



## Reliability and Validity of the Tamil Version of the Borg Scale of Rate of Perceived Exertion

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### KEYWORDS

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ess,  
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Validity.

### ABSTRACT:

**Background:** The BORG Scale of rate of perceived exertion (RPE) is a valid, reliable, and widely used tool. Yet, there is no Tamil (Indian language) version of this tool. Hence, this study was conducted to translate, to find out face validity, and criterion validity of the Tamil version of Borg's RPE, and to find out the reliability analysis of the Tamil version of Borg's RPE. **Methods:** The original English version of the BORG scale of RPE was cross-culturally adapted to the Tamil version following the American Association of Orthopedic Surgeons' guidelines. The process involved forward and back-translations, review by an expert committee, pre-testing, and cognitive debriefing with 60 subjects to produce the Tamil version of the BORG scale. Criterion validity was demonstrated by the correlation of the Tamil version of Borg's RPE with VAS (dyspnea on exertion) at the same time, for 60 participants (18-25 years). As exertion is inducible with the Six Minute Walk Test, 60 normal subjects were made to do the six-minute walk test and the level of exertion was assessed using both the Tamil version of Borg's RPE and VAS (dyspnea on exertion). The test-retest reliability was determined by administering the Six Minute Walk Test to 60 participants after an interval of one week. **Results:** The test-retest reliability was excellent ICC= 0.720(0.572- 0.823). Internal Consistency was found to be good (Cronbach's alpha=0.837). The Tamil version of Borg's scale of RPE showed significant correlation by comparing against VAS(dyspnea on exertion) and Spearman's rho (0.849), p-value <0.001. The statistical analysis shows there is a relatively high positive correlation, test-retest reliability, with excellent agreement and an overall R-value of 0.812. **Conclusion:** The Borg's scale translation and adaptation processes were successful. The Tamil translation of the Borg scale of RPE was found to have a relatively high positive correlation. The test- retest reliability showed excellent agreement, with an overall r value of 0.812 high positive correlation.

### 1. Introduction

Dyspnea or SOB is used to define the sensation of having trouble breathing that is made up of several emotions of varying intensity. The major symptom of a pulmonary, cardiac, neuromuscular, psychogenic, or systemic illness or both, is regularly experienced by millions of individuals. Dyspnea can be transient or chronic, lasting anywhere from a few hours to a few days for acute symptoms and more than four to eight weeks for persistent symptoms. Dyspnea can be transient or chronic, with acute symptoms lasting a few hours to a few days and chronic symptoms lasting more than four to eight weeks<sup>1</sup>. Peak flow, blood gas analysis, and

asking patients several questions about their breathing during a period when they find it difficult to talk are frequently the only methods used to measure dyspnea, or the condition of being short of breath. It has long been believed that dyspnea in advanced COPD is brought on by functional inspiratory muscle weakening<sup>2</sup>. The most used submaximal exertion test in pulmonary and cardiac rehabilitation is the 6 Minute Walk Test<sup>3</sup>. Borg's rating of perceived exertion (RPE) is a popular psycho-physical measure for gauging how much effort one feels when exercising. Independent of gender, age, exercise modality, physical activity level, and CAD status, Borg's RPE appears to be an economical, useful, and reliable



instrument for monitoring and prescribing exercise intensity. For those who are less fit, exercising at an RPE of 11–13 (“low”) is advised, while an RPE of 13–15 (somewhat Hard,Hard) may be suggested when more strenuous but still aerobic exercise is required<sup>4</sup>. For those who are less fit, doing work at an RPE of somewhat hard is advised, while an RPE of 13–15 (somewhat Hard, Hard) may be suggested when more strenuous but aerobic exercise is required. The Borg Scale for ratings of perceived exertion, ratio-scaling methods, category methods, and a new technique that combines the category method with ratio features are all discussed. Both theoretical-psychophysical and psychophysiological research explore some of the benefits and drawbacks of various methodologies<sup>5</sup>. Rating of perceived effort (RPE) in relation to a subject's developmental stage. Both an estimating paradigm, which quantifies the effort sense at a specific degree of exercise, and a production paradigm, which includes generating a specific physiological effort based on an RPE value, have been used to use RPE in the exercise environment<sup>6</sup>. RPE score is a popular psychosomatic measure for gauging how much effort one feels when exercising. Borg's RPE appears to be an affordable, practical, and reliable instrument for measuring and exercise intensity prescription, regardless of gender, age, exercise type, physical activity level, or CAD status<sup>7</sup>. The exercise modality, test methodology, and age have an impact on Rate of Perceived Exertion levels, which is similar to observations observed in younger children<sup>8</sup>. For those who are less fit, doing work at an RPE of somewhat hard is advised, while an RPE of 13–15 (somewhat Hard, Hard) may be suggested when more strenuous but aerobic exercise is required<sup>9</sup>. The prevalence of chronic obstructive pulmonary disease (COPD), which is linked to lower health-related quality of life and greater mortality, is growing globally. Even with the best bronchodilator medication, many COPD patients suffering capacitating dyspnea and activity limitations<sup>10</sup>. Exercise limitation and dyspnea in these individuals are multifaceted, but their primary causes include abnormalities in lactic acid metabolism, abnormalities in pulmonary gas exchange, severe dynamic mechanical limits, and functional respiratory muscle weakness in various combinations. The Borg scale, which has been demonstrated to correlate with the HR and maximum oxygen consumption, is the most extensively used RPE

