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Urdu translation and cross-cultural validation of neurological fatigue index on post stroke

Sadia Nazir¹, Mehwish Ikram^{1*}, Maryam Ikram¹, Syed Shakil ur Rehman¹ and Hafiza Rabia Javed¹

Abstract

Background The Neurological Fatigue Index (NFI) is the instrument used to evaluate stroke patients' fatigue. There was no Urdu version of NFI available officially.

Objective This study aimed to translate the Neurological Fatigue Index into Urdu and to determine the validity and reliability of Urdu NFI among stroke patients.

Methodology It is a cross-cultural validation study. According to international guidelines in phase I, a process of translation was carried out. In phase II, using the sample of 120 participants, validity and reliability of the Urdu version of the Neurological Fatigue Index scale was conducted. The Urdu version's content validity, convergent/concurrent validity, test-retest reliability, and internal consistency were determined. The latest version of SPSS was used for the data analysis.

Results The Urdu version of NFI was drafted after the expert's review. The content validity index was used to analyze the content validity. The reliability and validity of the Urdu version NFI were evaluated by calculating Cronbach's alpha ($\alpha = 0.86$), and intra-class correlation coefficient (ICC = 0.823). Correlations with other scales were the fatigue Severity Scale (FSS) ($r = 0.76$), Mental Fatigue Scale (MFS) ($r = 0.68$), Beck Depression Inventory (BDI) ($r = 0.53$) and Epworth Sleepiness Scale (ESS) ($r = 0.47$).

Conclusion The Urdu Version was linguistically acceptable for the fatigue assessment in post-stroke patients. It showed good content validity, convergent/concurrent validity, internal consistency, and test-retest reliability.

Keywords Fatigue, Stroke, Validity and reliability, Neurological examination

Introduction

Stroke is the second leading cause of death in Europe [1] and a significant contributor to disability resulting in morbidity and mortality [2]. The prevalence of stroke may increase as the population ages [3]. The incidence and prevalence of stroke in Pakistan remains unknown due to the high undiagnosed community [4]. It is the primary

cause of functional impairments, leaving 20% of survivors chronically immobile and 20% needing institutional care after three months [5]. In Pakistan, India, Russia, China, and Brazil, middle-aged stroke rates are five to ten times greater than in the United Kingdom and the United States. 20% of the world's population resides in South Asia which has one of the highest cardiovascular disease rates in the world. With an ageing population, there is an expected rise in stroke cases and a corresponding rise in stroke burden in developing countries like Pakistan [5, 6]. According to estimates, there are 350,000 new instances of stroke each year in Pakistan, where the incidence is estimated to be 250 per 100,000 persons.

*Correspondence:

Mehwish Ikram
mehwish.physiotherapist@gmail.com

¹Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Lahore, Pakistan



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Another population-based study found that a particular ethnic group in northern Pakistan and Afghanistan had a stroke prevalence of 4.8%, with a mean onset age of 45. In Pakistan, stroke and transient ischemic attack (TIA) are more common in women, and the age of onset of stroke in women is even younger than in men [7, 8].

Fatigue is the most common complaint among people who had a stroke [9, 10]. It can be described as an early feeling of stress, weariness, unwillingness to do any activity and an inability to focus due to lack of energy [11, 12]. Fatigue leads to depression and sleep disturbances [13]. Post-stroke fatigue (PSF) is the subjective complaint and persistent feelings of fatigue (weakness and exhaustion) and PSF are generally not alleviated by rest [14, 15]. According to various studies, those who survive a stroke in the first two years have a 50% likelihood of experiencing exhaustion. After a stroke, 40% of patients said tiredness was one of their worst complaints [16, 17]. Although some physical and cognitive difficulties have been linked to fatigue in stroke patients, few studies have found no link between emotional or physical causes and fatigue [18–20]. A few studies indicate that physical exhaustion may be associated with poorer exercise tolerance, increased energy costs, respiratory problems, and sleep issues [21]. It is unclear what causes fatigue or who will become fatigued following a stroke [22, 23].

