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Translation, cross-cultural adaptation, and psychometric testing of the STarT musculoskeletal tool into Yoruba language among persons with low back pain

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Abstract

Background The STarT Musculoskeletal (MSK) tool is a validated tool used to stratify patients with musculoskeletal disorder, as a guide to applying intervention and prognosticating outcomes. Only few translations and cultural adaptations of it exist. The availability of the tool in local and indigenous languages may help improve comprehensibility and usage among patients. This study was aimed to translate and cross-culturally adapt the STarT MSK tool into the Yoruba language, and to determine its psychometric properties.

Methods The first stage of this study involved translation of the English STarT MSK into the the Yoruba language following the Beaton criteria. A total of 55 respondents with low- back pain attending a University Teaching Hospital participated in the validity testing, while 25 patients responded in the reliability test of the tool. The Quadruple Visual Analogue Scale (QVAS) and the Fear Avoidance Belief Questionnaire (FABQ) were used for the convergent and the discriminant validity of the tool.

Results The mean age of the respondents was 52.13 ± 13.21 years. The Yoruba version of the STarT MSK (STarT MSK–Y) had an acceptable concurrent validity ($r = 0.993$; $p = 0.001$). The discriminant validity of STarT MSK–Y with FABQ yielded correlation co-efficient scores of $r = 0.287$; $p = 0.034$ and $r = 0.033$; $p = 0.810$ for FABQ-Work and FABQ-physical activities. The result indicated that STarT MSK–Y had fair discriminant validity with FABQ-work and a weak correlation with the FABQ-physical activities. The convergent validity of STarT MSK–Y indicated significant correlations with all domains and global score of the QVAS ($r = 0.727$; $p = 0.001$). The test- retest reliability and internal consistency (Cronbach's alpha = α) of the STarT MSK–Y yielded ICC = 1.00 and α = 0.97 for the global score of the items, respectively. The factor loading for five items were satisfactory ranging from 0.46 to 0.83.

Conclusion The STarT MSK–Y has acceptable validity and reliability and can be used as a valid assessment tool among Yoruba-

speaking patients with low back pain.

Keywords Cross-cultural adaptation, Low back pain, Psychometric testing, STarT musculoskeletal tool, Translation, Yoruba

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Background

Musculoskeletal disorders (MSDs) are one of the primary reasons people seek medical care worldwide [1]. MSDs are the largest causes of disability globally, with low back pain (LBP), being the most common type, affecting approximately 577 million people [2]. In line with foregoing, the 2019 Global Burden of Disease study findings ranked conditions such as LBP as the greatest contributor to global disability and ninth in terms of disability-adjusted life years (DALYs) [3]. LBP is the leading cause of activity limitation, leading to a reduction in productivity at work, and incurs high medical expenses annually [4, 5], with the lifetime prevalence reported as about 70% in the industrialized population and peak prevalence between ages 35 and 55 [6].

Assessing the severity, impact, and prognosis of individual patients can be difficult in short primary care consultations, and patient access to other treatments often varies [7, 8]. To improve clinical outcome and cost-effectiveness in the treatment of patients, a stratified approach of care would be effective [8]. Several authors have established that proper recognition of prognostic factors helps in effective early prevention for LBP [9, 10]. Specific and generic instruments have been developed to measure the outcomes from episodes of LBP [11]. One of such instruments is the Keele Start Back-Screening Tool (SBT).

The SBT is a prognostic questionnaire that helps clinicians identify risk factors that are modifiable (psychological, social, and biomedical). The tool consists of nine items from which the results are used to stratify patients into low, medium, or high risk of back-related physical disability categories [12]. The SBT was developed in the United Kingdom (UK) and validated for people with low back pain [12]. Subsequently, the use of the tool in stratified care system has helped in sub-grouping patients, and matching them with different treatments has demonstrated greater clinical outcomes compared to usual primary care [10, 13]. Building on the success of SBT, the STarT MSK Tool was developed within the Keele Aches and Pains Study (KAPS) for patients with the five most common musculoskeletal pain presentation (neck, back, shoulder, knee, or multi-site) [14, 15]. The tool contains 10 items that, once scored, place patients into three categories based on their risk of a poor outcome (low, medium, and high) in the most common musculoskeletal conditions [14]. The STarT MSK comprises a range of physical and psychological constructs including referred pain, fear of movement, perceived disability, anxiety, and bothersomeness.

