Validation of a modified Hindi version of the Epworth Sleepiness Scale among a North Indian population

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Abstract

Background: Since a majority of population in India does not drive automobiles, one item on the Epworth Sleepiness Scale (ESS) requires modification and validation. In addition, data collected by us indicated that a majority of rural and urban Indians regularly spend time in prayer/spiritual activity. The main purpose of this study was to develop a cross-cultural adaptation of the ESS for a North Indian population, in Hindi language (ESS-I). The study also provides evidence of reliability and validity of the modified version. Methodology: The subjects included were normal volunteers aged 18–75 years (Group 1) (n = 70), compared with patients with complaints of excessive daytime sleepiness, who had undergone polysomnography (Group 2) (n = 22) and patients who had undergone multiple sleep latency test (Group 3) (n = 10). The study was carried out in four phases: Translation and retranslation of the original scale with modification of item 8 (mainly addition of option of question on “while offering prayers or in spiritual activity”); reliability (test–retest) (n = 30); internal consistency (using Cronbach’s alpha index) (n = 102); and sensitivity to change (n = 8). Results: Group 1 showed spiritual activity as a significantly more commonly practiced activity than driving. The Cronbach’s alpha for the modified version was 0.892 (excellent), and this was not improved by removing the modified item. The alpha value for Group 1 versus Groups 2 and 3 was 0.667 and 0.892, respectively. The scale was reliable over time (test–retest), and it was sensitive to sleepiness change in patients with obstructive sleep apnea during treatment. Conclusion: The ESS-I is comparable to the original scale. It is reliable, valid, and change-sensitive. It is proposed that the modified version can be very useful for detecting sleepiness among Indian population, especially those who do not drive their own vehicles.

Key Words

Excessive daytime sleepiness among Indian population, Hindi version of Epworth Sleepiness scale, Indian cross-cultural adaptation of Epworth Sleepiness scale

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Introduction

Epworth Sleepiness Scale (ESS) has been extensively used in the assessment of excessive daytime sleepiness (EDS).¹⁻³ Translated and modified versions of the ESS have been validated across the world in different languages. The ESS has been translated into several languages and validated in populations with different lifestyles and economic backgrounds.⁴⁻¹¹ One of the major problems encountered while using the ESS for evaluating EDS among Indian patients is the question pertaining to driving, since a large proportion of rural patients and women from both rural as well as urban backgrounds, in India, do not drive. For evaluation of such patients, modifying the total ESS score for applicable points of the ESS renders the scale less effective as a tool, especially on comparison with existing literature. There are no modifications of the scale available based on the lifestyle and sociocultural characteristics of Indian or other populations. On the other hand, the Hindi version of ESS-I offers a scaled-down version of the original ESS that is comparable in reliability, validity, and change sensitivity.
hand, there are certain candidate activities like praying at home or at a place of worship, which are commonly practiced by a majority of the Indian population. This study was conducted to test the validity of a simple modification of the ESS, translated into the Hindi language (the Epworth Sleepiness Scale for a North Indian population [ESS-I]).

Methodology

This study was conducted at the sleep disorders clinic of the Neurology Department of an apex referral and academic institution in North India, to validate the modified version of a Hindi translation of the ESS.

Ethical considerations

The participation of people in this study was voluntary. All participants signed an informed consent. There was no financial compensation for their participation. The study was cleared by our Institute Ethics Committee.

Inclusion criteria

Consecutive normal healthy attendants of patients attending Neurology clinic, belonging to either gender, between 18 and 65 years age, who understood and spoke the Hindi language, were included in this study (Group 1). In addition, patients with the diagnosis of obstructive sleep apnea (OSA) made by polysomnography (PSG) (Group 2) and those with a history of EDS, suspected to have narcolepsy diagnosed through PSG and multiple sleep latency test (MSLT) (Group 3) were also included in the study. We excluded people with medical or mental illnesses, which would make it impossible to read, understand, or address the scale.

All participants filled out a form with demographics questions (age, sex, educational level, and occupation) and were also asked if they drove a motorized vehicle.