Post-stroke objective or subjective weariness affects almost half of all patients, and it's common (30%) even after mild strokes. It has a different quality from normal fatigue and a great response to rest and can persist for more than a year after the occurrence. Fatigue is the most common after affect in stroke patients, although it has been a neglected topic in research and is frequently combined with other symptoms [24]. The neurological fatigue index is a self-reported scale with good validity and reliability for assessing physical (8 items) and cognitive exhaustion (4 items) by Roger G Mills in 2012. [25–27]. NFI is a self-reported measure and there is a dire need for the Urdu version of NFI for the assessment of post-stroke fatigue in the Pakistani population.

Methodology

Study design

The study was a cross-cultural validation study conducted at the Hussain Memorial Hospital, and Sheikh Zaid Hospital, Lahore, Pakistan. A sample of 120 Stroke patients participated for validity and reliability. The sample size was taken based on previous studies, here each item was evaluated with ($n=10$), formula $12 \times 10 = 120$ [28, 29].

Ethical consideration

Ethical approval

was necessary for every research study involving humans. Therefore, ethical approval was sought from the review panel of the Riphah International University Lahore ethical committee with reference no. REC/RCR & AHS/21/0245. Written informed consent was taken from each participant of the research. Permission for the translation was taken from the concerned authority [25].

Experts who were involved in translation and validation

Two bilingual translators (fluent in English and Urdu Language) contributed to Urdu translation. Two English Language Experts (fluent in both Languages) for backward translation. A panel of three experts (two physiotherapists and one neurologist with experience greater than 10 years in neuro science) was involved in the forward and backward translation process. Ten Physiotherapists (Experience > 5 Years) were involved in the content validity index [30–32]. The non-probability Convenient Sampling Technique was used for data collection.

Participants

Participants aged 30–60 years were involved, both genders with post-stroke (actively participated in the community and able to read and understand Urdu Language). Participants with other neurological disorders (dementia, psychiatric disorders, speech disorders, neuromuscular disorders etc.) and with unstable medical conditions (diabetes, arthritis, fibromyalgia) were excluded from the study.

Translation steps

The Neurological Fatigue Index Scale (NFI) was translated and cross-culturally validated using Beaton's and COSMIN guidelines [33–36]. The steps of the translation are as follows: (Flow chart of steps is shown in Fig. 1).

First version (forward translation)

The questionnaire was initially translated into Urdu from the original English version of NFI. These steps were performed by two bilingual experts who were proficient in English and whose native language was Urdu and the objective of this study was completely explained to one of them translator who had a medical background as well. The other translator was not aware of the concept being quantified and neither had a medical background.

Synthesis of U-NFI by experts committee

Synthesis of one Urdu version was done with the help of an expert reviewer committee. The expert committee selects the most appropriate translated sentences and the percent agreement was determined.