Compared with SBT, the STarT MSK is yet to have wide applicability in clinical and research settings. The availability of this new tool in local and indigenous languages may help improve comprehensibility and usage among patients. Employing of outcome tools in clinical and research settings is gaining increasing attention in Nigeria [16]. Thus, the availability of outcome tools in Nigerian local languages may improve the uptake of tools [17] and in turn enhance patients' care. Nigeria is the most populous black African nation comprising of three major ethnic groups with different languages which are Hausa, Igbo, and Yoruba tribes. According to CIA World Factbook [18], the Yoruba tribe constitute around 47 million people worldwide, majorly found in Nigeria, where they make up about 21% of the population, making them one of the largest ethnic groups in Africa. The Yoruba language is spoken in some other countries, including Benin Republic, Sierra Leone, Togo, and Brazil [19]. Therefore, the availability of the Yoruba version of the STarT MSK tool will improve the usability of the tool among patients in these regions. The aim of the study was to translate, culturally adapt, and test the psychometric properties of the STarT MSK tool among patients with LBP.

Methods

This cross-sectional validation study recruited consecutive patients with LBP attending the General Out-patient Department and Orthopaedic clinic of a University Teaching Hospital in Nigeria. Eligible patients were those with a clinical diagnosis of non-specific LBP (i.e., LBP that cannot be attributed to a distinct or known specific pathology) of not less than 2 weeks, and who were literate in both English and Yoruba languages. Any patient with a positive psychiatric history or systemic illness (such as a tumour) is excluded.

According to Terwee et al. [20], a sample size of a minimum of 50 respondents was suggested as sufficient for validation studies. A total of 55 respondents [26 males (47.3%) and 29 females (52.7%)] participated in this study, while only 25 of the respondents were involved in the test–retest reliability. The flowchart of respondents is shown in Fig. 1.

Instruments

The English version of the STarT MSK tool

The STarT MSK Tool was developed within the KAPS for patients with the five most common musculoskeletal pain presentations (neck, back, shoulder, knee, or multi-site) [14, 15]. The tool consists of 10 items related to physical and psychosocial statements used to categorize patients based on risk for poor disability outcomes. The items ask about the function, disability, pain, coping, comorbidity, and the impact of pain, each having scores for answers (yes = 1, no = 0). To calculate the total score for each respondent, scores from the 10 items are added up and scored over 12. The total score is 12 because item 1 has a

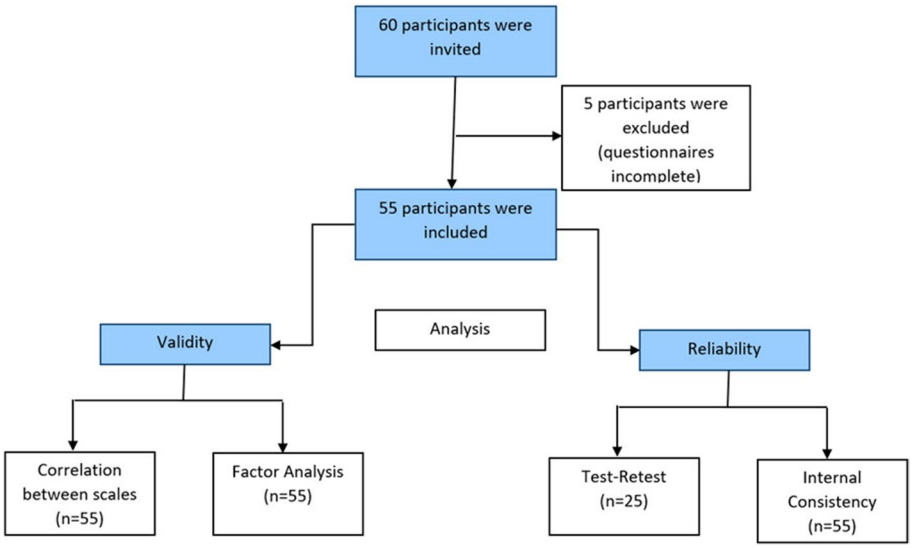

Fig. 1 The flowchart of respondents

maximum score of 3. The tool has been translated to various languages and demonstrated good validity and reliability with ICC ranged between 0.71 and 0.85 [21–23].

