The Yoruba version of LittlEARS Auditory Questionnaire: Evaluation of auditory development in children with normal hearing

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ABSTRACT

The goal of this study was to translate the LittlEARS Auditory Questionnaire into Yoruba language for use with Yoruba-speaking parents and to evaluate the psychometric properties of the Yoruba version of questionnaire. Translation of the LittlEARS Auditory Questionnaire into Yoruba language was done using a back-translation method. The study participants included 423 parents of normal hearing children aged 6–24 months. Psychometric analyses (scale analysis and item analysis) of the translated questionnaire was done. The scale characteristics in the dataset are: Internal consistency: Cronbach's alpha = 0.907; reliability; Split-half = 0.701; predictive accuracy; Guttman's lambda = 0.583; correlation between total score and children's age = 0.783. The regression analysis showed that 75.3% of the variance in the total scores can be explained by age. The Yoruba version of the LittlEARS Auditory Questionnaire is a dependable and valid tool as evidenced by the results of psychometric analyses. The tool is useful for assessing auditory development in children between 6 and 24 months of age.

1. Introduction

Maturation of the auditory system in infants is dependent on early exposure to appropriate sounds and the ability of the infant to recognize and derive pertinent details from the language within their environment (Kuhl, 2000). Therefore, inability or reduced responsiveness to auditory stimulation in infants can lead to impaired development of verbal communication and educational progress (Kennedy et al., 2006). Infants with such disability, if identified early can be fit with amplification devices as young as 4 weeks of age. Such early intervention will permit placement of the children in regular classrooms in both primary and secondary schools (Joint Committee on Infant Hearing, 2000). This early intervention, especially if done before age 6 months enables remarkably improved speech and reading comprehension than if the intervention is done after 6 months of age (Yoshinaga-Itano and Apuzzo, 1998). Since even minimal loss in hearing acuity could lead to serious interference with education performance, early identification of loss of hearing in children with appropriate intervention

is advocated to reduce the need for extensive habilitation in subsequent years (Ross, 2001). This early intervention could be facilitated by identification of hearing loss through documenting behavior of pre-verbal children with a structured questionnaire administered to parents or caregivers (O'Neil et al., 2004).

The LittlEARS Auditory Questionnaire (LEAQ), is a structured 35-item questionnaire which reflects the receptive, semantic, and productive dimensions of auditory behavior (Obrycka et al., 2009). LEAQ was developed to assess auditory development and behavior in children up to two years of age (Weichbold et al., 2005). Normative data from LEAQ was originally developed in German speaking families, however the normative data had been validated in 15 other languages in children with normal hearing (Connix et al., 2009). It is possible to use LEAQ to assess auditory development in children who could not undergo hearing screening test either due to scarcity of appropriate equipment or the associated financial costs.

The Yoruba ethnic group is one of the major ethnic groups in Nigeria and the dominant ethnic group in South West Nigeria. About 35% of the Nigerian population speaks Yoruba language (Fabunmi and Salawu, 2005), with a current population projection of 198 million population (NPC, 2018), this implies that there are 69.3 million Yoruba language speakers in Nigeria. Outside Nigeria, the Yoruba language is also spoken in several African countries such

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as Togo, Republic of Benín, Ghana, Sudan, Sierra-Leone and Côte D'Ivoire and outside Africa a large number of Yoruba language speakers are found in Brazil, Trinidad and Tobago and Cuba (Fabunmi and Salawu, 2005).

Therefore, this study aimed to (1) produce a Yoruba version of LEAQ for use with Yoruba-speaking families and (2) evaluate the psychometric properties of the Yoruba version of LEAQ (3) generate normative data for the Yoruba of version of LEAQ, providing expected and minimum values for Yoruba speaking children.

2. Materials and methods

2.1. Subjects

Voluntary parents were recruited and evaluated with the Yoruba version of LEAQ. Recruitment was done in immunization clinics of the Institute of Child Health, University College Hospital, Ibadan and Adeoyo Maternity Teaching Hospital, Ibadan and crèches of private schools in Ibadan North Local Government hospitals and Crèches. Ethical approval for this study was obtained from Oyo State Research Ethical Review Committee, Ministry of Health, Ibadan, Nigeria. All the parents gave informed consent before recruitment into the study. We determined normal hearing status of children by requiring parents to fill a short survey form initially. Children who had a history of hearing loss, aural disease, neurologic or other developmental disorder were excluded from the study (Geal-Dor et al., 2011).