tool (Borg, 1998; Mihevic, 1981; Riebe et al., 2017). Although the Borg scale is mostly accurate, kids could have trouble to understand (Chen et al., 2017). The Borg scale and HR and maximum oxygen uptake have lower correlation coefficients in the elderly than in young adults<sup>8</sup>. Another independent predictor for heart failure patients' prognosis is physical exercise (Izawa et al., 2013). As a result, it's critical that people with heart disease keep up their normal exercise routine. Exercise volume is usually gauged<sup>11</sup>. Dyspnea in advanced COPD is thought to be caused by functional inspiratory muscle weakness over a long time. In order to understand man at work, perceptions of perceived effort are greatly desired. These assessments serve as essential complements to behavioural and physiological exams that measure a person's physical prowess and work capability. This is supported by theoretical investigation as well as actual use in the fields of medicine, human factors, and sports. When characterising generic perceptual variation, perception estimates derived using Methods of psychophysical ratio scaling are reliable; however, when describing individual differences, category methods are more beneficial<sup>12</sup>.

The RPE score ratio-scaling methods, category methods, and a new technique that combines the categorical procedure with ratio features are all discussed. Theoretical-psychophysical research, as well as psychophysiological research examine some of the advantages and disadvantages of various approaches<sup>13</sup>. Rating of perceived effort (RPE) in relation to a subject's developmental stage. Both an estimating paradigm, which quantifies the effort sense at a specific degree of exercise, and a production paradigm, which includes generating a specific physiological effort based on an RPE value, have been used to use RPE in the exercise environment<sup>9</sup>. If someone gives themselves a high rating while feeling exhausted and out of breath, they may be placing themselves in danger for harm. This suggests that they should ease off and lessen their effort. Additionally, it can be a useful tool for people as their level of fitness varies. After some time, one could notice that maintaining the same speed when jogging or cycling results in a decreased RPE score<sup>14</sup>. A mental sensation of work associated with voluntary acts is referred to as "perception of effort," also known as "perceived exertion" or "sense of effort". It appears that compared to adulthood, the RPE-heart rate (HR) association is less



significant throughout adolescence. The exercise modality, test methodology, and age have an impact on Rate of Perceived Exertion levels, which is similar to observation in younger children. Heart rate or rate of perceived effort (RPE) is frequently used to gauge the intensity of an exercise session<sup>15</sup>. However, when used with older persons, each technique has issues. For instance, in the presence of certain drugs or arrhythmias, HR may not be accurate<sup>16</sup>. The most used RPE gauge is the Borg's scale, which has been shown to correspond with maximal oxygen uptake and heart rate. Children may find it difficult to grasp, despite the Borg scale's relative accuracy<sup>17</sup>. In comparison to young individuals, the association between the Borg's scale and maximal oxygen intake by the heart is lower in the elderly. Regular exercise has a proven track record for secondary myocardial infarction prevention. The level of daily physical activity is linked to cardiovascular death<sup>18</sup>. Another independent predictor for heart failure patient prognosis is physical exercise. As a result, it is critical that people with heart disease keep up their normal exercise routine. As the RPE score is a widely used, valid and reliable tool in measuring patient symptoms and in clinical settings, it will be of immense need to translate it to Tamil so that it can be widely used during the rehabilitation of Tamil speaking population<sup>19</sup>.