Quadruple Visual Analogue Scale (QVAS)

This is a validated tool used to subjectively measure pain at four levels: current level of pain, average pain, pain level at mildest, and worst pain. Each level of measurement consists of a line 10 cm long with ends marked at extreme states (0—no pain) and (10—worst possible pain). The scores from questions 1, 2, and 4 are averaged and then multiplied by 10 to yield a score from 0 to 100. The tool has shown moderate to good reliability among patients with musculoskeletal pain and is used among the Nigerian population [24, 25].

Fear Avoidance Belief Questionnaire (FABQ)

This is a patient-reported questionnaire that is focused on how a patient's fear avoidance beliefs about physical activity and work which may contribute to their pain and disability. It consists of 16 questions scaled from zero to six (maximum score of 96). It takes about 5 min to complete. The FABQ contains 2 scales: a work scale (FABQ-W) composed of 7 items and a physical activity scale composed of 4 items. The two scales are scored separately. Five additional items, which are not part of the scoring, complete the questionnaire. Higher FABQ scores indicate a high level of fear-avoidance beliefs. The FABQ-W has a point score that ranges from 0 to 42 points. It can be calculated as follows: Total points for items 6, 7, 9, 10, 11, 12, and 15 = Work scale score. The physical activity scale (FABQ-PA) has a score point that ranges from 0 to 24 points. Scores are calculated as follows: Total points for items 2, 3, 4, and 5 = Physical activity scale score. Items 1, 8, 13, 14, and 16 are not part of either scale, and their scores are not factored into the respondent's total scores. FABQ has been translated to various languages (including Yoruba) and shown to demonstrate good psychometric properties with ICC ranged between 0.72 and 0.97 [26–28].

Procedure

The English version of STarT MSK tool was translated to the Yoruba language using five-step guidelines proposed by Beaton et al. [29]. The sequential steps include the following:

Forward translation: forward translation of the item and response choices was done independently by two professionally qualified translators bilingual in both English and Yoruba languages. One was informed of the concept being examined in the tool and the other was not aware of the concept. This stage involves two forward translations T1 and T2.

Synthesis: A synthesized version (T-12) was produced after a reconciliation meeting between the two translators and the researcher.

Back Translation: The synthesized version (T-12) was then translated back into English by two independent qualified translators who are fluent in the English language to identify inconsistencies in the words and concepts of the synthesized version. This was referred to as BT1 and BT2.

Expert committee review: An expert committee comprising of the researcher and all four translators met

to discuss issues of cultural adaptations and linguistic equivalence with the original version of STarT MSK tool. The outcome of this stage was used as the pre-final version of the STarT MSK–Y.

Pilot testing: The pre-final version was pilot tested by administering to 15 Yoruba-speaking patients with LBP. This was to explore their perception, understanding, and interpretation of the translated items of the Yoruba version of the various terminologies used, and the formatting of the tool. Respondents' interpretation was investigated to evaluate whether the adapted retained equivalence to the items of the English version. Reports were prepared at each stage to cover issues that were faced and how they were resolved and the final translation of STarT MSK–Y emerged after participants debriefing. The respondents were given the Yoruba STarT MSK (see Appendix), QVAS, and FABQ to complete. The instruments were delivered to the respondents by hand. Socio-demographic information and anthropometric measurements were obtained from the respondents. The participants simultaneously completed English and Yoruba versions of STarT MSK to assess the concurrent validity. In contrast, QVAS and FABQ were completed in no particular order to determine construct and discriminant validity, respectively. Also, the STarT MSK-Y was reapplied after 7 days to assess test–retest reliability.