2.2. Materials

The Yoruba version of LEAQ was translated from the English version provided by MED-EL Medical Electronics GmbH. The English version was derived from translation of the original German language LEAQ and subsequently used as source instrument for translation into other languages (Kuehn-Inacker, 2003). A "back-translation" method was adopted in translating LEAQ into Yoruba. This method enables a linguistically correct version from the English language to Yoruba language while aiming to preserve the "variable meaning" questionnaire items (Harkness, 2003). The various phases of back-translation method are: (i) direct translation from source to target language; (ii) re-translation of the document back to the source language by an independent party and (iii) comparisons of the similarity of the original and re-translated versions in the source language.

In this study, the primary translation from English Language to Yoruba Language was done by an expert in the Department of Linguistics, University of Ibadan who is fluent in both languages. The back-translation step (i.e. from Yoruba to English) was carried out by another expert in the same department independently, both translators were supervised by a senior colleague (a professor of linguistics). Comparisons between the back translated and original English language versions were done by three ENT doctors who are fluent in both Yoruba and English language to ensure the back translation was the best possible translation for all the items. The second author met with the ENT doctors to resolve areas of disagreements and agree on the best translation to measure the same auditory behavior as in the original English version.

The questionnaire consists of 35 questions with yes-or-no answers (Tsiakpini et al., 2004). The parents were asked to answer "yes" if the behavior was seen in their child at least once, and "no" if they had never observed the behavior or unsure of the answer. Summation of all "yes" answers gave the total score of each subject.

The questionnaires were self-administered by the respondents however the first author was available to provide assistance to the respondents as required.

2.3. Data analyses

Scale analyses and item analyses were computed to evaluate the reliability and validity of the Yoruba LEAQ. Subsequently, a norm curve was created from a polynomial regression analysis using children's age as independent variable and total score from the questionnaire as the dependent variable (Connix et al., 2009).

3. Results

Parents of children (209 males and 214 females) with normal hearing, aged 6–24 months were recruited. The mean age of the children is 14.75 months. The age distribution of the children is shown in Fig. 1.

3.1. Item analysis

3.1.1. Age and item score
The correlation of the score with age was computed to confirm items suitability for measuring the age dependency of behavior. The correlation coefficients of all the items are shown in Table 1. The coefficients ranged from −0.12 to 0.71. Some of the items showed a strong positive correlation with age ($r \geq 0.7$), while some are weakly correlated ($r \leq 0.3$). This result showed that a few questions had a very weak correlation with age (questions 1–4, 9, 10, 12, 14 and 29) (see Table 2).

3.1.2. Index of difficulty
The index of difficulty for individual items, gives the ratio of the subjects who gave the "yes" response to the total number of subjects. The indices ranged from 0.51 to 0.99, it displayed that LEAQ items had an hierarchal pattern of presentation in difficulty, from the "easiest" items pointing to basic auditory skills to the most "difficult" ones demonstrating advanced auditory skills. Results are shown in Table 1.

3.1.3. Discrimination coefficient
The discrimination index gives the correlation of a question with the overall score, while a high correlation coefficient shows that the question has a significant effect on the total score thus distinguishing between superb and dismal performers. Questions with a lower coefficient have poor meaning for assessing the age-dependent auditory response. As shown in Table 1, most of the coefficients in the results are greater than $r = 0.4$; this value shows satisfactory discriminatory power. Therefore, the Yoruba LEAQ is able to differentiate between children with more or less highly developed hearing behavior.

3.1.4. Cronbach's alpha when item is deleted
The Cronbach's alpha coefficient value is 0.899 or greater for every item in the Yoruba LEAQ, this suggests that the responses from subjects are greatly consistent across the Yoruba LEAQ items. The values of the Cronbach's alpha coefficient seen demonstrate that the Yoruba LEAQ items can reliably differentiate the degree of auditory development in the children evaluated in this study.

