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Sinhalese Version of the Global Physical Activity Questionnaire for Community-Dwelling Older Adults: Reliability and Validity

Bimba Wickramarachchi[a,b], Sidiah Siop[a], Bilesha Perera[c,*]

[a] Department of Nursing, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Malaysia
[b] Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna, Galle, Sri Lanka
[c] Department of Community Medicine, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

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ABSTRACT

Background: A reliable and valid measurement of physical activity (PA) is vital for PA surveillance activities in community settings and for evaluating PA intervention programs targeted at older adults. This study assessed the reliability and validity of a Sinhalese version of the Global Physical Activity Questionnaire-version 2 (GPAQv2) adapted for community-dwelling older adults (aged 60+) in Sri Lanka.

Methods: Cross-cultural adaptation and an assessment of content validity of the GPAQv2 were done. Indirect criterion validity (n = 210) and test-retest reliability (n = 40) of the tool were assessed. Content validity index, Spearman rank correlation coefficients and intra-class correlation coefficient (ICC) were calculated, and Bland–Altman plots were drawn.

Results: The content validity index of the questionnaire was 0.82, an acceptable value. The 360^0 turn test (r = –0.258, p= 0.03), and timed up-and-go test (r = –0.197, p= 0.02) were negatively correlated, whereas total balance (r= 0.241, P= 0.00), single leg stance (r= 0.206, p= 0.01), and instrumental activities of daily living score (IADL) (r= 0.244, p= 0.00) were positively correlated with the GPAQv2 scores of PA, confirming the indirect criterion validity of the Sinhalese version of the GPAQv2. The tool demonstrated favorable test-retest reliability (ICC = 0.713). The mean difference between the test and retest total PA scores was –302.6 MET/week, a slight overestimation of PA in the retest.

Conclusions: The Sinhalese version of the GPAQv2 demonstrates acceptable reliability and validity. It is suitable for use in PA measures among community-dwelling older adults in Sri Lanka.

1. Introduction

Sri Lanka has one of the fastest aging populations in Asia [1]. The proportion of older adults (aged 60+) in the country was 11.7% in 2013, and the figure is expected to increase to 21.1% by 2030 [2]. Aging of its population is not in parallel with the economic growth of the country and these trends have already made devastating consequences on health and economic well-being of older adults in the country. Chronic ill-health conditions are steadily increasing among Sri Lankan older adults as has been seen in many other countries [1–4]. Being an agricultural country for many centuries, the older adult population currently living in Sri Lanka is largely a physically active cohort. Nevertheless, recent demographic and epidemiological transitions that have led to urbanization and westernization of the Sri Lankan society have resulted people in the country being less active and vulnerable to developing chronic ill-health conditions [1, 4, 5, 7].

The classification of individuals by activity level is the main objective of measuring physical activity (PA) across populations, and it enables the study of trends and associations with other types of behavior or health outcomes [6]. Data on the PA statuses of older adults in Sri Lanka and personal, socio-cultural, economic, and structural determinants of such statuses are grossly inadequate. One of the major challenges in measuring PA in older adults in Sri Lanka is the unavailability of reliable and valid measuring tools. The International Physical Activity Questionnaire (IPAQ), which was developed to assess PA among adults (15–69 years), has been frequently used by health professionals in many countries, including Sri Lanka, to measure PA in older adults [5, 8–10]. However, the IPAQ has its own limitations in collecting a broad spectrum of PA data in populations originating from different cultural

* Corresponding author.
E-mail addresses: biwickramarachchi@ahs.ruh.ac.lk (B. Wickramarachchi), jsidiah@unimas.my (S. Siop), pperera@indiana.edu (B. Perera).

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settings in the developing world [11, 12]. The complexity of the tool to be used in developing country settings and deficiencies in capturing occupational, domestic, and transport-related physical activities common to people in developing countries were the main limitations identified in the IPAQ. Further, leisure-time activities assessed in the IPAQ, which have been commonly observed in the developed country setting, were relatively uncommon in the developing country setting [11, 13].

After reviewing the existing PA questionnaires, specifically the IPAQ, a PA measurement tool (the Global Physical Activity Questionnaire -GPAQ) was developed by the World Health Organization (WHO) [11, 14, 15]. A revised version of the GPAQ (GPAQv2) has been validated in many countries, including several countries in Asia: Bangladesh, China, India, Indonesia, and Japan [14]. This tool has been recommended for PA surveillance among adults (18–70 years old) in developing countries [15]. In the recent past, in both developed and developing countries the GPAQv2, have been used to assess PA status among adults [16–20].