Data analysis

Data was summarized using descriptive statistics of mean, standard deviation, and percentages. Intra-class correlation (ICC) was used to assess the reliability of the Yoruba version of STarT MSK tool. Cronbach alpha was used to test for the internal consistency of STarT MSK–Y. Construct validity of the Yoruba STarT MSK tool was determined by correlating with the Yoruba version of VAS using Pearson's correlation coefficient. Discriminant validity with FABQ was assessed using Spearman's rank correlation. Data was analyzed using SPSS (Statistical Package for Social Sciences). Alpha level set at $p < 0.05$.

Results

The personal and clinical characteristics of the respondents are presented in Table 1. The mean age, weight, height, and body mass index of the respondents were 52.13 ± 13.21 years, 80.34 ± 11.56 kg, 1.69 ± 0.06 m, and 28.10 ± 4.14 kg/m^2, respectively.

After the backward translation stage, the expert committee met to finalize the pre-final questionnaire. All items of the questionnaire were discussed; a few minor discrepancies were noticed and were related to linguistic difficulties with 'pain impact', 'long-term expectations', 'other important health problems' and 'anxious'. In item 3, 'Èròfà ìrora' was used instead of 'ipa ti irora n ko' because using 'ipa' means 'role' which does not connote the meaning of 'impact'. In item 6, 'Àfojúsùn' was used to replace 'ìrètí ọjọ- iwájú' because 'ìrètí' means 'hope' in English which does not connote the meaning of the item. In item 7, 'gbòógì' was used to connote the meaning of 'important health problems'. In item 8, 'ìlera' was used instead of 'àlàáfíà' to connote the meaning of well-being. Also, 'àníyàn' was used instead of 'ìrèwèsì' to connote the meaning of 'anxious'. In item 9, 'ìpayà' was used to replace 'àníyàn', so as to connote the actual meaning of 'worry' (Table 2).

Table 1 Personal and clinical characteristics of the respondents ($N = 55$)

Variable	Mean + SD
Age (years)	52.13 ± 13.21
Weight (kg)	80.34 ± 11.56
Height (m)	1.69 ± 0.06
Body mass index (kg/m^2)	28.10 ± 4.14
Pain intensity	
Current pain	5.25 ± 1.67
Average pain	5.27 ± 1.50
Best pain	5.26 ± 1.31
Worst pain	6.36 ± 1.32
Total pain score	56.38 ± 13.85

Key: *SD* Standard deviation

The mean, standard deviation, skewness, and kurtosis scores for the STarT MSK–Y are presented in Table 3. The mean scores for the items in the STarT MSK–Y range between 0.33 ± 0.47 and 0.95 ± 0.70 for items 7 and 1, respectively. The skewness scores range from − 2.93 to 0.77.

The concurrent validity of the STarT MSK–Y tool presented in Table 4 shows the Pearson correlation coefficients (r) of the reliability of the STarT MSK–Y (correlated with the English version) ranging from 0.833 to 0.964 for the items. Items 2 and 3 had the lowest and the highest correlation coefficient: $r = 0.833$; $p = 0.001$ and $r = 0.964$; $p = 0.001$. The correlation co-efficient of the total STarT MSK–Y was $r = 0.993$; $p = 0.001$. The convergent validity of the STarT MSK–Y (using the Quadruple Visual Analogue Scale) was $r = 0.727$; $p = 0.001$. Also, the discriminant validity of the STarT MSK–Y tool (using FABQ) showed a correlation coefficient of $r = 0.287$; $p = 0.034$ and $r = 0.033$; $p = 0.810$ for FABQ-W and FABQ-PA scales, respectively.

The Cronbach's alpha coefficient and intra-class correlation (ICC) coefficient of the relationship between the Yoruba and English version of the STarT MSK tool is presented in Table 5. The test–retest reliability of the STarT MSK–Y within a 7-day interval was assessed. The results