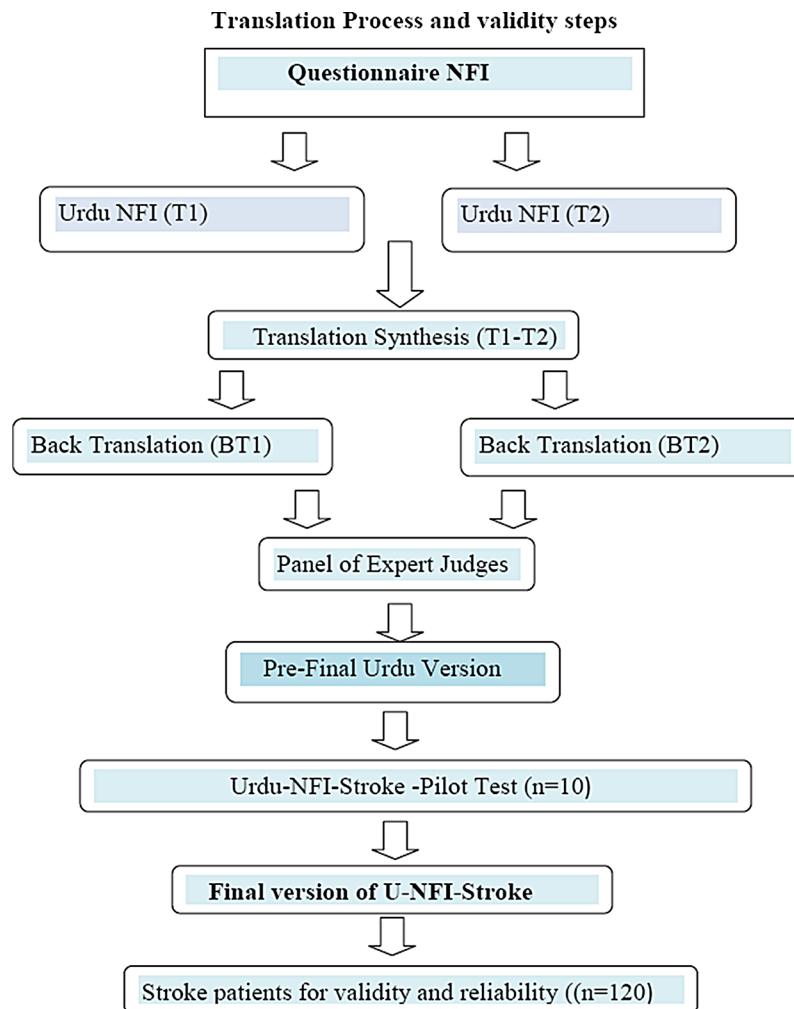


Fig. 1 Steps of translation process

Backward translation

Two bilingual translators fluent in Urdu and English but had no expertise in medicine or knowledge of the ideas being assessed back-translated the preliminary NFI (U-NFI) into English. They did not have access to the original version of NFI. Two backward translation versions were drafted.

Reviewers committee

A team of experts, comprising backwards and forward translators drafted the pre-final version of U-NFI while emphasizing conceptual, semantic and idiomatic similarity to the original NFI.

Pilot testing

Ten stroke participants were involved in the pilot study. Afterwards, all the questionnaire items were discussed with the participants, one by one (face validity). All queries of the individual were heard and recorded regarding the understanding and all prospects of the assessment

tool. The expert committee appraised all the results from the stage of the adaptation process. The main objective was to assess whether the translated questionnaire was comprehensible, the terminology was appropriate, and the expression was pertinent for Urdu-speaking nations; hence a final Urdu version of NFI was drafted.

Final version

The ultimate final version of U-NFI was used for validity and reliability on patients diagnosed with stroke.

Outcome measures

Tools that were used for the validity are as follows:

- Neurological Fatigue Index (NFI) [25].
- Fatigue Severity Scale (FSS) [37, 38].
- Mental Fatigue Test (MFS) [39].
- Beck Depression Inventory (BDI) [40].
- Epworth Sleepiness Scale (ESS) [41].
- Modified Rankin Scale (mRS) [42].

Table 1 Descriptive statistics of 10 individuals with post-stroke included in the pilot testing of the Urdu NFI-Stroke

| No | Age (years) | Gender | Side of paresis | mRS | Stroke type | Duration of stroke | U-NFI-Stroke |
|-----|-------------|--------|-----------------|-----|-------------|--------------------|--------------|
| 1. | 61 | Male | Left | 3 | Ischemic | 6 months | 40 |
| 2. | 55 | Female | Right | 3 | Hemorrhagic | 8 months | 41 |
| 3. | 43 | Female | Right | 2 | Hemorrhagic | 9 months | 40 |
| 4. | 46 | Female | Left | 2 | Hemorrhagic | 6 months | 40 |
| 5. | 44 | Male | Left | 1 | Hemorrhagic | 1 year | 39 |
| 6. | 52 | Female | Right | 2 | Ischemic | 1.4 Year | 44 |
| 7. | 53 | Male | Right | 1 | Hemorrhagic | 9 months | 42 |
| 8. | 51 | Female | Right | 2 | Ischemic | 10 months | 44 |
| 9. | 54 | Female | Right | 2 | Hemorrhagic | 6 months | 43 |
| 10. | 55 | Male | Left | 3 | Hemorrhagic | 7 months | 41 |

[Abbreviations mRS=Modified Rankin Scale; U-NFI: Urdu Neurological Fatigue Index]

Data collection procedure

Participants were given the questionnaires to fill them. The same participants were asked again after a week to complete the form (U-NFI-Stroke).

Data analysis

Data were analyzed by using SPSS version 25.