The GPAQv2 is a user-friendly measurement tool that comprises 16 questions covering four domains: activity at work, transport, leisure, and sedentary behavior [15]. It can be easily administered by a trained interviewer in the field, and the scope of the GPAQv2 is broader than that of the short IPAQ version. The GPAQv2 asks about PA in a typical week, thus minimizing recall bias, and is considered suitable for surveys among people who are confined to regular work patterns. Moreover, this tool provides room for the development of age- and culturally appropriate flash cards to explain PA, which is advantageous when using the tool among different population segments. The GPAQv2 has demonstrated favorable reliability and validity properties [14, 20]. The test-retest reliability of the tool has demonstrated good-to-excellent results (0.67–0.81), and it has shown better measurement properties than those of the IPAQ tool [18, 20]. However, fairly poor test-retest reliability was demonstrated when the GPAQv2 was used among participants with unstable work patterns [19]. Criterion validity for various GPAQ measures, namely, overall, work, transport, and leisure-related PAs, ranged from poor to fair [20]. Although the GPAQv2 has several advantages over other available surveillance measures of PA engagement in community settings, such as pre-set PA lists to help participants recall PA, it has also been observed that the tool has overlooked vital components, such as light and functional PA embedded in recreational work, which is an important aspect of older adults' PA behavior [20]. Hence, the use of the tool may result in significant underestimation of sedentary behavior in older adults. Further, the reliability and validity properties of the GPAQv2 have not been assessed for older populations across the world [20].

In light of the above evidences, a validated PA measurement tool is urgently required to measure and maintain surveillance of the PA status of older adults, and to assess PA interventions that promote the health of the ever-growing geriatric population in Sri Lanka. Thus, an evaluation of the psychometric properties of the GPAQv2 for older Sri Lankans is of paramount importance and a timely need. In addition, reliable, valid, and user-friendly measurement tools that measure PA in older adults are of immense value to the comparison of cross-cultural discrepancies in PA among older adults in Asian countries. Such information would assist in identifying regional strategies required to combat existing disability and chronic disease burdens of population aging in Asia. Hence, this study is aimed to evaluate the reliability and validity of a Sinhalese version of the GPAQv2 adapted for community-dwelling older adults in Sri Lanka.

2. Methodology

Cross-cultural adaptation of the GPAQv2 was performed using the WHO guidelines [21]. Content validity, indirect criterion validity, and test-retest reliability of the Sinhalese version of the GPAQv2 were evaluated using a sample of 210 older adults.

2.1. Cross-cultural adaptation process of the GPAQv2

The WHO recommended questionnaire adaptation procedure [21] was used to develop the Sinhalese version of the GPAQv2. The adaptation process included forward-translation, expert panel discussion, back-translation, pre-testing, and cognitive interviewing. First, the entire questionnaire was translated into Sinhala, the local language, by a group of three bilingual experts whose mother tongue is Sinhala. The expert panel met and discussed the inadequate and inappropriate expressions resulting from the translation of the original into the translated version. Necessary modifications were made. This modified version was then back-translated into English by two independent bilingual translators. Cognitive interviews using cognitive probes and pre-testing of the questionnaire were conducted among 10 older adults (five men and five women) to ascertain any significant misinterpretations of the questions and check the comprehensibility of the questionnaire. The pre-final Sinhalese version of the GPAQv2 was developed based on the results of these procedures. The content validity ratio (CVR) and content validity index (CVI) were determined according to the Lawshe test [22]. A panel of content experts rated each item of the scale in terms of its relevance to the underlying construct. For each item, CVR was computed by dichotomizing the ordinal scale into categories: "relevant" and "not relevant," and it was subsequently tested for each subscale of the instrument. The number of agreements for each item was rated accordingly. The average CVR was calculated to determine the CVI of the developed instrument.