3.2. Scale analysis

3.2.1. Correlation between age and total score
Correlation between age and total score was computed to determine the ability of the Yoruba LEAQ to evaluate age-dependent auditory behavior. Pearson's correlation coefficient ranges from 0 to 1, a value of ≥ 0.70 indicates a high correlation. The correlation coefficient seen in our dataset is 0.783, which shows that older Yoruba children are more likely to higher scores.
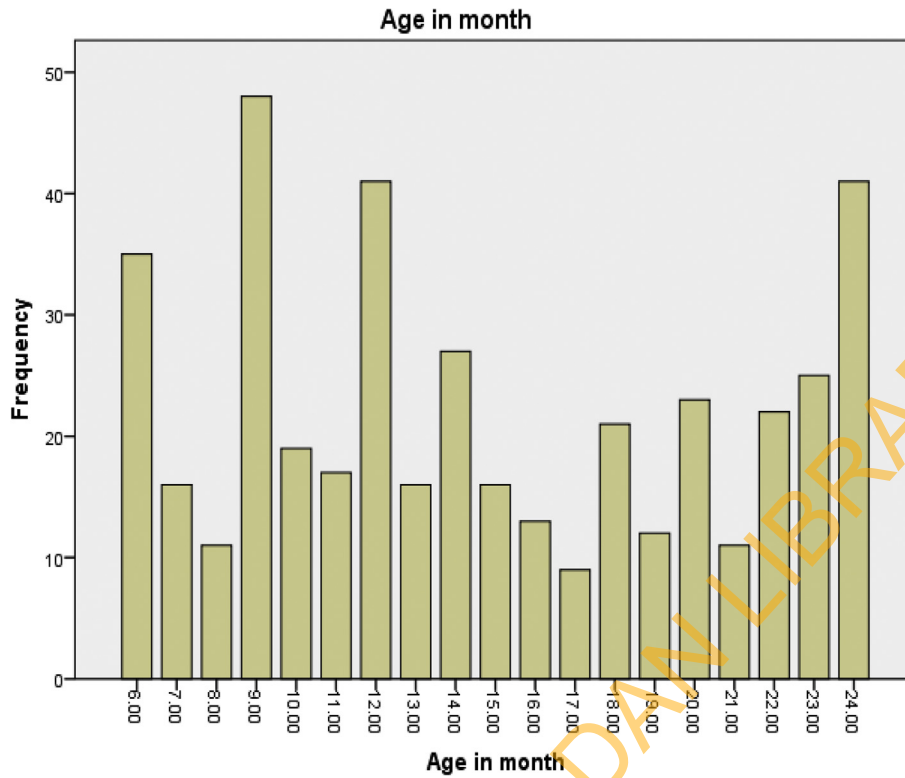
Fig. 1. Age distribution for the children sample.

Table 1
Parameters of the item analysis (N = 423).

Item no	Index of difficulty	Discriminatory power coefficient	Correlation between age and item score	Alpha if item is deleted
1	0.998	0.05	0.02	0.908
2	0.991	0.01	−0.01	0.908
3	0.986	0.03	0.05	0.908
4	0.979	0.05	−0.02	0.908
5	0.915	0.43	0.21	0.905
6	0.901	0.40	0.28	0.906
7	0.839	0.50	0.37	0.904
8	0.783	0.41	0.32	0.906
9	0.844	−0.04	−0.12	0.913
10	0.924	0.21	0.07	0.908
11	0.953	0.40	0.22	0.906
12	0.993	0.13	0.10	0.908
13	0.948	0.46	0.25	0.905
14	0.948	0.06	0.06	0.909
15	0.903	0.58	0.37	0.904
16	0.934	0.44	0.26	0.906
17	0.739	0.67	0.52	0.902
18	0.877	0.63	0.46	0.903
19	0.688	0.72	0.68	0.901
20	0.754	0.68	0.52	0.902
21	0.934	0.34	0.26	0.906
22	0.827	0.75	0.55	0.901
23	0.671	0.80	0.71	0.899
24	0.735	0.76	0.66	0.900
25	0.896	0.35	0.24	0.907
26	0.697	0.66	0.56	0.902
27	0.506	0.67	0.66	0.902
28	0.627	0.50	0.37	0.905
29	0.910	0.28	0.15	0.907
30	0.563	0.68	0.68	0.901
31	0.797	0.61	0.48	0.903
32	0.787	0.71	0.55	0.901
33	0.747	0.28	0.22	0.909
34	0.615	0.73	0.64	0.900
35	0.761	0.64	0.50	0.902

Table 2
Scale analysis of the Yoruba LEAQ.

Parameters	Yoruba version
Correlation between age and total score (r)	0.78
Cronbach's alpha (α)	0.91
Split-half reliability	0.70
Guttman's lambda (λ)	0.58
Regression coefficient (R^2)	0.75

3.2.2. Internal consistency of the scale

Internal consistency was measured by the Cronbach's alpha (α). Values of Cronbach's alpha that exceed 0.70 shows good reliability (Nunally and Bernstein, 1994). The results from our dataset gave Cronbach's alpha = 0.91, which shows very high internal consistency in Yoruba LEAQ.

3.2.3. Split-half reliability

The Spearman—Brown split-half coefficient predicts the full-test reliability, based on half-test correlations. The coefficient values range from 0 to 1, with a value of ≥ 0.70 indicating a high precision. The estimate of the full test reliability of the Yoruba LEAQ was 0.70, indicating a good reliability.