- Content Validity:** This was determined using the content validity index. A coefficient of 0.7 or above must be obtained for an item to be legitimate.
- Demographic data/Standard Error Mean (SEM)/Minimal Detectable Change (MDC):**
 - Demographic data was determined with descriptive statistics by using frequencies, and mean values. SEM ($SD/\sqrt{120}$) and MDC ($SEM \times 1.96\sqrt{2}$) were calculated.
 - Internal consistency:** Cronbach's alpha was used to measure the internal consistency. The score range from 0.50 to 0.69 is considered poor, 0.70 and 0.79 acceptable, 0.80 and 0.89 good, and the value of Cronbach's alpha that is > 0.90 is considered excellent [43].
 - Test-retest reliability:** Test-retest reliability was determined by using the Intra-class correlation coefficient. ICC values are estimated at a 95% confidence interval; values less than 0.5 indicate poor, 0.50–0.75 indicate moderate, between 0.75 indicate good, and 0.90 indicate excellent reliability. For this computation, individuals responded to the survey twice, with a one-week gap between responses. An ICC value > 0.80 is considered appropriate [44].
- Convergent and Concurrent validity:** The Spearman correlation coefficient was used to determine the convergent and concurrent validity. Negligible correlation ranges from 0.00 to 0.10, weak correlation ranges from 0.10 to 0.39, moderate correlation ranges from 0.40 to 0.69, strong

Table 2 Content validity of Urdu-NFI

| | Relevance | Clarity | Simplicity | Ambiguity | ICVI |
|-----|-----------|---------|------------|-----------|------|
| Q1 | 0.95 | 0.95 | 0.95 | 0.91 | 0.94 |
| Q2 | 0.95 | 0.95 | 0.87 | 0.91 | 0.92 |
| Q3 | 0.95 | 0.91 | 0.87 | 0.87 | 0.90 |
| Q4 | 0.91 | 0.91 | 0.91 | 0.87 | 0.90 |
| Q5 | 0.95 | 0.87 | 0.91 | 0.91 | 0.91 |
| Q6 | 0.91 | 0.95 | 0.91 | 0.91 | 0.92 |
| Q7 | 0.95 | 0.95 | 0.87 | 0.91 | 0.92 |
| Q8 | 0.95 | 0.91 | 0.95 | 0.87 | 0.92 |
| Q9 | 0.91 | 0.91 | 0.95 | 0.91 | 0.92 |
| Q10 | 0.95 | 0.95 | 0.87 | 0.87 | 0.91 |
| Q11 | 0.91 | 0.91 | 0.95 | 0.91 | 0.92 |
| Q12 | 0.95 | 0.91 | 0.91 | 0.87 | 0.91 |

[Abbreviations: NFI=Neurological Fatigue Index; Q=Question; I-CVI=Item-Content Validity Index]

correlation ranges from 0.70 to 0.89, and very strong correlation ranges from 0.90 to 1.00 [45]. FSS, MFS, BDI and ESS were used for the correlations [37–41].

Results

Pilot study

There were a few words which were not understood in the pre-final version by the stroke participants and needed some revision. The pilot study data of the participants is shown in Table 1.

Content validity

According to the Waltz and Bausells method, content validity values were measured by ten physical therapists (who were not involved in the process of translation and have clinical experience of more than 5 years). Experts rated all the items, and all the values were above 0.70 (Shown in Table 2).

Demographic statistics

There were 120 individuals with stroke, with a mean age of 55.42 ± 7.32 . Demographic data is shown in Table 3.

Table 3 Descriptive statistics of 120 patients with stroke

| Descriptive statistics (120 Patients with stroke) | |
|---|--------------------|
| Gender | n (%) |
| Male | 66 (55%) |
| Female | 54 (45%) |
| Age of Participants | Mean ± S.D (Years) |
| Male | 58.5 ± 5.3 |
| Female | 52.6 ± 6.1 |
| Affected side of body | n (%) |
| Right | 83 (69.1%) |
| Left | 37 (39.1%) |
| Type of stroke | n (%) |
| Ischemic/TIA | 74(61.6%) |
| Hemorrhagic | 46(38.3%) |
| Duration of Stroke | n (%) |
| Under 5 months | 0 |
| 6 to 8 months | 34 (28.3%) |
| 9 to 12 months | 75 (62.5%) |
| 12 to 16 months | 11 (9.2%) |
| Modified Rankin Scale | n (%) |
| No Disability | 9 (7.5%) |
| Slight Disability | 88 (73.3%) |
| Moderate Disability | 23 (19.2%) |
| Moderate Severe Disability | 0 |
| Severe Disability | 0 |