Table 2 Cross-cultural adaptation

Item	Translational equivalent	Final version	Reason for cross cultural adaptation
Pain intensity On average, how intense was your pain? (where 0 is –no pain as bad as it could be)	**Ìrora kíkankíkan** Ní àpapò, báwo ni ara se máa ń ro ó sí? ("Kò sí ìrora" ni 0, "ara ríro yìí búrú jáì" ni 10)	**Ìwòn ìrora** Ní àpapọ̀, báwo ni ìrora rẹ ṣe tó? ("Kò sí ìrora" ni 0, "ara ríro yìí burú jáì" ni 10)	Ìrora kíkankíkan suggests high level of pain, rather than grading of the pain severity
Pain self-management Have you been struggling to manage or control this pain by yourself(e.g. using medication or exercises)	**Bíbójútó ìrora ara eni** Nje´o ti ń làkàkà láti mójútó tàbí de´kun ìrora?	**Bíbójútó ìrora ẹni fún ara ẹni** Ǹjẹ o ti ń làkàkà láti mójú tó tàbí dẹ́ kun ìrora yí fún ara rẹ (B.a- lílò òògùn tàbí ṣíṣe eré ìdárayá abbl…)	
Pain Impact Over the last 2 weeks, have you been bothered a lot by your pain	**Ipa tí ìrora ń kó** Ní òsè méjì séyìn, njé ìrora yìí ń dà ó láàmú púpo bí?	**Èròfà ìrora** Ní ọ̀sẹ̀ méjì sẹyìn, ǹjẹ ìrora yìí ń dà ọ láàmú púpọ bí?	The word role as a translational equivalent of impact, have more cultural relevance to the item. Thus, role (Èròfà) ìrora was used instead of impact (Ipa) tí ìrora ń kó
Walking short distances only Have you only been able to walk short distances because of your pain	**Rírìn àwon ibi tí kò jìnnà** Njé àwon ibi tí kò jìnnà nìkan lo lè rìn nítorí ìrora re?	**Rírìn àwọn ibi tí kò jìnnà nìkan** Ǹjẹ àwọn ibi tí kò jìnnà nìkan lo lè rìn nítorí ìrora rẹ?	
Pain elsewhere Are you having troublesome pain in more than one part of your body	**Ìrora níbòmíràn** Njé o máa ń ní ìrora tó le ju ònà kan lo ní ara re bí?	**5. Ìrora níbò mìíràn** Ǹjẹ o máa ń ní ìrora tó le ní ọ̀ nà tó ju eyọkan lọ ní ara rẹ bí?	
Long term expectations Are you concerned you are developing a long term problem	**Ìrètí ojo´iwájú** Njé ò ń se àníyàn pé ìsòro olójo´pípe´fé bèrè sí í gbèrú?	**6. Àfojúsùn** Ǹjẹ ò ń ṣe àníyàn pé ìṣòro olọ́ jọ́ pípẹ́ fẹ́ bẹ̀ rẹ̀ sí ní gbèrú?	Àfojúsùn was used to replace 'Ìrètí ojo´iwájú 'may also be confused with hope (Ìrètí)
Other important health problems Are you also having to deal with other important health problems at present?	**Àwon ìsòro ìlera tó lágbára** Nje´o tún ń gbìyànjú láti kojú àwon ìsòro tó níí se pèlú ìpèníjà ìlera re lówólówó?	**7. Àwọn ìṣòro ìlera gbòógì míràn** Ǹjẹ́ o tún kojú àwọn ìṣòro ìlera gbòógì míràn lówólówó?	Gbòógì was used to express the meaning of 'important health problems'
Emotional wellbeing Have you felt anxious or low in your mood because of your pain ?	**Ìmòlára àlàáfíà** Sé ò ń se ìrèwèsì /káàárè nípa àìlera re bí?	**8. Ìmọ̀lára ìlera** Ǹjẹ o ń ṣe àníyàn/ọkàn rẹ ká àárẹ̀ nítorí àìlera rẹ?	Ìlera was used to imply the actual meaning of ' àlàáfíà ', while 'àníyàn' was also used to connote the actual meaning 'anxious'
Fear of harm Do you worry that physical activity could make your condition worse?	**Èrù ìpalára** Nje´ò ń se àníyàn pé àwon ise´ sise tàbí eré ìdárayá lè dákún àìlera re bí?	**9. Bíbẹ̀rù ìpalára** Ǹjẹ́ o ní ìpayà pé àwọn akitiyan fún ìdárayá lè dá kún àìlera rẹ bí?	Ìpayà was used to replace 'àníyàn ' to express the meaning of 'worry ', as 'àníyàn ' means to be anxious
Pain duration Have you had your current pain problem for six months or more?	**Gbèdéke àkókò ìrora** Nje´ ìrora tí ò ń là kojá lówólówó báyìí ti tó osù méfà tàbí jù béè lo?	**Gbèdéke àkókò ìrora** Nje´ ìrora tí ò ń là kojá lówólówó báyìí ti tó osù me´fà tàbí jù be´e. ` lo?	

