PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Examining the reliability and validity of a modified version of the International Physical Activity Questionnaire, long form (IPAQ-L) in Nigeria: A cross-sectional study
AUTHORS	Oyeyemi, Adewale; Bello, Umar; Philemon, Saratu; Aliyu, Habibu; Majidadi, Rebecca; Oyeyemi, Adetoyeje

VERSION 1 - REVIEW

REVIEWER	Pedro C Hallal Federal University of Pelotas, Brazil
REVIEW RETURNED	10-Jul-2014

GENERAL COMMENTS	This is an interesting paper about the reliability of IPAQ in Africa. The reliability results are interesting and novel. My only suggestion would be presenting Bland & Altman graphs for the reliability results. In terms of validity, I have concerns about its use in this paper. Please keep in mind that cross-sectional associations of physical activity with blood pressure or BMI do not represent much, because hypertensive and obese people actually get oriented to exercise. Therefore, a cross-sectional association between activity and these outcomes is not even expected, and can actually happen in the opposite direction. My suggestion is therefore to focus on the reliability results.

REVIEWER	Fei Xu Nanjing Municipal Center for Disease Control and Prevention
REVIEW RETURNED	21-Sep-2014

GENERAL COMMENTS	Physical activity promotion has been proved to be effective in non-communicable diseases prevention worldwide. As a tool to assess population-level physical activity, a reliable and valid questionnaire is an instrument with the best cost-effectiveness. Although IPAQ has been validated in different societies, it is also necessary to do the ratability and validity study on IPAQ in African countries considering that the social, cultural and economic contexts are really different and specific there. This article reported findings from a pioneer study on the ratability and validity of a modified IPAQ-long form in a specific African society. As a researcher with interest in physical activity for more than 10 years, I believe this manuscript makes its contribution to present literature.

	However, I have some concerns regarding this present submission. 1. Sampling approach Authors stated "a purposive sample" were recruited. It is necessary and of help to provide detailed information on the actual sampling method and process. 2. Questionnaire used Authors described that "Participants were eligible for this study if they were willing to complete a written survey twice in English Language, the official language in Nigeria. " (line 155-156 on page 5) However, the purpose to this study was to investigate the reliability and validity of Hausa version of IPAQ. What actual language of the questionnaire used in this study, English or Hausa? 3. Administration of the study Was the data collected through self-administered or interviewer-administered questionnaire? It is really important to clarify it, considering the educational and socioeconomic disparities within participants. 4. Limitations of this study The most important limitation of this study was that the validity was examined through exploring the relationship between physical activity level and selected anthropometric and biological measurements NOT the comparison of physical activity levels recoded by the questionnaire and objective devices (e.g., accelerometers). Although authors has mentioned this point as a limitation of their study, I think they are expected to provide further information that what they did is also acceptable. 5. Manuscript Generally, this manuscript is well prepared, however the section of DISCUSSION is a little bit too long. It is better to make this session concise and sticking to the points.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Reviewer Name Pedro C Hallal
Institution and Country Federal University of Pelotas, Brazil
Please state any competing interests or state ‘None declared’: None declared

This is an interesting paper about the reliability of IPAQ in Africa. The reliability results are interesting and novel. My only suggestion would be presenting Bland & Altman graphs for the reliability results.
Response
We thank the reviewer for the positive review and helpful suggestion to improve this manuscript. We appreciate the additional insight on the validity aspect of this paper. As suggested we have presented the Bland and Altman graphs for the reliability results (please see Figure 1,2 and 3; and the results section). We also included in the analysis section a statement to include that Bland-Altman plot was

used in addition to the ICCs to explore reliability of the adapted IPAQ-LF in our study

Results Section (page 10, lines 289-295)
Figures 1, 2 and 3 (Bland-Altman plots) illustrate the agreement in the scores (minutes per week) of total PA, MVPA and sitting between the first and second administrations of Hausa IPAQ-LF. For total PA, the mean difference was 106.7 min/wk, with a wide 95% limits of agreement (-762.2 to 965.6 min/wk). For MVPA, the mean difference was about one and half hour per week (91.6 min/wk) with a wide 95% limits of agreement (-744.5 to 927.7 min/wk). For sitting time, the mean difference was small (26 min/wk) and the 95% limits of agreement range from -2178.1 to 2230.9 min/wk.