[Abbreviations TIA=Transient Ischemic Attack]

Table 4 Mean/ SEM/MDC and Cronbach's alpha of Week 1 and 2 readings of Urdu-NFI

| Week 1 (n = 120) | Physical Component | Cognitive Component | Total (U-NFI) |
|------------------|--------------------|---------------------|---------------|
| Mean ± SD | 27.53 ± 4.62 | 8.69 ± 4.78 | 39.83 ± 5.21 |
| SEM | 0.421 | 0.436 | 0.475 |
| MDC | 1.166 | 1.207 | 1.315 |
| Cronbach's Alpha | 0.84 | 0.83 | 0.86 |
| Week 2 (n = 115) | Physical Component | Cognitive Component | Total (U-NFI) |
| Mean ± SD | 26.89 ± 4.85 | 9.25 ± 4.67 | 40.22 ± 4.81 |
| SEM | 0.442 | 0.426 | 0.439 |
| MDC | 1.224 | 1.180 | 1.216 |
| Cronbach's Alpha | 0.85 | 0.84 | 0.88 |

[Abbreviations SD=Standard Deviation; SEM=Standard Error Mean; MDC=Minimal Detectable Change]

A self-assessment questionnaire was filled out by stroke patients (U-NFI), which contained both physical and cognitive aspects showing strongly disagree, disagree, strongly agree, and agree (4 point Likert scale).

Mean//SEM/MDC (weeks 1 and 2)

Mean values, SEM, MDC and Cronbach's alpha of week 1 and week 2 (physical, cognitive and total U-NFI) are shown in Table 4.

Table 5 Internal consistency and test-retest reliability of the Urdu NFI-stroke (120 stroke patients)

| Test-Retest Reliability | ICC (95% CI) | Lower Bound | Upper Bound | Cronbach's Alpha Coefficient (α) |
|-------------------------|--------------|-------------|-------------|----------------------------------|
| Question 1 | 0.961 | 0.932 | 0.977 | 0.979 |
| Question 2 | 0.815 | 0.696 | 0.891 | 0.895 |
| Question 3 | 0.984 | 0.972 | 0.991 | 0.993 |
| Question 4 | 0.961 | 0.932 | 0.978 | 0.980 |
| Question 5 | 0.849 | 0.748 | 0.911 | 0.923 |
| Question 6 | 0.982 | 0.969 | 0.990 | 0.994 |
| Question 7 | 0.864 | 0.772 | 0.921 | 0.934 |
| Question 8 | 0.750 | 0.598 | 0.850 | 0.856 |
| Question 9 | 0.761 | 0.614 | 0.857 | 0.867 |
| Question 10 | 0.820 | 0.785 | 0.896 | 0.899 |
| Question 11 | 0.786 | 0.721 | 0.797 | 0.810 |
| Question 12 | 0.890 | 0.765 | 0.901 | 0.912 |
| Total | 0.823 | 0.805 | 0.857 | 0.869 |

Abbreviations NFI: Neurological Fatigue Index; W1:Week 1; W2:Week 2; Q1 to Q12:Question 1 to 12]

Internal consistency and test-retest reliability

The intra-class correlation for total U-NFI was ICC=0.823 and items ICC ranged from ICC=0.75–0.99. (Shown in Table 5)

The internal consistency (α) of each item (12 items) is shown in Table 5.

A scatter plot of two weeks' readings (total U-NFI-stroke) is shown in Fig. 2.

Convergent and concurrent validity

Convergent validity was determined by comparing the U-NFI with FSS ($r=0.76$) and MFS ($r=0.68$). The concurrent validity was determined by correlating U-NFI with BDI (0.53) and ESS (0.47). All scales show a positive moderate correlation except FSS which shows a strong correlation. Cognitive and Physical component correlations with FSS, MFS, BDI and ESS were also determined. (Shown in Table 6)

Discussion

The study's objective was to determine the validity of the self-reported NFI-stroke scale in the Urdu language. An Urdu version of this questionnaire was drafted conceptually and semantically equivalent to the original scale, through translation and adaptation. After the pilot study content validity was determined, Item-CVI was ≥ 0.90 and each question CVI ranged from 0.87 to 0.95. Moderate positive intercorrelations between the Urdu NFI and the other questionnaires (MFS, BDI, ESS) were determined through Convergent/Concurrent validity and a strong positive correlation ($r=0.76$) was with FSS ($p<0.01$). Cognitive and physical component correlations ranged from 0.34 to 0.72 ($p<0.01$). Cronbach's alpha was