## 2. Objectives

The BORG Scale of rate of perceived exertion (RPE) is a valid, reliable, and widely used tool. Yet, there is no Tamil (Indian language) version of this tool. Hence, this study was conducted to translate, to find out face validity, and criterion validity of the Tamil version of Borg's RPE, and to find out the reliability analysis of the Tamil version of Borg's RPE.

## 3. Methods

Before the study, an INSTITUTIONAL ETHICAL CLEARANCE (IEC number 8347/IEC/2022) was obtained from the IEC of SRM Medical College Hospital & Research Centre, Kattankulathur. The participants were informed about the procedure of the study. Informed consent was obtained before the procedure from the participants.

### Participant

This study was conducted at the Physiotherapy department of SRM College of Physiotherapy from June

2022 to December 2022. Sixty participants were undergone for this study.

**Step 1: Forward Translation:** Initial Translation to the Tamil language from the original English version of the Borg scale. The initial translation of the Borg scale [RPE] was translated into Tamil. The Borg Scale was translated into Tamil by two bilingual people: a pulmonologist and a cardiopulmonary physiotherapist who both speak Tamil as their mother tongue.

**Step 2: Synthesis:** In order to reach an agreement on the translated Borg scale [RPE] without changing the original version, the two translators met.

**Step 3: Back Translation:** The two linguists, who are competent in Tamil and English, performed the back translation of the preliminary Borg scale [RPE]. Translators should not work in the medical or paramedical fields and should not be familiar with the original scale.

**Step 4: Reviewer's Committee:** A pulmonologist, two physical therapists, and two back translators worked together to create the final version of the scale.

**Step 5: Face Validity:** The pre-final scale was given to 10 participants to evaluate the understanding of each item. By this, face validation of each item was determined based on the impact score reported by the participants. The impact score of more than 1.5 indicates proceeding with the steps further. The pre-final and final Tamil versions of Borg's Rate of Perceived Exertion would be the same because no additional adaptation was mentioned. The major goal was to determine if the translated scale could be used across cultures and understood by Tamil-speaking people.

**Step 6: Criterion Validity** was demonstrated by the correlation of the Tamil version of Borg's RPE with VAS (dyspnea on exertion) at the same time, for 60 participants (18-25 years). As exertion is inducible with the Six Minute Walk Test, 60 normal subjects were made to do the six-minute walk test and the level of exertion was assessed using both the Tamil version of Borg's RPE and VAS (dyspnea on exertion).

**Step 7: Reliability Analysis:** The test-retest reliability was determined by administering the Six Minute Walk Test to 60 participants, after an interval of one week.



## INSTRUMENTS

### BORG RATE OF PERCEIVED EXERTION (BORG RPE)

#### 4. Results

The translated Borg scale of Rate of Perceived Exertion (RPE) was found to have a relatively high positive correlation. The test-retest reliability showed excellent agreement, with an overall  $r$  value of 0.812 high positive correlation.

The International Business Machines Statistical System for Social Science (SPSS) version 20 for Windows was used to tabulate and interpret the data obtained. Based on the Kolmogorov-Smirnov test's normality test, the participants' ages were represented as Mean and Standard Deviation (KS test) Shapiro-Wilk test was implemented to assess the normality of the data that was received. Since the data deviates from a normal distribution. Tamil Version of Borg's RPE and VAS construct validity was tested using Spearman's rank correlation (Dyspnea on Exertion). The following was determined for the correlation's strength as weak ( $r < 0.25$ ), moderate ( $0.25 < r < 0.50$ ), good ( $0.50 < r < 0.75$ ), and excellent ( $r > 0.75$ ). Internal consistency of the Tamil Version of Borg's RPE was evaluated using Cronbach's alpha coefficient, with the acceptable value being 0.70–0.95. The first and second administrations of Borg's RPE Tamil translation were used to compute it. Test– retest reliability of the Tamil Version of Borg's RPE was evaluated after 2 days by an intraclass correlation coefficient (ICC). The coefficient can range from 0 to 1, and a coefficient  $> 0.7$  indicates good reliability. For all the statistical analyses, the level of significance was set at  $p < 0.05$ .

Participants- The demographic variables of the participants were tabulated in Table 1, which demonstrates that the mean age of the participants is  $21.58 \pm 2.36$  years (including both male & female).

