CROSS-CULTURAL ADAPTATION, RELIABILITY, AND VALIDATION OF THE INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE SHORT FORM IN LANGUAGES IN AFRICA: A SYSTEMATIC REVIEW

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Abstract

Background: The African population consists of diverse cultures and languages whose first language is not English. To address the challenges of using the English version of the International Physical Activity Short Form (IPAQ-SF), encourage physical activity (PA) participation/research, and curb non-communicable diseases (NCDs) in developing countries in Africa, there is a need for cultural adaptation of the questionnaire.

Aim of the study: This study aimed to conduct a Systematic Review on cultural adaptation, reliability and validation of the IPAQ-SF into African languages and to proffer probable reasons for differences between the versions.

Materials and Methods: We searched PubMed, Google Scholar, and AJO from inception to August 14, 2022. Studies were recruited if they conducted a cultural adaptation, validation and reliability of IPAQ-SF into the African language. The data analysis included descriptive statistics, ANOVA, and Student's t test using SPSS version 23, and a $p<0.05$ was used as the level of significance.

Results: A total of 453 healthy adult subjects (Hausa, *n* = 102 & Yoruba, n = 351) who met the inclusion criteria were documented. The mean age and BMI were 29.3±6.255 years and 24.1±4.335 (kg/m^2), respectively. Majority of the subjects were male (*n* = 293) and single (*n* = 375) than married (*n* = 74) and female (*n* = 160). The reliability and concurrent validity of the Yoruba and Hausa IPAQ were acceptable. The total scores obtained from the concurrent validity in the males in the Hausa (*r* = 0.844) IPAQ-SF were significant (*r* = 0.022) and more than that of the Yoruba (*r* = 0.640) version. The ICC total and female was significantly higher in the Hausa than the Yoruba IPAQ-SF.

Conclusions: Overall, not many studies reported the cultural adaptation of English IPAQ-SF into African languages. Both Hausa and Yoruba IPAQ-SF have acceptable concurrent validity and test-retest reliability for assessing PA. The total score for the concurrent validity male, ICC total and female were significantly higher in the Hausa than the Yoruba IPAQ-SF. We recommend that the English IPAQ-SF be culturally adapted to the Africa languages such as Igbo, pidgin, Swahili, Ajagam, Boki, and Effik.

Keywords: *international physical activity short form, cross-cultural adaptation, Africa, Validation, reliability*

Introduction

Morbidity and mortality as a consequence of a sedentary lifestyle have long become a global concern owing to the resultant debilitating effect on vital body systems, such as the cardiovascular and musculoskeletal systems, predisposing individuals to noncommunicable diseases (NCDs)[1-5]. Physical activity (PA) participation, on the other hand, has a magnitude of health benefits, as evident in several studies across the populations[6-10]. A PA lifestyle is presumed to be uncultivated by many people, it requires self-discipline to keep and adhere to and often habituated[6].

Having posed a challenge in the past, numerous methods of assessing the level of PA and participation have been developed over the years and adapted among diverse cohorts[11-14]. Generally, PA assessment tools are grouped into objective and subjective measures. For example, accelerometers, pedometers, computer-based activity monitors, motion sensors, and armbands, made up the objective methods[15-16] but are not readily accessible and affordable by the low socioeconomic class of persons who seem to make up a major fraction of the population in developing countries[17-20]. Simple affordable subjective measures, such as the International Physical Activity Questionnaire (IPAQ), have been validated to suit populations in developed and developing countries.

The IPAQ is a universally reliable and valid self-report questionnaire with a 9 and 31-item short/long form. Both forms of the questionnaire assess PA on a 7-day recall with the long form assessing PA in the domains of occupational PA, housework/house maintenance/care for family, transportation PA, time spent sitting and leisure-time and recreation/sport PA. For example, the short form assesses PA in the domains of walking, vigorous-intensity activity (e.g., aerobics), sitting, and moderate-intensity activity (e.g., leisure cycling)[19]. The IPAQ was first validated with studies pooled from populations across 12 countries, recommendations from which led to increased utilization of the IPAQ-SF for assessing PA compared with other existing questionnaires[21]. Lee et al.[22] carried out a systematic review of 21 validated studies pooled from the US, Europe, Asia, and Africa, with Africa having one study validating IPAQ-SF among populations in South Africa. They found a lot of inconsistency in methodology, but all 21 studies had similar findings. The correlation between objective measurement of PA level and the IPAQ-SF utilized in the studies ranged between 0.09 to 0.39, which is less than the minimal acceptable standard of PA according to the literature (objective measurement = 0.50 and measurement for fitness = 0.40). Second, there was even greater variability in the correlation between domains of the IPAQ-SF (moderate or vigorous PA) compared to objective standards (-0.18 to 0.76), but the majority of the correlation was up to the minimum acceptable standard. Additionally, a comparison between PA level as assessed by IPAQ-SF and an objective criterion was provided by only six of the 21 studies. There was also an overestimation of the PA level by 36 to 173% in IPAQ-SF and an underestimation of PA by 28%.