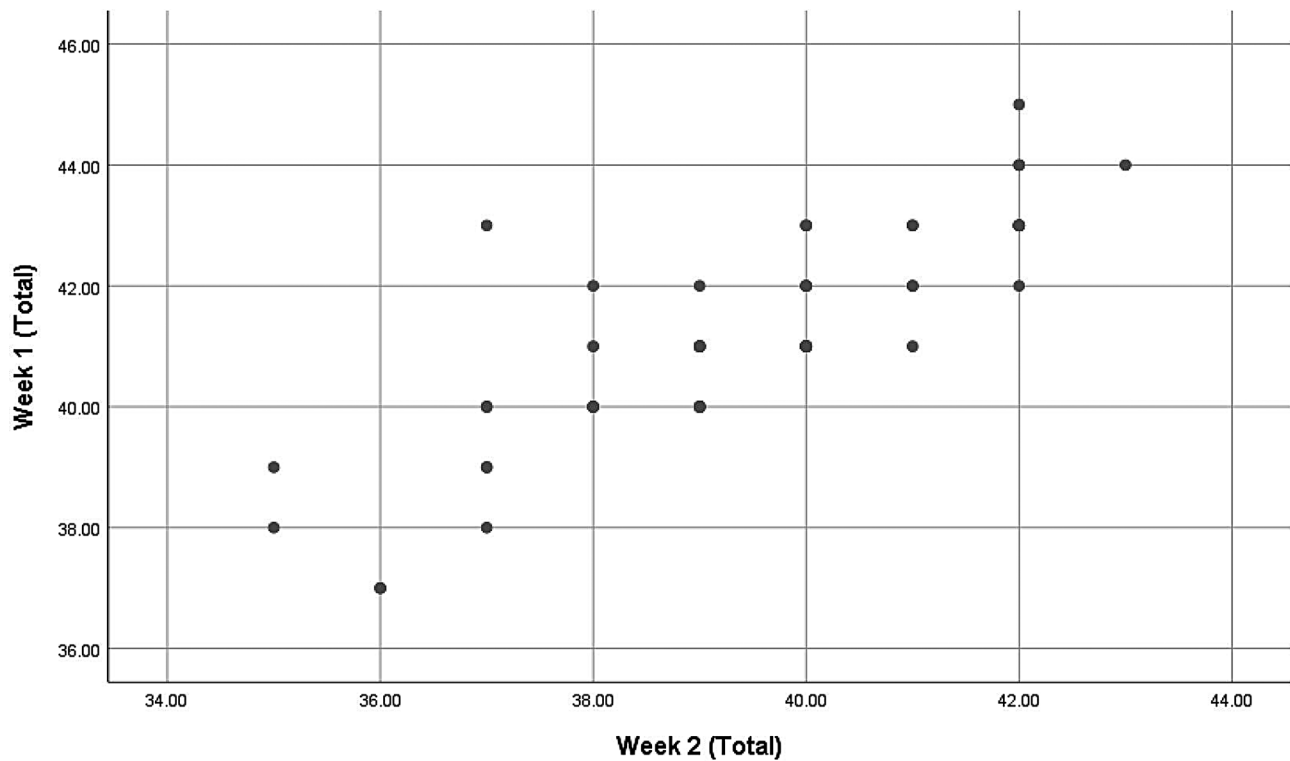


Fig. 2 Scatter Plot of total U-NFI readings Week 1 and Week 2

Table 6 Convergent and concurrent validity (correlations with other scales)

| Scales | Physical Subscale | Cognitive Subscale | Total U-NFI |
|--------|---------------------|---------------------|---------------------|
| FSS | 0.72 ($p < 0.01$) | 0.54 ($p < 0.01$) | 0.76 ($p < 0.01$) |
| MFS | 0.62 ($p < 0.01$) | 0.69 ($p < 0.01$) | 0.68 ($p < 0.01$) |
| BDI | 0.36 ($p < 0.01$) | 0.42 ($p < 0.01$) | 0.53 ($p < 0.01$) |
| ESS | 0.38 ($p < 0.01$) | 0.34 ($p < 0.01$) | 0.47 ($p < 0.01$) |

[Abbreviations NFI=Neurological Fatigue Index; FSS=Fatigue Severity Scale; MFS=Mental Fatigue Scale; BDI=Beck Depression Inventory; ESS=Epworth Sleepiness Scale]

used to calculate internal consistency, and the results for weeks one and two were 0.86 and 0.88, respectively and test-retest reliability was high (ICC=0.823).