2.2. Indirect criterion validity

2.2.1. Participants, study settings, and sample

A sample of 220 older people (aged 60 years and older) from five senior citizen societies in a divisional secretariat area in the Colombo district in Western Sri Lanka was selected for the study. Older adults in the district fairly represent community-dwelling older adult population in the country. Senior citizen societies in the selected Grama Niladhari divisions in the divisional secretariat area were used as data collection centers. Monthly meetings of senior citizens are held at these centers. Participants were selected from the attendance registry based on predefined inclusion and exclusion criteria. Participants suffering from terminal illnesses, those with severe speech or hearing difficulties, older adults who were unable to speak the Sinhala language and those who scored less than 17 in the Mini Mental State Examination (MMSE) were excluded from the study. Written informed consent was obtained before data collection. A subject item ratio of 1:10 was used to determine the sample size [23]. An additional 30% were allowed for possible dropouts and adequate male participation.

2.2.2. Variables and measurements

The questionnaire included the Sinhalese version of the GPAQv2, body strength (leg strength and handgrip strength), balance (four-stage balance test, 360^0 turn test, and stand-up-and-go test), anthropometric measurements; body mass index (BMI) and fat percentage, and questions on Instrumental Activities of Daily Living (IADL). GPAQv2 is a 16-item tool that collects domain-specific physical activity data under three domains: activity at work, active transport and leisure time–related activities. The tool measures physical activity using the mean metabolic equivalence task per week (MET/week). Participants' PA status was categorized as "sufficiently active" and "inactive" using the GPAQv2 guidelines. Sufficiently active individuals are defined as those who do a minimum of 1500 MET/week of PA, and inactive individuals as those who do less than 1500 MET/week of PA [11, 15]. The 30-s chair-stand test was performed to assess lower extremity muscle power (leg strength). Handgrip strength was measured using a dynamometer. Values were recorded to the nearest kilogram. A higher value was considered to reflect a good performance. To test static balance, a four-stage balance

test was performed, including the standing balance, semi-tandem position, tandem stance position, and one-leg stance position. Each task was tested for 10 s, and the number of seconds expended for each activity was recorded. Dynamic balance was tested using the 360^0 turn and timed up-and-go tests. In the 360^0 turn test, the time taken by the participant to turn himself or herself 360^0 was recorded. In the timed up-and-go test, the person was asked to stand up and walk 3 m and then turn back to the chair and sit down. The average time taken to perform the two rounds was recorded. A lower value was considered to reflect a good performance. Body mass index (BMI) was calculated using a person's height and weight (kg/m^2). Fat percentage was assessed based on skinfold thickness and calculated using the Durnin and Womersley method [24]. Skinfold thickness recordings in the biceps, triceps, suprailiac, and subscapular areas were used to calculate the fat percentage.

Instrumental activities of daily living (IADL) is a tool useful for identifying how a person is functioning at the present time. It has eight items [25]. A summary score ranges from 0 (low function, dependent) to 8 (high function, independent).

2.3. Test-retest reliability

The test-retest reliability of the questionnaire was evaluated using the same researcher-administered questionnaire on a sub-sample of 40 participants out of the 210 participants in the final sample, after a one-month interval.

2.4. Ethical clearance

Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (UNIMAS/NC-21.2/03.02 Jld.2(94)), Malaysia and from the Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka (12.07.2018: 3.1).

2.5. Data analysis

Data analysis was performed using SPSS (version 25). The mean CVR value was calculated to determine the CVI of the questionnaire. According to the Shapiro–Wilk test, PA data were not normally distributed ($p < 0.05$). Therefore, non-parametric tests were used. The Spearman rank correlation coefficient was used to test the correlation between PA and physical measures. Test-retest reliability was assessed using intra-class correlation coefficient (ICC). The 95% confidence interval was calculated as the mean difference ± 1.96 standard deviations. Bland–Altman plots [26] were used to determine the agreement between pre- and post-test values.

3. Results

A total of 220 older adults participated in the study. Invalid questionnaires from 10 participants were excluded. They included incomplete questionnaires and outliers. If anyone had >16 h for any subdomain, such a case was excluded according to the analysis guide. If a participant provided a value for only one domain, with those for other domains missing, they were considered to have missing domains and, thus, assigned a '0' value. Finally, 210 cases were used for the final analysis (rejection rate = 4.7%). Among the 210 participants, 16.7% (n = 35) were men and 83.3% (n = 175) were women.

One hundred and six (50.4%) were in the age group 60–69 years followed by 84 (40%) in the age group 70–79 years and 20 (9.6%) in the age group 80+ years. The majority (73.8%, n = 155) were studied up to secondary level. Thirty one (14.8%) participants were in the lowest income category (monthly household income < US$ 53) followed by 135 (64.3%) in the middle income category (monthly household income US$ 53 – US$ 71) and 44 (20.9%) in the higher income category (monthly household income > US$ 71).