The cultural adaptation of the IPAQ-SF consists of a step-by-step process of translation of the original English version into a different language and ends with assessing the validity and reliability of the new version and correlating it with the original version. In most cultural adaptation of outcome measures, the guideline by Beaton et al.[23] is mostly used. Some researchers have translated and adapted the IPAQ-SF into languages that are alien to African culture. For example, the Spanish version by Craig et al.[19] has been recommended by Medina et al.[24] and used by Medina[25] among Mexicans. Additionally, the Greek and Chinese versions of the IPAQ-SF have been reported in the literature[26-27]. The degree to which the IPAQ-SF obtains similar results when compared to another instrument is label validity[28-29], while the capacity of the IPAQ-SF to obtain similar scores in consecutive measurements is labelled reliability[28]. For example, in a study by Oyeyemi et al.[30], the construct validity of the IPAQ-SF was assessed by testing it with the rate pressure product (RPP), while the reliability was tested by administering the questionnaire within consecutive intervals with a time lapse of one week[30-31]. Additionally, to strengthen efforts to encourage PA participation and curb NCDs in developing countries in Africa, a review of the reliability of the conclusions

drawn from validation studies assessing the level of PA among the continent's populations is warranted.

The African population is made of a diverse group of cultures and languages whose first language is not English. To address the challenges with using the English IPAQ-SF, there is a need for cultural adaptation of the questionnaire. Additionally, systematic reviews (SR) of studies on cultural adaptation of IPAQ-SF in languages in Africa are lagging in the literature, since none was found from our search. We therefore sought to conduct this SR of studies on cultural adaptation, reliability and validation of the IPAQ-SF in African languages and to identify probable reasons for differences between various versions. Second, we compared the reliability and validity of the different language versions of the IPAQ-SF.

Materials and Methods

Criteria for eligibility

The criteria for inclusion were as follows: 1) Studies that cross-culturally translated and adapted the English version of the IPAQ-SF into languages in Africa. 2) Studies that reported the psychometric property─ reliability and validity of the IPAQ-SF. 3) Studies whose subjects were healthy adults 18-65 years.4) Studies that followed the prescribed guidelines of translation and cultural adaptation of the IPAQ-SF as specified by the guideline of IPAQ for data processing found at http://www.ipaq.ki.se[32] ─ synthesis, backwards translation, subjection to review by expert committee, and pretesting. 5) Studies whose PA data underwent a cleaning process to make sure that the various domains of IPAQ-SF fell in the range of 10 and 180 MET-min/week-[1] for all subjects as prescribed by the guideline of the IPAQ core group found at http://www.ipaq.ki.se[32]. 6) Studies published in the English language whose full text can be freely assessed.

The criteria for exclusion were as follows: 1) Studies whose subjects were18 - 65 years but not on African descent.2) Studies that followed the stepwise process for culturally adapting the IPAQ-SF into languages other than Africa. 3) Studies whose full text cannot be openly assessed. 4) studies on cultural adaptation of PA questionnaire other than IPAQ-SF into African language.

Included source information

The idea to commence this study surfaced in 2022, and the systematic search for relevant studies (keywords) was carried out on August 14, 2022, and was carried out from January 2000 to August 14, 2022. To retrieve relevant studies on the validation, reliability, and cross-cultural adaptation of the IPAQ-SF in languages in Africa, search engines such as PubMed and Google Scholar were employed. Additionally, we searched the website of the Africa Journal online. Therefore, our search was consistent with the guidelines for SR/MA as recommended by AMSTAR[33].

The strategy utilized in searching

We searched PubMed using keywords and Boolean operators (AND; OR), after which we applied the same strategy to Google Scholar and AJO. A researcher (PAE) searched keywords linked to the reliability, validation, and cross-cultural adaptation of the IPAQ-SF in languages in Africa. Therefore, the search (MeSH) terms included "cross-cultural adaptation" OR "cultural adaptation" AND "reliability" OR "Validation" AND "short international physical activity questionnaire" OR "international physical activity questionnaire" OR "IPAQ-SF" AND "Africa languages".