The neurological fatigue index (NFI-stroke) has been translated into a few languages. NFI can assess fatigue both physically and mentally [25]. After a stroke, patients usually complain about the feeling of tiredness. PSF can lead to several problems, including behavioural and emotional disturbances [12]. NFI is a self-reported scale for the accurate assessment of subjective feelings about fatigue and can be used for clinical evaluation.

The Urdu version of NFI is a reliable and valid tool and results are comparable to the Chinese version by Lilly YW HO in 2021 of NFI, whose value of α was 0.69–0.88 and ICC=0.88–0.93 [26]. The Chinese version of NFI-stroke was correlated with other scales e.g. fatigue scales correlation $r=0.55$ – 0.63 , with self-efficacy (Spearman) correlation ($r= -0.31$ to -0.37), and for depressive features

correlation was ($r=0.53$ – 0.60). The Urdu version was compared with scales; FSS, MFS, BDI and ESS. Fatigue scale results of the Chinese and Urdu versions were comparable but the Urdu version showed a strong correlation with value $r=0.76$ and other scales showed moderate correlations [26]. Norwegian version of NFI-stroke by Ingrid Tassan in 2020, 82 participants completed the survey two times. The results showed that $\alpha=0.90$ and weighted kappa for chronic stroke 0.89 which were greater than the Urdu translation of the neurological fatigue index in post-stroke patients [27].

Fatigue is a multi-dimensional experience including, physical, emotional and cognitive aspects [14]. The strength of this study was that Urdu-NFI can assess both physical and mental post-stroke fatigue. U-NFI can be useful for the Urdu-speaking community. It can be used in hospitals and clinics for the subjective measurement of fatigue.

The limitation of the study was the participant’s stroke duration was ≥ 6 months (chronic). The modified Rankin Scale (mRS) was used for the clinical evaluation of disability although it is used in the acute stage and the current study patients were in the chronic stage (>6 months). The disability level at the time of stroke was not included in this study. In future, it is recommended that U-NFI-stroke should be used in acute and sub-acute stages of stroke. The Urdu version of NFI can be used for clinical research purposes.

Conclusion

The study concluded that the Urdu version of NFI-stroke showed good content, convergent/concurrent validity, internal consistency and test-retest reliability. The Urdu version may be useful for the Urdu-speaking population as well as for clinicians.

Abbreviations

| | |
|--------|---|
| NFI | Neurological Fatigue Index |
| FSS | Fatigue Severity Scale |
| MFS | Mental Fatigue Scale |
| ESS | Epworth Sleepiness Scale |
| BDI | Beck Depression Inventory |
| mRS | Modified Rankin Scale |
| COSMIN | Consensus-based Standards for the selection of health Measurement Instruments |
| CVI | Content Validity Index |
| ICC | Intra-Class Correlation |

Acknowledgements

Not Applicable.

Author contributions

The study was initially conceptualized by the MI(1), the data were collected by SN, HRJ, MI(2), guidance was done by SSR, and manuscript writing, data analysis and interpretation were done by MI(1).

Funding

No financial support was available for this study.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Institutional Review Committee of Riphah International University Islamabad (Lahore Campus), Pakistan with reference no. REC/RCR & AHS/21/0245 and followed as per guidelines. All the participants provided written informed consent to participate in the study. The method of translation and adaptation used in this work is in line with the Beaton's and COSMIN guidelines. All methods were carried out following relevant guidelines and regulations.

Consent for publication

Pilot study data (10 stroke patients) is shown in the manuscript (publicly) with the consent of participants. All the participants provided written informed consent to publish the data publicly.

Competing interests

The authors declare no competing interests.

Received: 30 December 2023 / Accepted: 26 August 2024

Published online: 06 September 2024

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