Table 1
Physical activity status of the participants .(n = 210)

Domains of physical activity	Physical activity (Mean and SD in MET/week)
Total physical activity	7501(±4609)
Vigorous activity at work	950 (±2730)
Moderate activity at work	5504 (±4231)
Active transport	812 (±1068)
Vigorous leisure time activities	7 (±76)
Moderate leisure time activities	331 (±878)
Sedentary activities	2448 (±1148)

Note: MET refers Metabolic Equivalent Task.

3.1. Cross-cultural adaptation of the GPAQv2 questionnaire

Participants took an average of six minutes to complete the questionnaire in the pre-test. Show cards and examples of PA were modified according to the participants' capacity to comprehend. The final Sinhalese version of the GPAQv2 was prepared considering all these aspects.

3.2. Content validity index

The CVR values calculated based on the ratings for each of these items were 0.66, 0.99, 0.99, 0.66, 0.66, and 0.99. Therefore, the overall content validity index (CVI) of the tool was 0.82. A minimum score of 0.8 is required to accept the tool as having good content validity [18]. Therefore, the Sinhalese version of the GPAQv2 was found to have good content validity.

3.3. Indirect criterion validity

Physical activity status of the participants: Table 1 shows the PA status of the participants. The mean (*SD*) value of the total PA was 7501 MET/week (± 4609). Moderate activity at work was the main contributor to the total PA participation of the participants (5504 MET/week (± 4231)).

Indirect criterion validity of the questionnaire: The indirect criterion validity of the Sinhalese version of the GPAQv2 was examined by calculating correlation coefficients between PA and observed physical measures (Table 2). We identified a negative correlation between age and total mean MET/week of PA (–0.320, p= 0.00), indicating that young older adults were more physically active than senior older adults. The total mean MET/week of PA was positively correlated with total balance (r= 0.241, $p < 0.05$), single-leg stance (r= 0.206, $p < 0.05$), and IADL (r= 0.244, $p < 0.05$), and negatively correlated with the 360^0 turn test (r= 0.258, $p < 0.05$) and timed up-and-go test (r = –0.197, $p < 0.05$). The mean MET/week of vigorous activity at work positively correlated with total balance (r= 0.116, p= 0.05) and single-leg stance (r= 0.180, $p < 0.04$) and negatively correlated with the 360^0 turning test (r = –0.151, $p < 0.05$) and timed up-and-go test (r = –0.158, $p < 0.05$). Fat percentage (r= 0.11, p = 0.09) and BMI (r= 0.06, p= 0.32) were not significantly associated with the total mean MET/week of PA. Although the leg and handgrip strength were positively correlated with the total mean MET/week of PA of the participants as expected, no significant results were obtained.

3.4. Test-retest reliability

3.4.1. Intra-class correlation coefficient

Table 3 shows the ICC of the test and retest results. The ICC falls between 0.632 and 0.837 for subgroups stratified by the PA domain. The overall ICC was good (r= 0.713). Vigorous and moderate activity at work, active transport, moderate leisure-time activities, and sedentary activities demonstrated a higher ICC.

Table 2
Spearman rank correlation coefficient between physical activity and demographic and biological variables (n= 210).

