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# Validation of the Yoruba version Modified Borg Scale for assessing dyspnea in asthma

Rufus Adesoji Adedoyin, Gregory Efosa Erhabor, Tolulope Abiola Aikomo, Matthew Olatokunbo Olaogun, Luqman Adekele Bisiriyu, Olubusola Esther Johnson, Mukadas Oyeniran Akindele, Theresa Odunayo Akinola

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## Research Report

**RA Adedoyin**
Dept of Medical Rehabilitation, Obafemi Awolowo Univ, Ile-Ife, Nigeria, PhD, MNSP

**GE Erhabor**
Dept of Medicine, Obafemi Awolowo Univ, Ile-Ife, Nigeria, MBBS, FWACP, Prof

**TA Aikomo**
Dept of Physiotherapy, Univ of Ilorin Teaching Hospital, Ilorin Nigeria, BMR, PT

**MO Olaogun**
Dean, Faculty of Basic Medical Sciences, Obafemi Awolowo Univ, Ile-Ife, Nigeria, MS, FNSP, Prof

**LA Bisiriyu**
Dept of Demography and Statistics, Obafemi Awolowo Univ, Ile-Ife, Nigeria, MSc

**OB Johnson**
Dept of Medical Rehabilitation, Obafemi Awolowo Univ, Ile-Ife, Nigeria, MSc, PT, MNSP

**MO Akindele**
Physiotherapy Dept, Bayero University, Kano, MSc, PT

**TO Akinola**
Dept of Physiotherapy, Ikeja, Lagos, MSc, PT

**Address correspondence to:**
RA Adedoyin, PhD, MNSP
Senior Lecturer and Post Graduate Program Coordinator, Department of Medical Rehabilitation, Obafemi Awolowo University, Ile-Ife, Nigeria
E-mail: radedoyi@yahoo.com

**Purpose:** While substantial evidence demonstrates the modified Borg Scale (MBS) to be a valid outcome measure in determining physical exertion in patients with cardiorespiratory dysfunctions, it has not been proven if it will be useful for Nigeria subjects in which English is not their first language and have to depend on translation from English to vernacular. This study aimed to compare Yoruba MBS with visual analog scale (VAS) in measuring level of exertion in patients with asthma. **Material and methods:** Fifty patients with asthma and fifty apparently healthy control subjects participated in the study. Mean age for patients with asthma was 21.50±2.53 years and 21.40±2.20 years for control subjects. Each subject exercised on bicycle ergometer for 6 minutes. The exercise started with a 20 W load which was increased by 8 W every minute. Level of exertion was rated immediately after the exercise using VAS and Yoruba MBS concurrently. **Results:** Results of the correlation matrix revealed high correlations between VAS and Yoruba MBS ($r=0.835$; $p<0.01$) for the patients with asthma and also for healthy subjects ($r=0.932$; $p<0.01$). **Conclusion:** The result implied that Yoruba MBS is valid in measuring the level of exertion in Nigerian patients with asthma.

**Key words:** Asthma, Visual Analogue Scale, Yoruba Modified Borg Scale.

## Astmada dispneyi değerlendirmede Yoruba versiyonu Modifiye Borg skalasının geçerliği

**Amaç:** Modifiye Borg skalasının (MBS) kardiyorespiratuar disfonksiyonu olan hastalarda fiziksel zorlanmayı belirlemede geçerli bir ölçüm yöntemi olduğunu gösteren yeterli kanıt olmakla birlikte, bunun anadilleri İngilizce olmayan Nijeryalı olgular için çevirisi yapılmış versiyonunun da geçerli olduğunu gösterir bir çalışma bulunmamaktadır. Bu çalışma, Yoruba MBS'yi astmalı hastalardaki zorlanmanın ölçümü amacıyla görsel analog skalası (VAS) ile karşılaştırmayı amaçlamaktadır. **Gereç ve yöntem:** Çalışma grupları 50 astmalı ve 50 sağlıklı bireyden oluştu. Astmalı hastaların yaş ortalaması 21.5±2.53 yıl, kontrol grubu bireylerinin 21.4±2.2 yıldı. Her olgu 6 dakika süreyle bisiklet ergometresinde egzersiz yaptı. Egzersiz düzeyi egzersizin hemen ardından VAS ve Yoruba MBS ile değerlendirildi. **Sonuçlar:** Korelasyon analizi gerek astmalı bireyler ($r=0.835$; $p<0.01$) ve gerekse sağlıklı bireylerde ($r=0.932$; $p<0.01$) VAS ile Yoruba MBS arasında anlamlı ilişki gösterdi. **Tartışma:** Bu sonuçlar Yoruba modifiye Borg skalasının Nijeryalı astmalı hastaların zorlanma düzeyini belirlemede geçerli bir ölçüm olduğunu gösterdi.