Epworth Sleepiness Scale

The ESS is a tool, which evaluates subjective sleepiness and it was designed by Johns in 1991. It consists of a brief questionnaire, which evaluates the probability of falling asleep in eight different daily life situations. Each of the eight items is scored with an integer ranging from 0 to 3, and the sum of the item scores is taken as a measure of subjective daytime sleepiness (range 0–24). A higher value than ten in the ESS reflects EDS.

Phase 1: Translation–retranslation

The original version of the ESS was translated in an autonomous way from English into Hindi by two bilingual qualified Indian clinicians (Geetika Bajpai [Internal Medicine] and Mohammed Afsar [Clinical Psychologist]). Consensus was made to obtain a consolidated Hindi version of the ESS from the translations. This version was retranslated into English in an autonomous way by two other bilingual English native language people without knowledge of the original scale or its purpose. We compared the retranslations with the original version.

Phase 2: Modification of the Epworth Sleepiness Scale for nondriving population

We conducted a single question survey on 100 consecutive patients attending our sleep disorders clinic, with a history of EDS and ESS scores of 10 or more, and who were in the practice of driving regularly. They were asked to enumerate (at least one) common activities, (in addition to those mentioned as part of the ESS), on any regular day, during which they were most likely to doze off. Ninety-six of these 100 patients (50 women) reported praying/worshipping individually or in groups; 19 patients (18 women) reported various cooking related activities (e.g., chopping or peeling vegetables, sorting food-grains, and others); 23 adolescents/young adults (12 female) reported attending classroom lectures as the most sleepiness generating activities of their daily lives [Table 1]. The item number 8 of the ESS was hence replaced by the Hindi version of “while offering prayers or listening to spiritual discourse or attending “Satsang” or just meditating”. This modified version was named ESS-I Version. This scale was used in the following study phases [Appendix 1].

Phase 3: Statistical analysis for the validation of the modified Indian version of the Epworth Sleepiness Scale for a North Indian population

Statistical analysis was carried out using the STATA® version 12.0 (Statacorp LP), and descriptive analysis used for demographic data.

Reliability (test–retest)

The scale was applied to subjects included from all groups, on two separate occasions at least 4 weeks apart. During this period, the subjects received no intervention. Intraclass correlation coefficient was calculated.

Internal consistency

For internal consistency, we used the Cronbach’s alpha index.

Sensitivity to change

We compared the ESS-I total scores from a sample of people diagnosed with OSA before starting the treatment prescribed. The start of the treatment marked two periods: Pretreatment (before) and treatment (after). We applied the ESS-I in the pretreatment period, and again, we applied it in the treatment period at least 4 weeks after starting treatment. All participants were treated with continuous positive pressure airway (CPAP) at pressures prescribed, on the basis of manual titration PSG studies, following the first administration of the ESS-I. An optimum use of CPAP was considered as ≥5 h/night and

Table 1: Data of 100 consecutive sleepy patients regarding activities (apart from those included in the Epworth Sleepiness Scale), during which they frequently dose off

| Activity                                      | n (%) |
|-----------------------------------------------|-------|
| Praying/worshipping individually and in groups| 96 (96) |
| Cooking related activities (chopping, peeling, sorting grains, etc.) | 19 (19) |
| Attending classroom lectures                  | 23 (23) |
| While having a meal                          | 1 (1) |
The rest of the scale did not undergo any other changes. The way the scale is rated was not changed, from 0 to 3 in relation to the likelihood of dozing, where 0 indicates “never doze” and 3 “high chance of dozing.”

### Validation of the modified Indian version of the Epworth Sleepiness Scale for a North Indian

On the reliability (test–retest) evaluation of the ESS-I, we found a high correlation between total scores obtained at the two different times (intra-class coefficient = 0.752, n = 102).

On internal consistency testing, the Cronbach’s alpha index for the ESS-I was 0.892, and this was not improved by removing the modified item (item 8). When we analyzed separately, the people with and without complaints of EDS, the Cronbach’s alpha index was 0.892 and 0.667, respectively.

The comparison between ESS-I scores using either the driving question or the religious/spiritual activity question showed no difference [Table 3]. The percentage of subjects reporting chance of dozing off while driving was similar to those reporting chance of dozing off while engaging in the religious or spiritual activity, although the number of positive responses was small (P = 1.0) [Table 4].