Data Analysis
Descriptive data were reported as mean, standard deviation and percentages. Mean group differences for continuous variables by gender were examined by independent t-test, and for dichotomous variables by chi-square statistics. The reliability analyses were performed using 2 strategies. First, the two- way mixed model (single measure) intraclass correlation coefficient (ICC) with 95% confidence interval (CI) between the continuous scores obtained on 1st and 2nd administration of the Hausa IPAQ-LF was calculated. The ICCs were calculated overall, and by gender and socioeconomic status. ICC estimates >0.75 were considered as good reliability scores, between 0.50 and 0.75 as moderate reliability and <0.50 as poor reliability.[31 Second, the Bland and Altman Method was used to assess agreement on scores of PA from the 1st and 2nd administrations.[32] Variables used for the Bland and Altman analysis were weekly time spent in moderate-to-vigorous activity (MVPA), sitting and total PA. MVPA was computed by summing the total min/week of reported physical activity of moderate and vigorous- intensities across all four domains. For total PA, the total min/week of activities in each domain were summed (total work + total transport + total domestic + total leisure-time min/week scores) to gain an overall estimate of physical activity in a week.

In terms of validity, I have concerns about its use in this paper. Please keep in mind that cross-sectional associations of physical activity with blood pressure or BMI do not represent much, because hypertensive and obese people actually get oriented to exercise. Therefore, a cross-sectional association between activity and these outcomes is not even expected, and can actually happen in the opposite direction. My suggestion is therefore to focus on the reliability results.
Response
We agree with the reviewer that cross-sectional associations of physical activity with blood pressure or BMI may not represent much as an indicator of validity as used in the present study. As such, we have tried to downplay the part on validity in the manuscript as much as possible, and focused mostly on our reliability results. For example we have provided a caution in the 5th paragraph of the discussion section that cross-sectional association between physical activity and BMI or blood pressure may not represent much information as indicators of construct validity of PA measures We have also eliminated the 6th paragraph in the discussion section that previously provided explanations to justify these cross-sectional associations.

Discussion, 5th Paragraph
In the absence of objective criterion standards for evaluating an absolute estimate of PA, the consistency of items on IPAQ with variables known to be related to PA such as body mass index (BMI), blood pressure, heart rate, indicators of lipid and glucose metabolism, and fitness index have been used as important construct validity measures.[7,10,21,24] In the present study, the correlations of the PA domains and intensities with biological and anthropometric variables were mostly significant in the expected direction, but they were low suggesting a modest evidence of construct validity for the modified IPAQ-LF in Nigeria. However, observed correlations were comparable with the values in other studies that have evaluated the IPAQ-LF.[5,7,8,24,30,33,39] Because better validity coefficients have been reported for other PA measures above that of the IPAQ,[39,41] with the present African finding, it is possible that the IPAQ-LF only have modest evidence of construct validity Worldwide. However, our findings on the relationships between physical activity and biological and anthropometric variables should be interpreted in the light of an important caution. Because hypertensive and obese people may get oriented to exercise,[3] cross-sectional associations of physical activity and blood pressure or BMI could also occur in the opposite direction and may not represent much information as indicators of construct validity of physical activity measures.

Discussion, 6th Paragraph (deleted from manuscript)
One interesting finding was that total PA was strongly and inversely related with BMI of men and women. This is biologically plausible because total energy expenditure would be expected to have the strongest effects on BMI. Similarly, domestic PA was related with resting blood pressure and BMI in the expected direction, and this was mainly among women. Contrarily, no such gender based associations of domestic PA with health variables were found in previous studies of the western developed countries.[10, 24] It is possible that African women are accumulating domestic related PA at sufficient intensities needed to circumvent deleterious health outcomes. This kind of finding has implications for intervention strategies formulation, considering that domestic activities are common and dominant PA behaviour among women in Africa. In the present study, only in the domains of sitting and domestic PA did women accumulate more time than men. Perhaps, promotion of the typical domestic related activities like households chores, sweeping of compound and pounding of grains as integral components of health enhancing PA (HEPA) of women in Nigeria could be an important public health strategy for controlling the rising incidence of NCDs in this country, where current estimates indicate the prevalence of overweight/obesity as 33.3% (37.7% women and 28.8% men) and that NCDs already account for 27% (28.5% in women; 25.45 in men) of all deaths.[39]