**Anahtar kelimeler:** Astma, Görsel analog skalası, Yoruba Modifiye Borg skalası.

Asthma is the sixth greatest cause of morbidity according to World Health Organization.[1] An estimated incidence of 2.4% in a school survey in Ibadan, Nigeria was reported by Sofowora.[2] Several physical training programs have been developed to enable asthmatic patients live more achievable lives and also help them in overcoming their fears of having exercise induced asthma.[3]

It is imperative to rate the intensity of breathlessness caused by exertion during exercise performance in patients with asthma. This is especially so because despite the fact that exercise has been found to predispose patients with asthma to attacks. Carefully progressed and supervised exercise programs have been shown to help in building up the respiratory endurance and physical conditioning of the this group of individuals.[4,5]

Because the sensation of dyspnea is a sensory experience that is perceived and interpreted and rated by the individual, the accuracy of such measurement will grossly depend on clear understanding of such tools by the individuals. Studies have clearly showed that the Modified Borg Scale (MBS) is a valid and reliable tool for qualifying dyspnea in subjects with chronic obstructive pulmonary disease (COPD).[5-7]

The study of Simon and associate however found out that patients used a variety of expression when asked to describe their symptoms of breathlessness.[8] This might be an indication of different sensory experience rather than a single experience by the patients. It is therefore very difficult for patient who's English is not his or her first language to fully understand and interpret MBS, since it is designed in English language and in a different population setting. It may however difficult to use in an environment like that of this study, where Yoruba is a major language. Since MBS is similar to Visual Analogue Scale (VAS) which has also be found to be reliable in assessing dyspnea this study therefore sought to validate the Yoruba translation of MBS with VAS.

Visual analogue scale is a modification of numerical scale used in rating level of exertion during exercise. Aitken et al reported the use of VAS in the quantification of sensations experimentally induced by resistive loading on patients.[9] Since that time, the VAS has been validated in terms of reproducibility and sensitivity for the direct quantification of breathlessness induced by ventilatory stimuli both in normal subjects and patients with respiratory distress.[10] It has been used both in clinical tests and in studies of physiological mechanisms underlying the sensation of breathlessness. The VAS is extremely useful and is a rapid method of evaluating the effects of treatment. Its value in tracing the progress of the patient is immense. It seems an accurate and reproductive scale.[9]

Borg scale used to measure breathlessness in the study of perceived efforts of exertion during physical work. The scale initially ranged from 6-20 but it has been modified to make it more suitable for the purpose of assessing the severity of breathlessness. This MBS is therefore similar to the visual analogue scale in dimension and purpose of use. The Borg scale is reliable, convenient and easy to apply in large population studies.[11]

Since dyspnea is one of the common and significant complaints of patients with asthma, its assessment and monitoring is essential. However, instruments for measuring shortness of breath are often limited to physiological measurements for possible causes and asking patients multiple questions about breathing at a time when they find speaking difficult.[12,13] We compared Yoruba MBS with VAS to measure level of exertion in patients with asthma.

## Material and methods

**Subjects:**

One hundred volunteers consisting of 50 patients with asthma (30 females and 20 males), and 50 apparently healthy subjects, (25 females and 25 males) participated in the study. Healthy subjects served as control group. Subjects were all screened by a chest consultant at the respiratory unit of Obafemi Awolowo University Teaching Hospital Complex (OAUTHC) Ile-Ife, Nigeria before recruitment.

Diagnosis of asthma was based on symptoms such as wheezing-high-pitched whistling sound, history of cough, difficult breathing. Asthma was also considered when peak expiratory flow (PEF)

increases more than 15% 15 to 20 minutes after inhalation of rapid acting beta agonist, or bronchodilator (more than 10% in patients who are not taking a bronchodilator, or if PEF decreases more than 15 % after 6 minutes of sustained exercise[14].

The inclusion criteria were clinically stable asthma, confirmation of past history of attack, drug requirement and the resting PEF, presence of an attack of less than 3 months, and PEF above 70% of the predicted value, patients with mild to moderate asthma, who must not require more than inhaled steroids or bronchodilators for maintenance, patients without history of any concurrent pulmonary or cerebrovascular disease or musculoskeletal abnormality (that could prevent exercise performance). Patient was excluded if diagnosis uncertain, and if exercise can worsen his or her condition. Those with an acute asthmatic attack were also excluded

**Instrumentation:**

The weight was measured in kilograms with the subject in standing position and shoes off. With the heels, the back and the occiput touching the stadiometer scale and the subject looking straight ahead, the height was measured. The body mass index was calculated as weight/height$^2$ (kg/m$^2$).

The MBS and VAS were used to evaluate dyspnea during exercise.[13] The MBS was interpreted to Yoruba language by an academic staff that is fluent in both English and Yoruba languages. The translated version was given to another person who had not seen the original version of MBS to translate it back to English language. The translation was found to be closely related (Appendix).

**Procedure:**

The research protocol was approved by the ethical committee of the OAUTHC Ile-Ife, Nigeria. The procedure of the study was explained to the subjects and an informed consent form was duly signed. Subjects were then informed that if at any time during the exercise test, they feel short of breath, excessive fatigue or discomfort, the exercise test will be terminated immediately and they would not be required to complete the exercise protocols. The physical characteristics were then measured, as well as the resting PEF.

Each subject was then made to sit on a bicycle ergometer (Monark, Sweden) which was adjusted to the level of the hip for each participant to have a slight bend in the knee joint and the ball of the foot was on the pedal for proper alignment of the body and comfort.