Table 3 Mean score, standard deviation, skewness, and kurtosis of each of the items of the STarT MSK-Y ($N=55$)

Item	Mean	Median	SD	Kurtosis	Skewness
1	0.95	1.00	0.70	−0.93	0.77
2	0.91	1.00	0.29	6.81	−2.93
3	0.60	1.00	0.49	−1.89	0.42
4	0.55	1.00	0.50	−2.04	−0.19
5	0.67	1.00	0.47	−1.48	−0.76
6	0.36	0.00	0.49	−1.72	0.58
7	0.33	0.00	0.47	−1.48	0.76
8	0.65	1.00	0.48	−1.61	0.67
9	0.55	1.00	0.50	−2.04	−0.19
10	0.65	1.00	0.48	1.61	0.67
Total score	6.22	7.00	2.66	−1.11	−0.33

Key: *SD* Standard deviation

Table 4 Concurrent, convergent, and discriminant validity of the STarT MSK-Y tool ($N=55$)

Item	*r*	*p*
Pain intensity	0.962	0.001
Pain self-management	0.833	0.001
Pain impact	0.963	0.001
Walking short distances only	0.964	0.001
Pain elsewhere	0.960	0.001
Long term expectations	0.926	0.001
Other important health problems	0.887	0.001
Emotional well-being	0.890	0.001
Fear of harm	0.855	0.001
Pain duration	0.961	0.001
Total score	0.993	0.001
QVAS 1	0.749	0.001
QVAS 2	0.656	0.001
QVAS 3	0.507	0.001
QVAS 4	0.524	0.001
QVAS Total	0.727	0.001
Fear Avoidance Belief Questionnaire-Work	0.287	0.034
Fear Avoidance Belief Questionnaire- Physical Activity	0.033	0.810

Key: *QVAS* Quadruple Visual Analogue Scale

are presented in Table 5. Items 1, 2, 6, 9, and 10 yielded a perfect ICC, while others yielded acceptable scores ranging between 0.954 and 0.958. The test–retest reliability of the STarT MSK–Y total score based on ICC yielded a perfect score of 1.00 (95% CI (1.00–1.00).

The confirmatory factor analysis (CFA) of the STarT MSK–Y tool is presented in Table 5 and Fig. S1. The factor loading for five items was satisfactory ranging from 0.46 to 0.83. The one-factor model returned satisfactory fit after modification when including two correlation residuals {Comparative Fit Index (CFI) = 0.96; Tucker-Lewis Index (TLI) = 0.94; Root Mean Square Error of Approximation (RMSEA) = 0.05 (90%CI = 0.00–0.11)}. The Composite reliability was also satisfactory (0.70). Furthermore, Fig. S2 is a scattered plot diagram which depicts the correlation between the Yoruba and English version of the STarT MSK tool. Figure S3 is a scattered plot diagram which depicts the correlation between the test–retest of the Yoruba version of the STarT MSK tool.

Discussion

The STarT MSK tool has shown good predictive and discriminative ability in the development and validation samples [15] identifying patients at low, medium, or high risk of persistent LBP. Comprehensibility of scales is believed to be enhanced by the local languages because cultural groups are reported to vary in disease expressions and in their use in various health care systems [30]. The need to increase usability and comprehensibility among non-English speakers has necessitated the translation of tools into local languages. Currently, the STarT MSK tool is not available in any Nigerian language. As a first step in the process of increasing the use of outcome tools among Nigerians, the overarching objective of this study was to translate, culturally adapt, and test the psychometric properties of the STarT MSK tool among patients with LBP. The study is imperative as the increase in the number of international research works and the need to adapt health status measures for use in other than the source language have become of primary importance [31]. The STarT MSK tool is a modified version of the STarT Back tool which is an outcome measure used to stratify patients with low back pain into three groups. The development of the original tool, and the new variant, according to Hill et al. [10] was relevant and of benefit to the stratified care approach to low back pain management. The STarT MSK tool is a prognostic tool that can be used to stratify patients for the appropriate matched treatment [32]. Primary care matching treatment options for patients with the five most common musculoskeletal pain presentations were proposed in a consensus group study [33] hence, the need for the appropriate tools. Though relatively new, the only translation of STarT MSK tool is that in the Dutch language [23], there seems to be no other translation till date.