Variable	Total Mean MET/Week	Vigorous activity at work	Moderate activity at work	Active transport	Vigorous leisure time	Moderate leisure time	Sedentary work
Age	−0.320 (p= 0.00)	−0.146 (p =0.00)	−0.270 (p =0.00)	−0.136 (p =0.00)	−0.008 (P= 0.91)	0.054 (P= 0.43)	0.234 (p =0.00)
Leg strength	0.134 (p= 0.052)	−0.001 (p= 0.99)	0.114 (p= 0.10)	0.050 (p= 0.46)	0.052 (p= 0.45)	0.082 (p= 0.23)	−0.168 (p =0.05)
Hand grip strength	0.067 (p= 0.335)	0.144 (p =0.05)	−0.016 (p= 0.81)	0.040 (p= 0.56)	0.177 (p =0.05)	−0.006 (p= 0.93)	0.003 (p= 0.96)
Total balance	0.241 (p =0.00)	0.116 (p =0.05)	0.128 (p= 0.06)	0.118 (p= 0.08)	0.006 (p= 0.93)	0.075 (p= 0.28)	−0.053 (p= 0.44)
Single leg stance	0.206 (p =0.01)	0.180 (p =0.04)	0.102 (p= 0.14)	0.082 (p= 0.23)	−0.02 (p= 0.72)	0.044 (p= 0.53)	−0.052 (p= 0.45)
360° turning test	−0.258 (p =0.03)	−0.151 (p =0.01)	−0.152 (p =0.02)	−0.165 (p =0.05)	−0.053 (p= 0.44)	−0.031 (p= 0.66)	0.160 (p =0.00)
Timed-up and go test	−0.197 (p =0.02)	−0.158 (p =0.00)	−0.100 (p= 0.14)	−0.129 (p= 0.06)	−0.096 (p= 0.16)	0.076 (p= 0.27)	0.148 (p =0.01)
Fat percentage*	0.114 (p= 0.09)	0.083 (p= 0.23)	0.251 (p =0.00)	−0.122 (p= 0.07)	−0.042 (p= 0.54)	−0.080 (p= 0.24)	−0.063 (p= 0.36)
BMI	0.068 (p= 0.32)	0.014 (p= 0.84)	0.124 (p= 0.07)	−0.074 (p= 0.28)	0.042 (p= 0.54)	−0.106 (p= 0.12)	−0.056 (p= 0.42)
IADL	0.244 (p =0.00)	0.077 (p= 0.26)	0.211 (p =0.03)	0.133 (p =0.05)	0.022 (p= 0.75)	−0.106 (p= 0.12)	−0.135 (p =0.02)
MMSE	−0.036 (p= 0.60)	−0.031 (p= 0.65)	−0.007 (p= 0.91)	−0.089 (p= 0.19)	−0.069 (p= 0.32)	−0.046 (p= 0.50)	−0.005 (p= 0.94)

Note. p from Spearmen's rank correlation coefficient values taken (P<0.05 considered as significant).

MET refers Mean Metabolic equivalent task.

BMI refers Body Mass Index: MMSE refers Mini Mental Health State Examination.

IADL refers Instrumental Activities of Daily Living.

SRH refers Self-rated Health.

* Fat percentage calculated based on skin fold thickness and skin fold thickness was taken by skin fold calliper.

Table 3
Intra-class correlation between test and retest (n= 40).

Variables	Intra-class correlation (ICC) R	P
ICC for the total sample		
Total physical activity	0.713	0.00
Vigorous activity at work	0.748	0.00
Moderate activity at work	0.715	0.00
Active transport	0.643	0.00
Moderate leisure time activities	0.837	0.00
Sedentary activities	0.632	0.00

Note: ICC, Intra-class correlation (two-way random effects were tested using absolute consistency);.
None of the participants had done Vigorous Leisure-time activities.

3.4.2. *Bland–Altman plots test*

There was no significant difference in the total mean MET/week scores between test and retest results (p= 0.833). The mean MET/week of total PA was 8690.3 in the pre-test and 8992.9 in the retest. According to Bland-Altman plot results, the agreement between pre and post test was –151 MET/week for the total PA. This observation indicates an overestimation of total mean PA MET/week in the retest. The highest overestimates were reported in the retest results of sedentary and moderate work activity (mean differences were –324 and –521 MET/week, respectively), and under-reporting was observed in vigorous work (+341.6 MET/ week), traveling (+65.7 MET/week), and leisure-time PA (+61.25 MET/week). Fig. 1 shows that a negative bias exists for the re-test with the majority of points falling below zero.

4. Discussion

In this study, the reliability and validity of the adapted Sinhalese version of the GPAQv2 were examined. Overall, the Sinhalese version of the GPAQv2 demonstrated acceptable reliability and validity properties. Further, the tool was well comprehended and accepted by community-dwelling older adults in Sri Lanka. The high literacy rate of the target population and culture-sensitive PA show cards were likely the major reasons for this high acceptance rate.