The initial workload was set at 20 W and increased by 8 W every minute until the subject was unable to maintain the pedaling frequency or voluntary signified intention to stop. The pedaling was kept at 60 to 75 revolutions per minute.[15] There was a stand-by hydrocortisone injection and beta agonist inhaler for emergence cases.

The subjects were asked to rate their levels of exertion using VAS and Yoruba MBS concurrently immediately after the exercise. Two patients with asthma were unable to complete the study due to excessive chest pain. Their data were removed from the final analysis.

**Statistical analysis:**

Data were analyzed using descriptive statistics of mean, and standard deviation to describe the result obtained, and interferential statistics of Pearson - product moment correlation to relate VAS with Yoruba BMS. Significant level was set at $p < 0.05$.

## Results

The physical characteristics of the subjects are presented in Table 1. The mean ages of the asthmatic and healthy subjects were 21.50±2.53 years and 21.40±2.20 years, respectively. The mean weight for the asthmatics and healthy subjects were 59.7±8.55 kg and 59.96±7.10 kg, respectively, and also the mean height for asthmatics and healthy subjects were 1.70±0.2 m and 1.66±0.2 m, respectively.

*t* test analysis showed that the asthmatics and the healthy subjects were comparable in age, weight, height and body mass index ($p>0.05$) (Table 1).

Correlation matrix between VAS and Yoruba MBS revealed high correlation between the two outcome measures in asthmatic ($r=0.835$), and in normal subjects ($r=0.932$) (Table 2).

**Table 1. Physical characteristics of the subjects.**

| | Asthmatics (N=50) Mean±SD | Healthy (N=50) Mean±SD | p |
|---|---|---|---|
| **Age** (yrs) | 21.5±2.5 | 21.4±2.2 | 0.818 |
| **Body weight** (kg) | 59.7±8.6 | 60.0±7.1 | 0.893 |
| **Height** (m) | 1.7±0.2 | 1.66±0.2 | 0.945 |
| **BMI** (kg/m$^2$) | 21.9±2.3 | 21.9±2.4 | 0.508 |

BMI: Body Mass Index.

**Table 2. Correlation between visual analogue scale (VAS) and modified Borg Scale in both asthmatic and healthy subjects.**

| | Yoruba Modified Borg Scale | |
|---|---|---|
| | Asthmatics | Healthy |
| **VAS** | | |
| Asthmatics | 0.835* | |
| Healthy | | 0.932* |

* Correlation is significant at p<0.01 level.

## Discussion

Result of this study revealed a significant correlation between the VAS and the MBS in assessing the level of exertion in both patients with asthma and normal subjects. The Yoruba MBS adapted for this study was initially for the rating of pain among subjects with chronic low back pain within the same population used for this study.[16] The authors reported a strong correlation between VAS and Yoruba MBS.

Although various instruments for evaluating breathlessness exist in the literature, the choice of a particular instrument for measuring treatment effectiveness is usually dependent on therapist decision. Cullen and Rodak reported that the most effective measure for a specific patient condition or treatment remains largely unexplored in the respiratory literature.[12] In line with this Mishoe and MacLean, therefore, recommend that only those tools that have documented sound psychometric such as validity, reliability and responsiveness among others be applied to clinical practice and research.[17] Since each measurement is known to be limited by its purpose and design the application of each instrument is therefore related to the purpose and design of such instrument.[17]

Though the validity and reliability of MBS in assessing breathlessness is well documented in the literature, this may not be valid for the population in which the present study was conducted. The reason being that the scale has to be translated by therapists into vernacular using different words for different patients. The instrument may yield data, but score may have limited meaning, since the measure has not been validated for the general population. Caution should therefore be exercised as the data generated may lack clinical relevance.

The present study is limited for generalization because of few numbers of subjects recruited for the study and for the fact that the study was conducted among the young adults only. Nevertheless, the outcome of this study is valuable for clinical assessments of breathlessness among patients with asthma that are from Yoruba ethnic group. The Yoruba MBS could provide quick, easy and rapid information about a patient's subjective state of dispread during patient rehabilitation than original version for the people of Yoruba people in diaspora.

Further study with large sample size across age groups and among other major ethnic group in Nigeria are recommended.

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**Appendix. Modified Borg Scale [English Translated Version (Yoruba)[19]].**

| | | | |
|---|---|---|---|
| Nothing at all | Kò sí èémí tó nira rárá | ☐ | 0 |
| Very slight | Fééréfé | ☐ | 1 |
| Slight | Ópò díè | ☐ | 2 |
| Moderate | Níwòntunwònsì | ☐ | 3 |
| Somewhat severe | Ófé lágbára díè | ☐ | 4 |
| Severe | Ólágbára | ☐ | 5 |
| Severe | Ólágbára | ☐ | 6 |
| Very severe | Ólágbára gan | ☐ | 7 |
| Very, very Severe | Kíkan Kíkan | ☐ | 8 |
| Almost maximal | Ófé pòjù | ☐ | 9 |
| Maximal | Ópò jù | ☐ | 10 |