Reviewer: 2
Reviewer Name Fei Xu
Institution and Country Nanjing Municipal Center for Disease Control and Prevention
Please state any competing interests or state ‘None declared’: None declared

Title: Examining the reliability and validity of a modified version of the International Physical Activity Questionnaire, long form (IPAQ-L) in Nigeria

Physical activity promotion has been proved to be effective in non-communicable diseases prevention worldwide. As a tool to assess population-level physical activity, a reliable and valid questionnaire is an instrument with the best cost-effectiveness. Although IPAQ has been validated in different societies, it is also necessary to do the ratability and validity study on IPAQ in African countries considering that the social, cultural and economic contexts are really different and specific there.

This article reported findings from a pioneer study on the ratability and validity of a modified IPAQ-long form in a specific African society. As a researcher with interest in physical activity for more than 10 years, I believe this manuscript makes its contribution to present literature.

However, I have some concerns regarding this present submission.
Response
We thank the reviewer for the interest on our work and for the positive review of the manuscript.

1. Sampling approach
Authors stated "a purposive sample" were recruited.

It is necessary and of help to provide detailed information on the actual sampling method and process.
Response
We think providing a detailed information about purposive sampling method will unnecessarily add to the length of the present paper. Moreover, we already indicated in the manuscript (page 5, method section) that a detailed description of the sampling and neighbourhood selection method can be found elsewhere in our recently published paper (ref # 26).

Participants (Page 5, method section)
A purposive sample of 180 adults from eight neighbourhoods that varied in socioeconomic status and walkability in Maiduguri city were recruited for the study. The sampling and neighbourhood selection strategy have been described in details elsewhere.[26]

2. Questionnaire used

Authors described that "Participants were eligible for this study if they were willing to complete a written survey twice in English Language, the official language in Nigeria. " (line 155-156 on page 5)

However, the purpose to this study was to investigate the reliability and validity of Hausa version of IPAQ. What actual language of the questionnaire used in this study, English or Hausa?
Response
The Hausa IPAQ-LF used in this study is available in both the Hausa and English (back-translation) language. Depending on the preference of the participants, both Hausa language and English (back-translation) language questionnaires were used in the present study, and this has been clarified in the manuscript (please see page 5, line 156)

Page 5, line 156
Participants were eligible for this study if they were willing to self-complete a written survey twice in either Hausa or English Language.

3. Administration of the study
Was the data collected through self-administered or interviewer-administered questionnaire? It is really important to clarify it, considering the educational and socioeconomic disparities within participants.
Response
Thank you for this observation. The data was mainly collected through self-administration but there were few participants that required assistants to be able to complete the questionnaire. This aspect has been explicitly revised in the manuscript (see page 5). We have also included a discussion on the importance of collecting self-reported PA data through interviewer-administered mode (see page 16, strength and limitation section, lines 448-450).

Participants (page 5)
A purposive sample of 180 adults from eight neighbourhoods that varied in socioeconomic status and walkability in Maiduguri city were recruited for the study. The sampling and neighbourhood selection strategy have been described in details elsewhere.[26] Maiduguri with an estimated population of 749,123 people is the largest and capital city of Borno State in North-Eastern Nigeria.[27] The city attracts immigrants from neighbouring countries of Cameroon, Niger and Chad Republic, and Hausa language is the common means of communication for commercial activities among the diverse inhabitants of Maiduguri.[27, 28] Participants were eligible for this study if they were willing to self-complete a written survey twice in either Hausa or English Language. However, researchers (UMB and STP) were in attendance to provide translation and interpretation assistance to participants (n=11) who were unable to independently complete the survey.

Strenghts and limitations (page 15, line 448-450)
However, because some of the participants in the present study required assistance to complete the survey, interview administration rather than self-administration of the IPAQ-LF should be encouraged in any future national studies in the African region.

4. Limitations of this study
The most important limitation of this study was that the validity was examined through exploring the relationship between physical activity level and selected anthropometric and biological measurements NOT the comparison of physical activity levels recoded by the questionnaire and objective devices (e.g., accelerometers). Although authors has mentioned this point as a limitation of their study, I think they are expected to provide further information that what they did is also acceptable.
Response
We have explained in the manuscript that examining the validity of the IPAQ-LF through the relationships between physical activity and selected anthropometric and biological measurements is an important limitation of our study (see page 3, article summary, line 76-77). This together with information that it is also acceptable to explore the validity of PA measures this way have also been included in the manuscript (page 14 and 15, strengths and limitations, lines 433- 440).