Beaton et al. [29] guideline for translation of tool was employed in this study. Accordingly, the translation process included forward translation, synthesis, backward translation, expert committee review, and pilot testing. Beaton et al. [29] posit that the reliable application of questionnaires to a local language demands the systematic and judicious cross-cultural adaptation to the local language. Cross-cultural adaptation of specific

Table 5 Psychometric property of the STarT MSK-Y tool ($N = 55$)

Item	STarT MSK—Yoruba vs English			Test–retest		Confirmatory factor analysis		
	Cronbach's alpha	ICC (95% CI)	*p*-value	ICC (95% CI)	*p*-value	Factor loading	R^2	Composite reliability
Pain intensity	0.980	0.980 (0.966–0.988)	0.001	1.000 (1.000–1.000)		0.646	0.417	0.699
Pain self-management	0.901	0.901 (0.830–0.942)	0.001	1.000 (1.000–1.000)		−0.026	0.001	
Pain impact	0.981	0.981 (0.968–0.989)	0.001	0.958 (0.904–0.982)	0.001	0.459	0.211	
Walking short distances	0.982	0.982 (0.968–0.989)	0.001	0.958 (0.902–0.982)	0.001	0.755	0.570	
Pain elsewhere	0.980	0.980 (0.965–0.988)	0.001	0.956 (0.899–0.981)	0.001	0.545	0.298	
Long-term expectations	0.961	0.961 (0.934–0.977)	0.001	1.000 (1.000–1.000)		0.248	0.062	
Other important expectations	0.940	0.940 (0.897–0.965)	0.001	0.954 (0.894–0.980)	0.001	0.177	0.031	
Emotional well-being	0.941	0.941 (0.900–0.966)	0.001	0.958 (0.902–0.982)	0.001	0.829	0.687	
Fear of harm	0.922	0.922 (0.866–0.954)	0.001	1.000 (1.000)		0.435	0.189	
Pain duration	0.988	0.980 (0.966–0.988)	0.001	1.000 (1.000)		0.060	0.004	
STarTMSK total	0.996	0.966 (0.993–0.998)	0.001	1.000 (1.000)	CFI = 0.958; TLI = 0.942; RMSEA = 0.046 (90% CI = 0.000–0.113)			

Key: *STarT MSK* STarT Musculoskeletal tool, *ICC* Intra class correlation, *C1* Confident interval

questionnaires is not simple as not only language differences, but also cultural differences should be taken into consideration for the reliability and the validity of questionnaires to be preserved [29]. Based on the foregoing, the cross-cultural adaptation of the STarT MSK tool was performed using expressions that are relative to the semantic, idiomatic, and conceptual equivalence while preserving the original concepts.

There are many ways in which translated questionnaire could be tested for their psychometric comparability with the source version. The objective is to ensure that the new version has demonstrated the measurement properties needed for the intended application. A strong evidence of construct validity is needed (i.e. is it measuring what it is supposed to be measuring?). In this psychometric testing phase of the STarT MSK tool, patients with low-back pain who were attending the Orthopedic Clinic and the General Outpatient Department of a University Teaching Hospital in Nigeria were recruited. The mean age of these patients was 52.13 ± 13.21 years. The mean age of patients in this study represents the age in which LBP is prevalent as literature submits that LBP is between 35 and 55 years [34]. A valid response rate of 100% was recorded in this study (as there were no invalid surveys), suggesting that the STarT MSK–Y is an easy-to-fill and acceptable tool among the Yoruba population with low back pain. Thus, based on difficulty and quality rating, the STarT MSK–Y had a high rate of data completion with good quality data in the study population.