Sensitivity to change: When the ESS-I was applied to the OSA patients who received CPAP therapy after titration, the mean ESS-I scores obtained were 18.4 ± 3.2 with significant improvement in the scores after treatment (mean 12.37 ± 6.87 [P = 0.04]). One patient who had not complied with the treatment protocol showed similar scores on both occasions.

On applying the Kruskal–Wallis test to the mean of all the three groups (Groups 1, 2, 3), significant difference was found between Group 1 versus Groups 2 and 3. On application of the Fisher’s exact test, there was a significantly higher proportion of sleepy (i.e. ESS > 10) subjects among the OSA and narcolepsy patients than among the controls [Table 5].

### Discussion

Our study validated a modified ESS (ESS-I), to assess EDS in a Hindi-speaking North Indian population. The scores obtained from the questionnaire were reliable with no statistically significant difference in the scores on test–retest evaluation. The modified scale was also found to be internally consistent, and the consistency was not improved by removing the modified item. The modified scale showed sensitivity to change in a small group of patients with OSA, whose sleepiness improved after receiving CPAP treatment. To our knowledge, this is the first such modification validated for use in Indian population.

Use of translated and modified versions of ESS has been validated in many different languages. We did need to change a few of the phrases during translation-retranslation process to maintain similarity to the original ESS to the maximum extent. However, due to population characteristics, some of the questions were impertinent in the Indian sociocultural setting (especially for the vast rural and urban poor populations). We replaced the question on driving with a

### Table 2: Demographic details of all subjects administered the Epworth Sleepiness Scale for a North Indian population

| Characteristics                        | Group 1 (normal volunteers) | Group 2 (OSA) | Group 3 (PSG with MSLT) |
|----------------------------------------|-----------------------------|---------------|--------------------------|
| (n=70) (%)                             | (n=22) (%)                  | (n=10) (%)    |
| Age (mean±SD)                          | 38.77±17.64                 | 44.63±7.62    | 31.47±11.47              |
| Sex (male)                             | 35 (50)                     | 19 (86.36)    | 9 (90)                   |
| Regular praying/meditation/spiritual activity | 66 (94.28)                  | 12 (51)       | 5 (50)                   |
| Regular driving                        | 4 (5.71)                    | 11 (50)       | 5 (50)                   |

SD = Standard deviation, PSG = Polysomnography, MSLT = Multiple sleep latency test, OSA = Obstructive sleep apnea

7 days/weeks. We analyzed the scores obtained at these different periods, using nonparametric statistics for paired studies (Wilcoxon sign test for paired data).

### Differentiating normal versus sleepy subjects

The Kruskal–Wallis test was used to compare mean ESS-I scores of the three different groups. Fisher’s exact test was used to study the differences among the participants in all three groups, who were excessively sleepy (ESS-I ≥ 10) and the nonsleepy (ESS-I < 10) subjects.

### Results

We included 70 normal healthy subjects (35 male, 35 female) (age 38.77 ± 17.64) and 22 patients with diagnosed OSA (19 male, 3 female) (age 44.63 ± 7.62) who had undergone PSG studies (both diagnostic and PAP titration), and 10 patients with suspected narcolepsy (9 male, 1 female) (age 31.47 ± 11.47) who had undergone diagnostic PSG as well as MSLT [Table 2].

### Modification of the Epworth Sleepiness Scale during the translation-retranslation phase

During the design of the consensus scale and to adapt the items to Indian sociocultural conditions based on the requirements identified during the translation-retranslation phase, some phrases and/or words of the ESS were changed or added. In item 3, instead of “sitting inactive in a public place (e.g., a theater or a meeting),” we decided to add everyday situations in which Indian people were more likely to spend time sitting in public, such as a cinema, a conference or wedding, or other traditional rituals.

In item 4, we changed the phrase “as a passenger in a car for an hour without a break” with “as a passenger in a car for an hour or less of travel,” and also we also made the term describing the vehicle more nonspecific, to allow for other means of transport, which are more common in our country such as “buses,” “metro-train,” or “auto rickshaw” or “taxis.”