Page 14 and 15, strengths and limitations, lines 433- 440
Thus, examining the construct validity through the relationships of PA with BMI and resting blood

pressure was an important limitation of our study. The choice and availability of appropriate criterion measures are particular issues of concern for the validation of PA questionnaires in low-income countries of Africa [5,49,50]. Despite this issue, the validity coefficients in our study were remarkably similar to those reported in other studies, [5,7,8,24,30,33,39] and the consistency of items on IPAQ with variables known to be related to PA such as BMI, blood pressure, heart rate, indicators of lipid and glucose metabolism, and fitness index have previously been used as important construct validity measures.[7,10,21,24]

5. Manuscript
Generally, this manuscript is well prepared, however the section of DISCUSSION is a little bit too long. It is better to make this session concise and sticking to the points.
Response
The section on discussion was long because we have a lot of results (about 5 tables) to discuss. We have tried to reduce the length by eliminating one of the two paragraphs that focused on the validity results.

Discussion, 5th Paragraph (deleted from manuscript)
One interesting finding was that total PA was strongly and inversely related with BMI of men and women. This is biologically plausible because total energy expenditure would be expected to have the strongest effects on BMI. Similarly, domestic PA was related with resting blood pressure and BMI in the expected direction, and this was mainly among women. Contrarily, no such gender based associations of domestic PA with health variables were found in previous studies of the western developed countries.[10, 24] It is possible that African women are accumulating domestic related PA at sufficient intensities needed to circumvent deleterious health outcomes. This kind of finding has implications for intervention strategies formulation, considering that domestic activities are common and dominant PA behaviour among women in Africa. In the present study, only in the domains of sitting and domestic PA did women accumulate more time than men. Perhaps, promotion of the typical domestic related activities like households chores, sweeping of compound and pounding of grains as integral components of health enhancing PA (HEPA) of women in Nigeria could be an important public health strategy for controlling the rising incidence of NCDs in this country, where current estimates indicate the prevalence of overweight/obesity as 33.3% (37.7% women and 28.8% men) and that NCDs already account for 27% (28.5% in women; 25.45 in men) of all deaths.[39]

VERSION 2 – REVIEW

REVIEWER	Pedro C Hallal Federal University of Pelotas, Brazil
REVIEW RETURNED	10-Oct-2014

GENERAL COMMENTS	All my comments were adequately addressed.

REVIEWER	Fei Xu Nanjing Municipal Center for Disease Control and Prevention, China
REVIEW RETURNED	24-Oct-2014

GENERAL COMMENTS	Many thanks for authors' response which meet most of my concerns. At this stage, I have only one minor comment regarding the data collection approach (my precious comment 3). I believe it will be much better if further discussion is available to support authors' argument that "because some of the participants in the present study required assistance to complete the survey, interview administration rather than self-administration of the IPAQ-LF should be encouraged in any future national studies in the

	African region." Apparently, considering the internal consistency, it may be not appropriate to pool the data collected using these two different ways. Ideally, one approach used to collect data in one study is encouraged and necessary.

VERSION 2 – AUTHOR RESPONSE

I believe it will be much better if further discussion is available to support authors' argument that "because some of the participants in the present study required assistance to complete the survey, interview administration rather than self-administration of the IPAQ-LF should be encouraged in any future national studies in the African region."
We thank the reviewer for the positive review and helpful suggestion to improve this manuscript. As suggested, we have included a discussion with a reference to support our assertion that interview administration of IPAQ should be considered in any future national study in the African region.

Apparently, considering the internal consistency, it may be not appropriate to pool the data collected using these two different ways. Ideally, one approach used to collect data in one study is encouraged and necessary.
Response
We agree with the reviewer that to maximize internal consistency of a study single approach should be used to collect data. As indicated in the method section in the manuscript, self-administration was the method that was used for data collection in our study. However, because our field experience indicated that few participants (n=11; about 6%) required interpretation assistance to complete the survey, we decided to recommend interview administration as the method of choice for future national study in the Africa region. Our results without including the data of the few participants that required assistance to complete the survey were largely the same with what was presented with the full data.