Selection of study

The researchers (PAE, ID) independently reviewed the retrieved studies to ascertain whether the abstracts or titles of the prospective included studies met the criteria for eligibility. Therefore, only articles with full-text that met the inclusion criteria were selected for this systematic review. Additionally, the authors used discussion to reconcile any misunderstandings in choosing an appropriate article. The data from the included studies were manually extracted into Excel and then into SPSS by one researcher (PAE), and another researcher checked to ensure that there were no errors during extractions. The extracted data were cleaned by the researcher PAE in the extraction sheet in a form that can be read by

analytical software. The NIH quality assessment for the included studies is presented in table 5.

Measures of outcome

Weight and height were used to measure subject BMI, and sociodemographic data such as age, sex, gender, marital status, ethnicity, employment status, educational level and health status were collected from the subjects in the included studies. Parameters such as heart rate and systolic blood pressure were used to measure the rate pressure product (RPP)—an index of cardiorespiratory fitness, while the IPAQ-SF was used to determine the amount of time spent in PA and measures sitting, walking, vigorous-intensity activity, and moderate-intensity in MET minutes per week 7 days ago. PRISMA guidelines for systematic review were adopted for this study (figure 1).

Assessment of reliability and validity

To assess concurrent validity, the researchers of the included studies administered the two versions of IPAQ-SF with a time lag of 1 hour and then compared the scores obtained by the subjects in Min week^{-1} in the original English IPAQ-SF with the language-translated version. In contrast, the construct validity was assessed by either comparing the scores obtained by the subjects in Min week^{-1} in the language translated version by RPP or by comparing the total PA in Min week^{-1} of the language version with one of its constructs, for example, walking in Min week^{-1}. Additionally, the reliability was assessed by administering the language-translated version of the IPAQ-SF on 2 occasions separated by 7 days.

Data analysis

The statistical analysis utilized in the recruited studies included descriptive statistics and independent t-tests. The validity of the questionnaire was evaluated by Spearman and Pearson correlation coefficients (r), while single measure intraclass correlation coefficient (ICC) was adopted to determine the reliability. The suggestion by Landis and Koch[34] was utilized in interpreting the reliability. For example, the level of agreements was rated as follows: *almost perfect* = 0.8-1.0, *substantial* (0.6-0.8), *moderate* = 0.4-0.6, *fair* (0.2-0.4), and *poor* = 0-0.2. The heteroscedasticity of the data was indicated by Bland–Altman analysis to describe the total error (95% limits of agreement) between the language-translated IPAQ and the retest English version. Additionally, the difference between the Yoruba and Hausa IPAQ-SF was determine using independent t test, while ANOVA was used to compare the Yoruba, Hausa, and meta-data (combined mean for both versions) IPAQ-SF, and $p < 0.05$ was set as the level of significance.

Results

Our search yielded 65 hits on PubMed, 1 study from AJO, and 14 on Google Scholar. Following an elaborate assessment, approximately 9 relevant articles were identified, and only 2 studies carried out on 453 (n = 102 IPAQ-SF Hausa & n = 351 for Yoruba) apparently healthy adult subjects who met the criteria for inclusion were documented (figure 1). Additionally, these studies were conducted in Africa (Nigeria)**.**

The study by Awotidebe et al.[31], conducted in Obafemi Awolowo University (OAU) Ile-Ife, Osun state, Southwest, Nigeria, purposively sampled a cohort of undergraduate students (age 22.4 ± 3.01 years, mostly male and singles) culturally adapted the IPAQ-SF into the Yoruba language. The prefinal version was tested on 15 subjects (mean age = 21.3±4.7 years; female: n = 6; male: n = 9) who were recruited for the pilot study, after which the final version (Yoruba) was developed and used to collect data in the main study. Additionally, based on the outcome of the pilot, some modifications were made; for example, the word “digging” translated to “gbígbẹ́ kòtò”, “vigorous aerobics and PA and was replaced with “hard running and PA”, and “serious farm work” and “cutting grass around the house and fetching of water” were also included in the moderate and hard PAs. In contrast, the study by Oyeyemi et al.[30], conducted at the University of Maiduguri, Borno state, northeastern Nigeria, sampled subjects (age = 36.2 ± 9.5 years, rage = 20-65 years, primarily males, and married) and had higher total PA than females— 4383.7 vs 3058.1 MET-Min week^{-1} respectively, and mean

rate pressure product, RPP = 9694.3±1195.94) from a different background— workplace (e.g., private establishments and university teaching hospital) and in Maiduguri city neighbourhoods, culturally adapted IPAQ-SF into the Hausa language. A pilot study was conducted on 7 (out of the 12 recruited) subjects who could speak/write in the Hausa and English languages using the prefinal final version, after which the final version was developed for collecting data. Additionally, similar to the study by Awotidebe et al.[31], some modifications were made after the pilot study of the Hausa version. For example, the phrase 'aikinkarfi'—meaning PA was misunderstood as being restless and replaced with, "motsajiki"—physical exercise, "tafiyadagawannanwurizuwawancan"—traveling from place to place by walking was replaced with "tafiya (tattaki) dagawannanwurizuwawancan"—"walking to move from place to place either for sports, leisure recreation or exercise".