The Sinhalese version of the GPAQv2 showed acceptable indirect criterion validity properties. Significant acceptable correlations between PA and balance, fat percentage and IADL were identified. Although the correlations between PA and leg and handgrip strengths were in the expected direction, no significant results were obtained. As individuals' age, body fat mass increases and is deposited predominantly in the abdominal region, and increased BMI and percentages of body fat are associated with lower physical performance [27–29]. It has been revealed that no significant sex differences in the relationship between body composition and physical function are evident [28]. A study conducted in Sri Lanka found that the prevalence of overweight and obesity is lower in older age groups than in middle-aged groups [30], and Sri Lankans are considered a "thin" population. Therefore, BMI and fat percentage in older adults are characterized by relatively low values, making them insignificant risk factors for PA in older adults, as has been observed in this study.

Sarcopenia, the loss in muscle mass with age, decreases strength in older adults with increasing age. Further, upper- and lower-extremity strength and muscle quality decrease as age increases [31]. Accordingly, increasing age, low levels of total and single-leg stand balances, and deficiencies in IADL were found to impede PA behavior of older adults as observed in this study. The timed up-and-go and 360^0 turn tests, the two types of performance-based measures of functional mobility, demonstrated that those who were weak in functional mobility were less likely to engage in PAs. These evidences strongly suggest that the GPAQv2 is a valid measurement tool for the measurement of PA in older adults.

Although the indirect criterion validity of the GPAQv2 for older adults has not been examined, the criterion validity of the PA scale for