Character	Mean	SD
Age	21.58	2.36

#### Construct Validity

Construct Validity of Tamil Version of Borg's RPE and VAS (Dyspnea on Exertion). Table 2: shows the construct validity between the Tamil version of Borg's

scale of RPE and the VAS (dyspnea on exertion) with Spearman's rho of 0.849, which shows excellent correlation strength.

Tamil version of borg scale RPE	Spearman's RHO	P-value
VAS	0.849	0.000

#### Test-Re Test Reliability Tamil Version

Correlation of Test-Re Test Reliability Tamil Version of Borg's Scale of RPE, Table 3: shows the internal consistency of Tamil Version of Borg's Scale of RPE by Cronbach's alpha of 0.837, which shows a value of 0.70–0.95 and stability reliability is expressed by Intra Class Correlation (ICC) of 0.720 (0.572-0.823), which indicates good reliability.

	MEAN	SD	Cronbach's Alpha	ICC
Test	11.08	3.14	0.837	0.72
Retest	7.81	1.90		

#### 5. Discussion

The study was carried out to undertake a cross-cultural adaptation and psychometric examination of the most often used therapeutic, valid, and reliable subjective scale- Borg's Scale of RPE. So that it can be used for symptom assessment and exercise intensity prescription in Tamil speaking population. The study was done strictly according to the guidelines<sup>20</sup>.

The original category of the Borg's scale was forward translated into the Tamil language by two bilinguals, one Pulmonologist, one Cardiopulmonary Physiotherapist (Translator 1- T1 and Translator 2 - T2). A common consensus was attained after a meeting between the two forward translators. This category was given for back translation to English, to two backward translators, who were non- medical people, not aware of the original Borg's Scale of RPE. The pre-final Tamil variant of Borg's scale of RPE was obtained after a meeting was conducted among the forward and backward translators. The original English version of the Borg scale of RPE maintained a scale from 6 to 20, where 6 means "very light", and 20 means "maximum effort. The back translation was compared to the original version of the scale, thus allowing for the Tamil Variant போர்கின்



அயற்சி அளவு கோல்<sup>21</sup>. Age-related differences in perceptual responsiveness may not exist in healthy middle-aged and older people as long as differences in cardiorespiratory fitness are included<sup>22</sup>. With a scale from 0 to 10, where 0 represents "no vocal effort at all" and 10 represents "maximum vocal effort," the Escala Borg CR10-BR adaptada para esforço vocal maintained the original's structure<sup>23</sup>. In order to compare the differences between the converted and original English variant of the RPE score, the following linguistic and structural evaluation was conducted before the Tamil Borg scale was created. The organisation adjusted the question's wording by removing or substituting a few terms to make it more relevant to the Tamil community. After a week, 60 participants were made to do the Six-minute Walk Test again, and the Final Tamil variant of RPE was given to them for the second time to demonstrate the Internal consistency and test-retest reliability. The internal consistency of the Tamil variant of the RPE scale by Cronbach's alpha was 0.837, which is within the acceptable value of 0.70–0.95, and test-retest reliability was expressed by Intra Class Correlation (ICC) of 0.720 (0.572-0.823), which indicates good reliability.

The RPE scales, converted into Cantonese shows good validity and reliability. When it comes to a measure of felt effort that can be utilised with Hong Kong adolescents, the efforts may be preferable to the RPE scale. Hence, this scale will be useful for both researchers and clinicians to measure exertion as outcomes in clinical evaluations and research in Tamil speaking population. The final Tamil variant of the scale was given to 10 participants to evaluate the understanding of each item and establish the face validation and the Final Tamil version of Borg's Scale of RPE was obtained. It followed the same structure and number of words as the original English form, ensuring it had similar items. As no other scale in the Tamil language was found to compare with Borg's RPE scale for criterion validity, VAS (dyspnoea on exertion) was used to test against the translated final Tamil version of Borg's scale RPE. 60 participants were made to do the Six Minute Walk test, and 24 at the end of the test were made to mark their level of exertion using the final Tamil version of Borg's scale RPE and VAS. Construct validity showed excellent correlation between the two scales with Spearman's rho of 0.849 and  $p < 0.05$ .

## Conclusion

The version of the scale translated into Tamil language Borg Scale of Rate of Perceived Exertion (RPE), is linguistically and culturally equivalent to the original English version of Borg's scale (RPE).

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