In item 8, we added the phrase “while driving” to “in a car, while stopped for a few minutes in the traffic.”

We also added a question an option to item 8. This phrase, as mentioned in the “Methods” section, was “while offering prayers or listening to spiritual discourse or attending “Satsang” or just meditating.”

On internal consistency testing, the Cronbach’s alpha index for the ESS-I was 0.892, and this was not improved by removing the modified item (item 8). When we analyzed separately, the people with and without complaints of EDS, the Cronbach’s alpha index was 0.892 and 0.667, respectively.

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question on offering prayers or while in spiritual activities since a large fraction of our patients do not drive. On the other hand, a large fraction of the patients engage themselves in some kind of prayer activity or meditation. This information was collected prospectively by us, on 100 consecutive patients attending our neurology clinic, with EDS; since no epidemiological or sociological studies were available to provide data on activities in which majority of Indians commonly engage on an almost daily basis.

Certain parameters had found to show great degree of variability in one study on African American and another on Chinese populations.[13,14] Although uniformity in the questionnaires across the population, ethnic group, and languages is important to maintain comparability, variability due to the irrelevance of a question does become a dominant issue. Hence, customizing the question according to the population being tested is important.[15,16] We changed the item 8 of the ESS by adding one option to the “driving” question, in our study due to population characteristics. However, change in this question did not affect the internal consistency of the scale and removing the option completely did not improve the Cronbach’s alpha index. Changing the question to “while in prayers and spiritual activities” is reasonable and very pertinent, and the scale has been able to maintain reliability and internal consistency, after introducing this change.

Such modification in the content of the questionnaires has been done in the Chinese study as well, with respect to driving and has been shown to preserve internal consistency and validity and sensitivity to change in the condition.[14] The authors of that study observed a poor response to the item 8 question and attributed this to the lack of driving experience among almost 75% of their patients. In this Chinese study also, modifications were added to the scale, based on the sociocultural characteristics of their population. A similar lack of reliability of item 8 was reported in an Australian study, in which Smith et al. found the lowest standardized regression weights for this item.[17]

The only study on ESS translation in the Indian subcontinent comes from Pakistan, which can be considered an ethnoculturally, socially, and linguistically similar group. In this study, both Urdu and English versions were tested in a group of bilingual patients and scores on the translated version was found to have high correlation with the scores on the test in English language. Hindi language is very similar to Urdu. However, this study tested only the correlation of score of the translated version. No change in the questionnaire was made to adjust for ethnocultural and social factors nor was any assessment on internal consistency was done in this study.[18]

Table 3: Comparison of Epworth Sleepiness Scale for a North Indian population scores among all three groups

| Variable | Group 1 (normal) (n=70) | Group 2 (OSA) (n=22) | Group 3 (suspected narcolepsy, who underwent PSG with MSLT) (n=10) | P |
|----------|------------------------|----------------------|-------------------------------------------------|---|
| ESS*     | 4 (0-14)               | 9 (1-22)             | 14 (0-20)                                       | <.001 |
| ESS >10** (%)| 1 (1.43)             | 10 (45.45)           | 7 (70)                                          | <.001 |

*Kruskal–Wallis equality-of-populations rank test, **Fisher's exact test.

| Variable | Group 1 (normal volunteers) (n=70) | Group 2 (OSA) (n=22) | Group 3 (narcolepsy) (n=10) | P |
|----------|-----------------------------------|----------------------|-----------------------------|---|
| ESS (driving) | 3.5 (1-14) | 8 (1-20) | 14 (0-18) | NS |
| ESS (religious/ spiritual activity) | 4 (1-12) | 9 (1-22) | 5-20 | NS |

Table 4: Median Epworth Sleepiness Scale for a North Indian population scores in response to the two different questions in item 8

| Group 1 (normal volunteers) (n=70) | Group 2 (OSA) (n=22) | Group 3 (narcolepsy) (n=10) | P |
|-----------------------------------|----------------------|-----------------------------|---|
| ESS (driving) | 36 (37.1) | 30 (28.6) | 60 (60) | NS |
| ESS (religious/ spiritual activity) | 27 (38.6) | 19 (28.6) | 50 (50) | NS |