The Yoruba IPAQ-SF by Awotidebe et al.[31] had good concurrent validity. For example, a significant correlation was found between vigorous PA in both the Yoruba and original English versions of the IPAQ-SF. Similar results were reported for the energy consumed in time spent sitting and total PA. However, there was a moderate correlation for energy consumed in walking and moderate activities between the original English and Yoruba versions. Additionally, in the female subjects, correlations were significantly greater than the in males for energy used in sitting times and other activities for both versions of the IPAQ-SF, which was inconsistent with the report of Oyeyemi et al.[30], which found no meaningful socioeconomic and gender variance. Similarly, the Hausa IPAQ-SF by Oyeyemi et al.[30] also had good concurrent validity ranging from moderate to high. For example, total PA from the original English version was significant/highly correlated with total PA in the Hausa version. Additionally, the time used in vigorous, walking, and moderate PA was significantly high and positively correlated with both versions of the IPAQ-SF. The time spent sitting on both versions of the IPAQ-SF (Hausa and English) was also significantly and positively linked. Additionally, in the study by Oyeyemi et al.[30], the "Bland–Altman plot" for the English and IPAQ-SF Hausa revealed a small mean variance that was not significant and with a wide range of 95% limits agreements. This finding was attributed to few subjects who reported moderate PA of more than 50 min/week. In contrast, the study of Awotidebe et al.[31] did not carry out this plot.

Additionally, while the study of Awotidebe et al.[31] carried out a discriminant and convergent validity (construct validity) and found a highly significant positive correlation between total PA and vigorous PA scores (good convergent validity) for the Yoruba version, the sitting time and total PA were not correlated (good discriminant validity). In contrast, the study of Oyeyemi et al.[30] assessed construct validity by correlating the scores accrued from RPP with the time spent sitting from the IPAQ-SF Hausa and found a weak positive significant correlation. A similar result was reported between time used in moderate PA and BMI however, time used in walking, vigorous PA, and total PA showed no relationship with BMI and RPP.

The Hausa IPAQ-SF by Oyeyemi et al. [30] showed an intraclass correlation (ICC) ranging from fair to good (substantial), with vigorous PA having the highest value and moderate PA having the lowest value. Additionally, the ICC scores for all items were significant and higher in males than in females (the ICC in women was lowest in moderate and highest in sitting activity). In contrast, the reliability (ICC value) of the Yoruba IPAQ by Awotidebe et al.[31] ranges from poor to modest— lowest for sitting and highest for vigorous PA. Additionally, the ICC value was fairly significant for all items in the Yoruba version; however, in the Hausa version, it was mostly substantial and modest. The findings for gender variance in the ICC value in the Yoruba version were consistent with those of Hausa—higher in males than females.

Meta-analysis of the data of the Hausa and Yoruba IPAQ-SF

We conducted a meta-analysis of the physical characteristics, sociodemographic variables and psychometric properties of the recruited studies. The mean age and BMI of the subjects (n = 453) were 29.3±6.255 years and 24.1±4.335 (kg/m^2)

respectively. There were more male subjects (*n* = 293) than female and singles (*n* = 375) than married (table 1 and Figure 2).

The correlation coefficient ranges from modest (*r* = 0.7185) to high (*r* = 0.8455), demonstrating good concurrent validity for the IPAQ-SF Yoruba/Hausa. These findings indicated that the total energy used in the total PA (MET-Min/week) in the IPAQ-SF Yoruba/Hausa was significant and highly (*r* = 0.839, p < 0.001) correlated with that of the original English version. Similar results were found in the moderate, vigorous, walking activities, and the time spent sitting. However, no meaningful gender variance was found, as presented in table 2.

Additionally, table 2 presents the results of the 1-week test-retest reliability (ICC), which generally ranged from 0.328-0.5815, highest for energy expended in vigorous PA and lowest for moderate PA. The coefficient of reliability for walking *ICC* = 0.469 (95% *CI* = 0.301-0.5715), vigorous *ICC* = 0.6205 (95% *CI* = 0.4825-0.7215), and total PA ICC = 0.481 (95% *CI* = 0.319-0.6115) were higher in males than in females. The time spent sitting showed the highest ICC in females (0.568, 95% *CI* = 0.357-0.729), while moderate activity showed the lowest score for reliability (*ICC* = 0.2275, 95% *CI* = -0.055-0.473).

