, as suggested by Nishigami *et al*., although these items are dependent, they address different aspects of a similar perceptive problem, hence must be retained.[6]

Internal consistency is typically expressed as Cronbach's alpha (a), which ranges from 0 to 1. In our study results, we observed a Cronbach's alpha of 0.91, indicating adequate internal consistency and optimal reliability.[23]

Item hierarchy of the FreBAQ-I revealed item 2 to be the easiest and item 3 as the most difficult one, unlike the Japanese version, which found item 7 as the harder item, and items 6 and 8 are the easier ones. As suggested, these differences are probably the result of translational, cultural, and population differences.[6]

The current study has some limitations like we could not evaluate test–retest reliability, as getting the same patients for evaluation was not possible. In addition to the educational level, we missed following the correlation of altered perception and response to therapy.

## Conclusions

Our FreBAQ-I has acceptable psychometric properties and is suitable for use in patients with chronic LBP with adequate internal consistency in the Indian population. Participants with higher disturbed body perception are addressed appropriately by the questionnaire rather than those with lower levels of altered perception. All nine items are essential and adequate, which make the questionnaire complete. Even though item 4 and 5 are found to be locally dependent and might influence each other, as both are addressing proprioceptive acuity of different aspects, both the items deserve to be as placed.

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### Conflicts of interest

There are no conflicts of interest.

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