Table 5: Number (%) subjects reporting sleepiness during various activities included in Epworth Sleepiness Scale for a North Indian population (both versions of item 8)

| Group 1 (n=70) | Group 2 (OSA) (n=22) | Group 3 (narcolepsy) (n=10) | P |
|---------------|----------------------|-----------------------------|---|
| ESS-I Q1 | 26 (37.1) | 20 (28.6) | 6 (60) | NS |
| ESS-I Q2 | 27 (38.6) | 20 (28.6) | 5 (50) | NS |
| ESS-I Q3 | 32 (45.7) | 32 (45.7) | 7 (70) | NS |
| ESS-I Q4 | 32 (45.7) | 2 (2.8) | 7 (70) | NS |
| ESS-I Q5 | 52 (74.3) | 0/4 | 5 (50) | NS |
| ESS-I Q6 | 3/66 (4.5) | 3/12 (25) | 4/5 (80) | NS |
| ESS-I Q8A | 3/6 (6.5) | 3/12 (25) | 4/5 (80) | NS |

*Data in these columns represents the frequency of obtaining a positive response (numerator) among subjects reporting regular engagement in mentioned activity. Percentages are in parentheses. ESS-I = Epworth Sleepiness Scale for a North Indian population, OSA = Obstructive sleep apnea.
is that the number of subjects who were studied for purpose of showing concurrent validity of the ESS-I, is small and there is possibility that due to the small number of subjects in Groups 2 and 3, and small number of respondents to Q8A in Group 1, there is still a risk that significant differences is missed [Tables 3 and 4].

In future, we still need to establish whether the cut off of >10 is optimal for ESS-I or not, as we changed the items number 8. This ESS-I version further needs to be tested for its ability to reliably assess excessive sleepiness among various populations of other sleep disorders, viz., insomnia, idiopathic hypersomnia, narcolepsy, drug-induced sleepiness, etc., This would extend its usefulness beyond the identification of sleepiness related to sleep-disordered breathing.

**Conclusion**

The Hindi language ESS modified for Indian sociocultural characteristics (the ESS-I), evaluated in this study, is a reliable, internally consistent tool, which is also sensitive to change and intervention. Modification of the ESS for the Indian population has been validated in this study.

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**Conflicts of interest**

There are no conflicts of interest.

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Appendix 1:

Epworth Sleepiness Scale for a North Indian population
आपकी निम्नलिखित स्थितियों में झपकी आने की कितनी संभावना है? आप केवल झपकी आने की संभावना का मूल्यांकन करें न कि अपनी थकान का प्रत्येक स्थिति के लिए निश्चित में से आपके लिए सबसे उपयुक्त विकल्प को चुनिए:

झपकी आने की कोई संभावना नहीं =0
झपकी आने की मामूली संभावना =1
झपकी आने की मध्यम संभावना =2
झपकी आने की बहुत अधिक संभावना =3

| स्थिति                                                                 | झपकी आने की संभावना |
|------------------------------------------------------------------------|--------------------------|
| 1. बैठ कर पढ़ते समय                                                   |                          |
| 2. टीवी देखते समय                                                   |                          |
| 3. किसी सार्वजनिक स्थान पर लिखित कागज पढ़ते हुए (थिएटर/ मीटिंग) |                          |
| 4. एक कार में एक यात्री के रूप में एक घंटे से अधिक के लिए बैठे हुए     |                          |
| 5. दोपहर में आराम करने के लिए बैठने का मौका मिलने पर             |                          |
| 6. बैठ कर किसी से बात करते समय                                     |                          |
| 7. दोपहर के भोजन (बिना शराब के) के बाद शांत कैद हुए                 |                          |
| 8. गाड़ी चलाते समय, कुछ समय के लिए यातायात के रूप में पकड़ने पर     | या                       |
| घर में प्रयाण करते समय                                               | या                       |
| धार्मिक गतिविधियों के दौरान (पाठ/प्रयाण/सांस्कृति इत्यादि)         |                          |