In table 3, the concurrent validity Male (*p* = 0.012), reliability total (*p* = 0.026), reliability female (*p* = 0.018) was all significantly different in the Yoruba, Hausa, and meta-data, while the other variables were not significant (p> 0.05). The concurrent validity (*r* = 0.844) of subjects who were male in the Hausa was significantly (*p* = 0.022) higher than that in the Yoruba (*r* = 0.640) IPAQ-SF. Similar results were found in the reliability total and female (table 4). However, the concurrent validity total and female and the reliability were comparable in both Hausa and Yoruba IPAQ-SF table 4.

Discussion

A PA lifestyle is assumed to be uncultured by many individuals in Africa and globally, it requires self-discipline to keep, adhere to, and often habituated[6]. The African population is made of a diverse group of cultures and languages whose first language is not English, and to address the challenges with using the IPAQ-SF English, there is a need for cultural adaptation of the questionnaire. This will aid in strengthening efforts to encourage PA participation, advance research in PA, and curb NCDs in developing countries in Africa. This study systematically searched for literature on reliability, validation, and cultural adaptation of the IPAQ-SF into African languages to proffer probable reasons for differences between various versions. Additionally, we compared the validity and reliability of the different language versions of the IPAQ-SF in Africa.

We found two studies on the reliability, validation, and cultural adaptation of the IPAQ-SF in languages in Africa —birthing the Yoruba[31] and the Hausa[30] IPAQ-SF. Additionally, these studies were all conducted in the northern and southern parts of Nigeria; hence, it seems that only a few studies have culturally adapted the IPAQ-SF into languages in Africa; therefore, we recommend that more studies should be conducted in this regard. The two validated studies in Africa were similar for obvious reasons. First, they were Nigerian-based studies and followed the step-by-step systematic process of cross-cultural adaptation of questionnaires as prescribed by Beaton et al.[23]. Second, a pilot study was conducted before the main study and the recommendations from the pilot study were implemented. Third, the data collected during the main studies were cleaned in accordance with prescribed guidelines by the core group of the IPAQ found at http://www.ipaq.ki.se[32], and both studies found good concurrent validity for the IPAQ-SF, indicating that the questionnaire is a valid subjective instrument that can be used to measure PA with results similar to other subjective and objective measures of PA. These findings are consistent with the results of other validated studies on the IPAQ-SF in a diverse group of population alien to Africa, such as Greek, China, and Mexico[24-25, 26-27, 19, 35]. However, caution should be used when directly comparing the results of our included studies with those of the abovementioned studies, since most of these studies validated the IPAQ-SF by comparing it with common objective criterion

standards, such as accelerometers[17, 25, 35-36]. Fourth, both studies recruited subjects from a population made up of students.

In contrast, there were also some differences between the included studies. For example, the study of Oyeyemi et al.[30] assessed the Hausa IPAQ-SF construct validity by correlating the RPP scores (9694.3±1195.94, an index of cardiorespiratory fitness) with the energy consumed in sitting from the Hausa IPAQ-SF and found a weak significant positive correlation. The RPP was computed by multiplying the resting heart rate by the systolic blood pressure, and the result of the RPP was higher than that of a recent report by Ewah & Oyeyemi[37], which found the value to be 7790.18±1131.59 in physically active students. However, the study of Awotidebe et al.[31] assessed the construct validity by correlating the energy expended in total PA and vigorous PA on the Yoruba IPAQ-SF and found a highly significant positive correlation. Additionally, in the study of Oyeyemi et al.[30], the heteroscedasticity of the data was indicated by Bland–Altman analysis to describe the 95% limits of agreement between the Hausa IPAQ and retest English versions however, this analysis was not demonstrated by Awotidebe et al.[31].

Other obvious variances in our included studies have been discussed in the results section of this report. It appears that the study of Oyeyemi et al. [30] was more robust for the following reasons: conduction of additional analysis, collection of additional data (blood pressure, heart rate, socioeconomic status), and collection of data from a diverse population, which demonstrates the possibility of collecting data from a diverse segment of the population in the country. However, the strength of the study of Awotidebe et al.[31] lies in recruiting a modestly large sample of the study's population.

The results of the meta-analysis showed that the total score obtained from the concurrent validity in the male subject in the Hausa IPAQ-SF was significant and more than that of the Yoruba version. Similar results were found in the scores of the ICC total and female. This indicates that the IPAQ-SF Hausa's reliability and concurrent validity were better than those of the Yoruba version.