From this study, a high concurrent validity was found for STarT MSK–Y with items having correlation co-efficient ranges greater than 0.70 that was considered desirable for good validity of a new tool [35]. The total score of the STarT MSK–Y showed a high negative skewness indicating a negatively skewed distribution. The internal consistency using Cronbach's alpha was acceptable as all the items had Cronbach's alpha greater than 0.70 [36]. Therefore, the STarT MSK–Y has an acceptable concurrent validity ($r = 0.993$; $p = 0.001$).

The construct validity of the STarT MSK–Y was tested using the FABQ and QVAS for its discriminant and convergent validity phases, respectively. The result for the discriminant validity of STarT MSK–Y with FABQ yielded correlation co-efficient scores of $r = 0.287$; $p = 0.034$ and $r = 0.033$; $p = 0.810$ for FABQ-Work and FABQ-Physical Activities (which are the two components of the FABQ scale). The result indicated that STarT MSK–Y had fair discriminant validity with FABQ-Work. This finding suggests that measures of constructs (i.e. STarT MSK–Y and FABQ) are theoretically different from each other, and were not found to be highly correlated to each other, as there was no significant correlation between STarT MSK–Y and FABQ-physical activities, while the correlation that exists with FABQ-Work was weak. On the other hand, the finding on the convergent validity of STarT MSK–Y indicates significant correlations with all domains and global score of the QVAS. This finding suggests that the STarT MSK–Y and QVAS are closely related and may measure constructs that theoretically should be related to each other.

The test–retest reliability of Cronbach's alpha and ICC of the total scores of the STarT MSK–Y yielded an ICC of 1.00 (95% CI, 1.00–1.00) which confirms the high reliability of the STarT MSK–Y. Test–retest reliability increased to 1.000 for the overall tool scores which was more compared to the Dutch translation

[23]. The high internal consistency reliability scores of the STarT MSK–Y suggest that the tool actually assesses what it was meant to measure.

In sum, the STarT MSK–Y showed excellent psychometric properties that lend credence to its usability and applicability in the clinic setting among patients with LBP. The new tool may promote assessment of psychosocial risk factors of LBP and also inform interventions to improve health outcomes of Yoruba-speaking patients with LBP.

The study has some inherent limitations. We conducted the study in a tertiary health facility, which may limit its generalizability to other settings or populations. Although the minimum sample size was met for the study, the number of participants that underwent a retest of the STarT MSK-Y is small and may affect the generalizability of the results to a larger population. The study did not assess the predictive ability of the STarT MSK-Y. However, the results of this study should be taken as preliminary findings and recommend a future study to assess the predictive ability of STarT MSK-Y.

Conclusion

It was concluded that the STarT MSK–Y has acceptable validity and reliability and can be used as a valid assessment tool among Yoruba-speaking patients with low back pain.

Abbreviations

MSK	Musculoskeletal
QVAS	Quadruple Visual Analogue Scale
FABQ	Fear Avoidance Belief Questionnaire
FABQ-W	Fear Avoidance Belief Questionnaire work scale
FABQ-PA	Fear Avoidance Belief Questionnaire physical activity scale
STarT MSK–Y	Yoruba version of the STarT MSK
MSDs	Musculoskeletal disorders
DALYs	Disability-adjusted life years
LBP	Low back pain
SBT	Start Back-Screening Tool
UK	United Kingdom
KAPS	Keele Aches and Pains Study
ICC	Intra-class correlation
CFA	Confirmatory factor analysis
CFI	Comparative Fit Index
TLI	Tucker-Lewis Index
RMSEA	Root Mean Square Error of Approximation

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

CEM, OEA, and AS made substantial contributions to the conception, design of the study, the acquisition, analysis, and interpretation of data and substantively revised the manuscript. FF, OOO, TG, FF, and CTF drafted the manuscript and substantively revised it. The authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

Ethical approval was obtained from the Health Research and Ethics Committee of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria (ERC/2021/06/08). The purpose and procedure of the research were explained to each of the respondents and their informed consent was obtained.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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