3.2.4. Predictive accuracy of Yoruba LEAQ

Predictive accuracy of Yoruba LEAQ is the accuracy of predicting the age of the child from the total score of the questionnaire. This was computed with Guttman's lambda (λ). Guttman's lambda values range from 0 to 1; adequate predictability is achieved with a value ≥ 0.30. A value of 0.58 was computed for this study suggesting a significant predictability of Yoruba LEAQ.

3.2.5. Norm curve

A norm curve for the development of auditory behavior of normal hearing Yoruba children was generated with a regression analysis. A second order polynomial regression with the regression equation: $y = -0.081x^2 + 3.303x + 0.648$; where x = age and y = total score (F = 669, df = 1, p < 0.001) represents the model. The coefficient for the model showed that 75.3% of the variance in the total scores can be explained by age. A scatter plot of the raw data and the generated norm curve generated is shown in Fig. 2.

4. Discussion

The translated Yoruba version of LEAQ was derived from a back-translation method which enabled correction of identified flaws in the initial direct translation of the LEAQ. Back translation is advantageous over ordinary direct translation because it is an excellent way of avoiding errors, it provides extra checks for accuracy and the highest quality of translated materials, while improving a translation's validity and readability. The possibility of bias occurring when a single translator conducts both the translation from the source to target language and subsequently from the target to source language is eliminated with our use of back translation using distinct independent translators at each stage. The use of native speakers in the target language who are also fluent in the source language will help to ensure a high degree of accuracy. Additional quality control measures were achieved through vetting of the translated document by ENT surgeons fluent in both Yoruba and English language to ascertain that the eventual questions in the Yoruba LEAQ measured the specified auditory behavior. The back-translation method used for this study is the same method used for Mandarin version (Wang et al., 2013), Polish version (Obrycka et al., 2009) and Hebrew and Arabic version of LEAQ (Geal-Dor et al., 2011). The results of this study showed the Yoruba LEAQ as a suitable instrument for measuring age-related auditory behaviors. Results of the scale analysis revealed that the Yoruba LEAQ exhibit satisfactory age-dependency, internal consistency, excellent reliability and predictability. The high correlation between the total score and age seen in the item analysis results revealed the Yoruba LEAQ is an excellent instrument for evaluation of children less than 2 years old. The Pearson's correlation coefficient of 0.783 seen in the Yoruba LEAQ showed a high correlation between age of the children and total score which strongly suggests that the Yoruba LEAQ can provide reliable estimates of auditory evolution in pediatric Yoruba subjects. Though the coefficient of this study is high and similar to the United Kingdom English version used with English speaking Canadian families with a value of 0.793 (Bagatto et al., 2011), it is not as high as that of the Polish version of LEAQ which had a value of 0.90 (Obrycka et al., 2009). The slightly higher mean age in the Polish study compared to the Yoruba may account for the differences in the Pearson's correlation coefficients.

The high coefficient determination of the non-linear model for generating the norm curve gives additional credence in calculating the expected values. The coefficient determination for the non-linear model shows that 75.3% of the variance in the total scores can be explained by age. This is similar to that of the Mandarin version which is 73.2% (Wang, 2013). Overall, the psychometric analyses show that the Yoruba LEAQ is useful tool in evaluating auditory development in children less than 24 months of age.

5. Conclusion

The Yoruba LEAQ is the outcome of a diligent exercise to adapt the English version of LEAQ for use among the Yoruba speaking families in West Africa. The meticulous back translation process and the psychometric analyses outputs of the Yoruba LEAQ strongly indicates it is a very dependable and responsive instrument to evaluate auditory behavior in Yoruba children less than 2 years old. The next step in research is to determine the adequacy of the Yoruba LEAQ instrument in auditory development assessment in populations where hearing screening tests are not routinely done such as Nigeria and other West African countries.
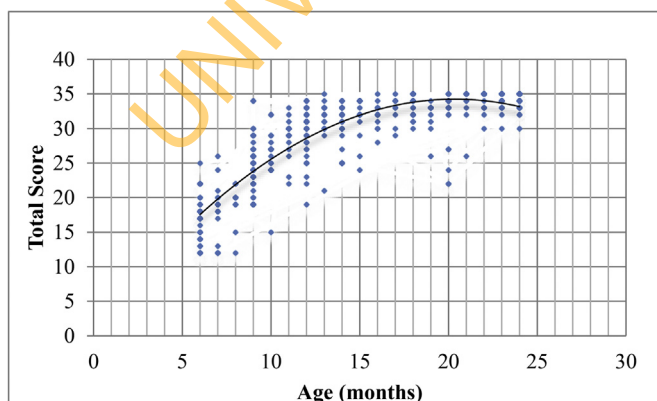
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Fig. 2. Regression curve (quadratic) with age as the independent and total score as the dependent variables.

Declarations of interest

None.

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