Limitations of the study

This study was limited by the small number of included studies that used a nonprobability sample to recruit subjects hence, the result should be interpreted with caution. For this same reason, we could not determine in detail the heterogeneity of the included studies. However, this is the first SR/MA on studies on the reliability, validation, and cultural adaptation of IPAQ-SF into languages in Africa.

Conclusion

Overall, we found a few studies that have successfully validated and cultural adapted the original English version of IPAQ-SF into the languages in African. Additionally, the results showed that both the Hausa and Yoruba IPAQ-SF have adequate ICC (test-retest reliability) and concurrent validity for assessing PA in a diverse inhabitant in Africa. We also found that the total score for the concurrent validity male, ICC total, and female were significant and higher in the Hausa IPAQ than in the Yoruba version. We recommend that the IPAQ-SF be culturally adapted to the following languages in Africa; Igbo, pidgin, Swahili, Ajagam, Boki, and Effik.

List of Abbreviation

SR/MA-systematic review and meta-analysis; PA-physical activity; BMI-body mass index; RPP-rate pressure product; NCD-noncommunicable disease; IPAQ-SF-international activity questionnaire short form; ICC-intraclass correlation coefficient, AMSTAR-assessment of multiple systematic reviews, PRISMA-Preferred Reporting Items for Systematic Review and Meta-analysis.

Declarations

Ethics approval and consent to participate

This was not applicable for this SR.

Consent for publication

Not Applicable.

Availability of materials and data

The data for this study can be obtained from the included studies.

Competing interests

All author herein states no conflict of interest.

Funding

The authors conducted this study without funding by any organization.

Authors contributions

The idea for conducting this systematic study was brought by PAE. PAE and ID searched the database, and IDW, PAA and PAE screened for eligibility. Preparation and writing of the manuscript were executed by all authors (PAE, IDW, PAA, FAD). All documented authors have read and therefore approved this manuscript for publication.

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Not Applicable**.**

Table 1: Physical and sociodemographic characteristics of the subjects for the Yoruba/Hausa IPAQ-SF

Variables	**Yoruba (*n* = 351)**	**Hausa (*n* = 102)**	**Total (*n* = 453)**
Gender			
Female	114	46	160
Male	237	56	293
Marital status			
Married	5	69	74
Single	346	29	375
Variable	**Yoruba**	**Hausa**	**Combine mean**
Age (years)	22.4±3.01 (18-35)	36.2±9.5 (20-65)	29.3±6.255
Body mass index (kg/m^2)	24.3±4.37	23.9±4.3	24.1±4.335
Rat pressure product (RPP)		9694.3±1195.94	

kg/m^2 = kilogram per meter squared

Table 2 Reliability (ICC) and concurrent validity of the Hausa/Yoruba IPAQ-SF

Hausa- H (*n* = 102) plus Yoruba- Y (*n* = 351) IPAQ-SF H+Y/2	**Total (*n* = 453) *R***	**Female (*n* = 160) *r***	**Male (*n* = 293) *r***
VPA (Min week^{-1})	0.8105**	0.8875**	0.788**
MPA (Min week^{-1})	0.7185**	0.832**	0.705**
Walking (Min week^{-1})	0.7335**	0.8885**	0.6945**
TPA (MET-Min week^{-1})	0.8455**	0.9595**	0.791**
Time spent sitting (Min week^{-1})	0.839**	0.899**	0.7325**
Hausa- H (*n* = 102) plus Yoruba- Y (*n* = 240) IPAQ-SF H+Y/2	**Total (*n* = 342) ICC (95% CI)**	**Female (*n* = 102) ICC (95% CI)**	**Male (*n* = 240) ICC (95% CI)**
VPA (Min week-^{1})	0.5815 (0.4375-0.6855)	0.27 (-0.178-0.5805)	0.6205 (0.4825-0.7215)
MPA (Min week-^{1})	0.328 (0.164-0.472)	0.2275 (-0.055-0.473)	0.3185 (0.1005-0.505)
Walking (Min week-^{1})	0.4355 (0.291-0.5555)	0.2615 (-0.036-0.508)	0.469 (0.301-0.5715)
TPA (MET-Min week-^{1})	0.492 (0.365-0.599)	0.3645 (0.117-0.571)	0.481 (0.319-0.6115)
Time spent sitting (Min week-^{1})	0.3575 (0.2295-0.478)	0.568 (0.357-0.729)	0.242 (0.0445-0.413)

PA = Physical Activity, Min = Minute, MET = Metabolic Equivalent, *r* = correlation coefficient, **, p < 0.001, ICC = intraclass correlation coefficient, VPA = vigorous physical activity, TPA= total physical activity

Table 3: Comparison of concurrent validity and reliability of the Yoruba, Hausa and combined data of the IPAQ-SF

Variables	**F**	**p - value**
Concurrent validity total	3.544	0.062^{NS}
Concurrent validity female	3.243	0.075^{NS}
Concurrent validity male	6.576	0.012*
Reliability total	5.024	0.026*
Reliability female	5.739	0.018*
Reliability male	3.199	0.077^{NS}

Analysis of variance– ANOVA: * p<0.05 = significant, NS = not significant

Table 4: Comparison of concurrent validity and reliability of the Yoruba and Hausa IPAQ-SF

Variables	Yoruba	Hausa	T	P - value
CV total	0.723 ±0.111	0.856±0.054	-2.414	0.054^{NS}
CV Female	0.937 ±0.053	0.850±0 .062	2.381	0.045^{NS}
CV male	0.640 ±0.133	0.844±0.064	-3.099	0.022*
Reliability total	0.320 ±0.104	0.558±0.145	-2.986	0.020*
Reliability female	0.187 ±0.159	0.490 ± 0.126	-3.348	0.011*
Reliability male	0.296±0.126	0.556± 0.203	-2.432	0.047^{NS}

CV=concurrent validity, * p<0.05 = significant NS = not significant,

Table 5: The National Institutes of Health (NIH) quality assessment for the included studies

Studies	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	P
Awotidebe et al. 2021	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**NA**	**1**	**11**
Oyeyemi et al. 2011	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**NA**	**1**	**11**

Key:
Q = question,
P- Total score Assessment of the quality of the included studies by application of the NIH tool (Shea et al. 2017),
scoring – items scored 1 if yes, 0 if no, absent or not applicable.
The tool is composed of 14 closed questions, with possible answers: 1 = Yes, 0 = No, CD = cannot determine, NA = not applicable, and NR = not reported.

Figure 1: Flow chart

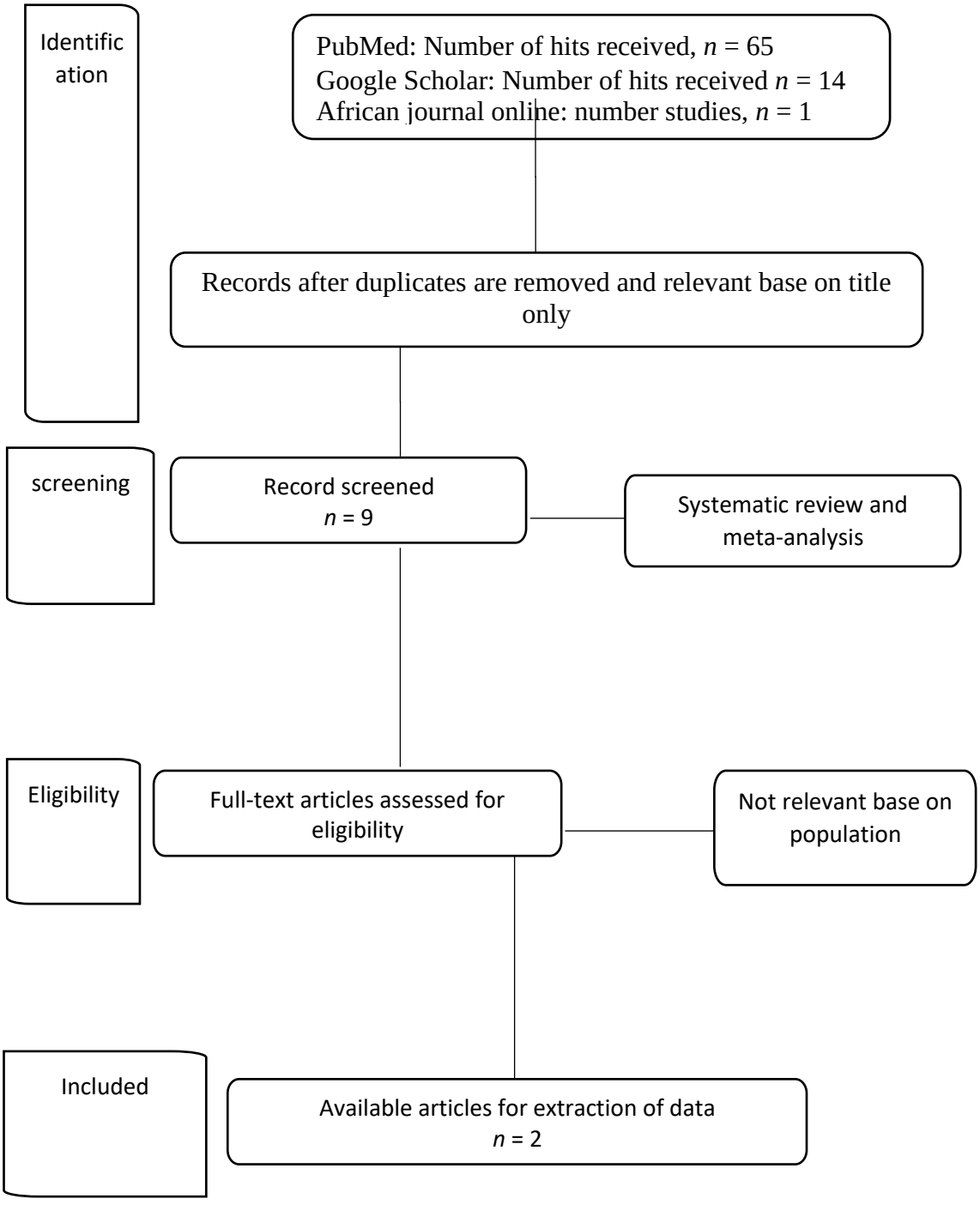
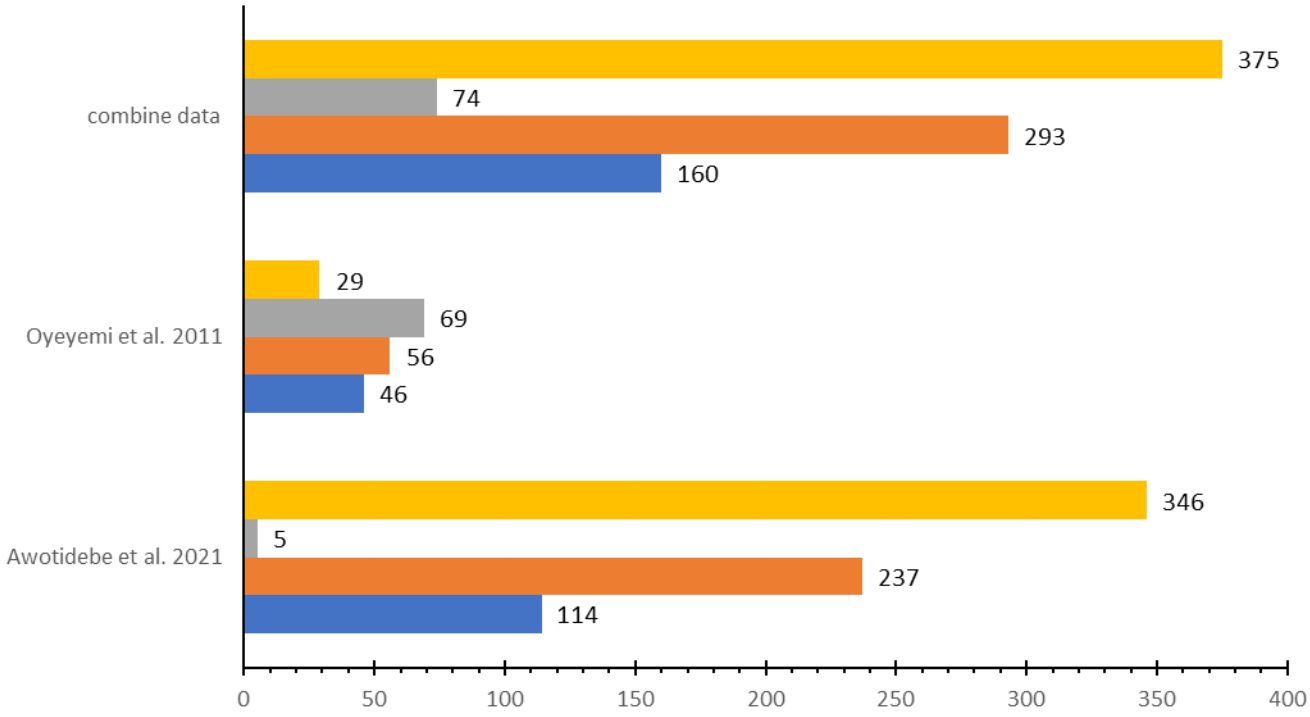


Figure 2: Gender and marital stutus of studies



	Awotidebe et al. 2021	Oyeyemi et al. 2011	combine data
single	346	29	375
married	5	69	74
male	237	56	293
female	114	46	160

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