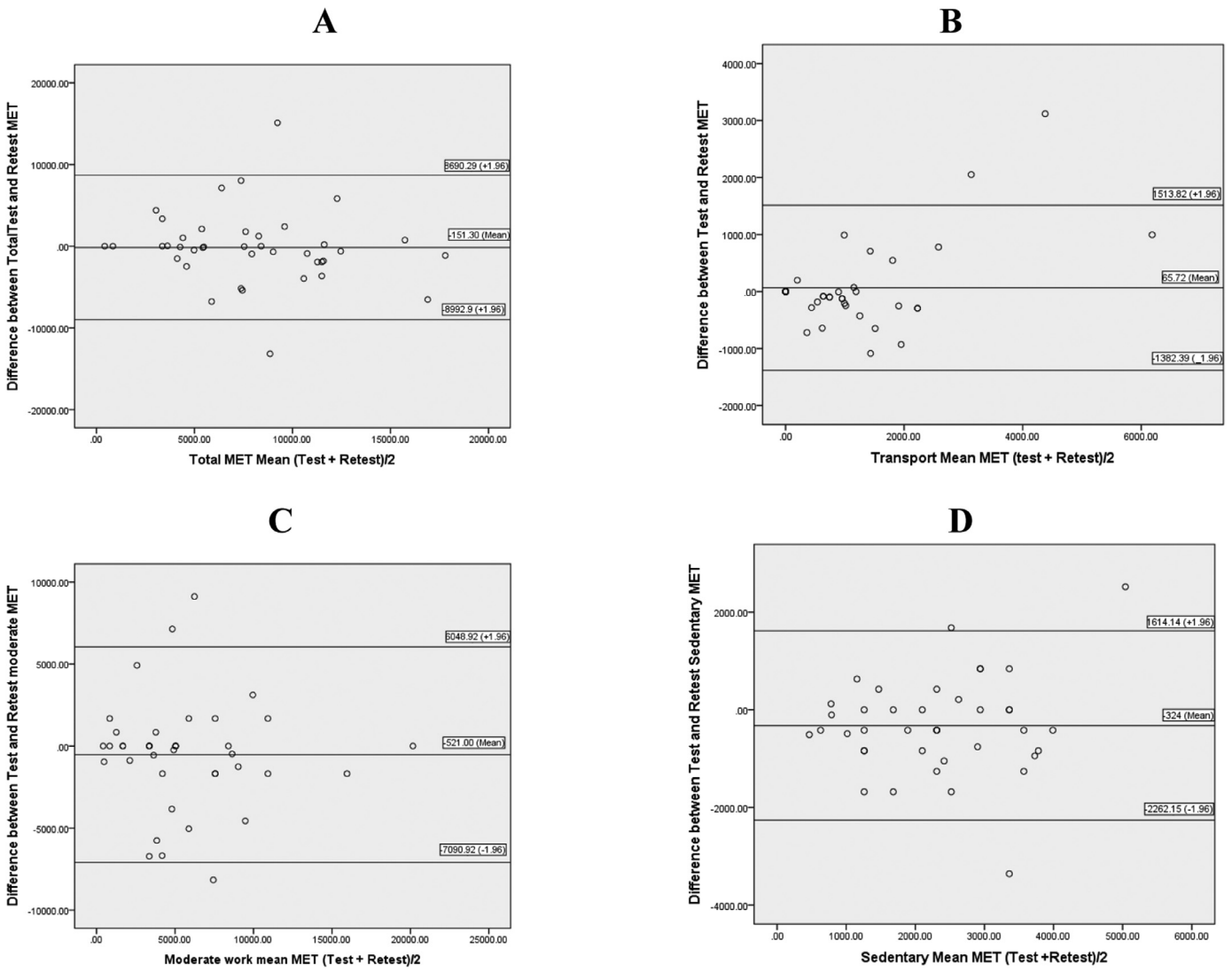

Fig. 1. Bland-Altman plots of the reliability of the Global Physical Activity Questionnaire version 2 (GPAQv2). Agreement between test and retest of GPAQv2 for total PA MET/week (A), transport MET/week (B), moderate work MET/week (C) and sedentary work MET/week (D). Abbreviation. PA, Physical Activity. MET, Metabolic Equivalent Task.

the elderly (PASE) [32, 33] and the IPAQ modified for the elderly [9] has been tested against indirect criterion validity measures. These studies used biological markers of activity, such as high sensitivity C-creative protein, and other measures, including IADL, walking speed, static balance, and grip strength. Further, using indirect methods, such as BMI, fat percentage, and waist circumference, the validity of the GPAQ has been evaluated for adult populations [34]. Several studies have verified the criterion validity of the GAPQ using self-report (i.e., IPAQ) and objectively measured data (e.g., accelerometers); however, none of these studies have targeted older adult population groups [20]. A poor-to-fair concurrent validity of the GAPQ was established in those studies.

The suitability of the IPAQ and accelerometers as "gold" standards for evaluating criterion validity of the GAPQ has been queried by a number of researchers [9, 20]. Studies have shown significant differences in values between accelerometers and the IPAQ. Further, the validity of the IPAQ as a PA measurement tool in less developed countries is questionable, as it does not capture occupational and transport-related PAs, a vital component of PA in those countries. In the GAPQ, the respondents were asked to recall PA in a typical week, whereas in the IPAQ, they were asked to recall their PA behavior in the last 7 days [34]. These differences in time frames may result in discrepancies in PA behavior among the respondents who were assessed using both the GAPQ and IPAQ. In addition, accelerometers are not accurate in detecting upper body movements when worn around the waist [9]. Therefore, indirect criterion validity measures that were employed in this study to assess the validity of the Sinhalese version of the GPAQv2 would be appropriate at present, given that no trustworthy "gold" standard is available to measure criterion validity of the GPAQv2 for older adults.

The overall test-retest reliability of the Sinhalese version of the GPAQv2 was favorable. Fair-to-excellent ICC results for all the subgroup categories of the PA domains were observed, as seen in other studies [19, 34, 35]. Test-retest reliability gradually reduces with increasing retest time [34]. It has been observed that people with stable work patterns tend to report moderate test-retest reliability, and those with unstable work patterns tend to report poor test-retest coefficients [19]. In this study, many participants experienced a stable work pattern. This, together with the use of culturally acceptable "show cards" in the tool and examining PA in a typical week, might have resulted in good test-retest reliability for the Sinhalese version of the GPAQv2. The Bland–Altman test demonstrated a negative mean difference between the test and re-test results. This indicates an overestimation of PA in the re-test results. The difference is wider in moderate activity under the work do-

main. Social desirability and contamination bias may be the reasons for this observed overestimation. Wanner et al. [36] conducted a validation study on the GPAQv2 against an accelerometer and found that the total PA in the GPAQv2 data was 2.8 times higher than the accelerometer data. Thus, future research is required to estimate degrees of over-or under-reporting of PA in the GPAQv2 using objectively measured data. Public health researches should pay attention to enhance validity, reliability and responsiveness to the change in the existing PA questionnaires rather than developing new questionnaires because cost and feasibility of the existing questionnaires including GPAQv2 are satisfactory [37, 38].

Overall, the Sinhalese version of the GPAQv2 demonstrated acceptable psychometric properties and is a suitable tool for measuring PA in community-dwelling older adults in Sri Lanka. Even though the country is categorized as a middle-income country (GDP per capita 3853 USD), Sri Lankans have a high human development index (0.78), an average of 76.4 years of life expectancy at birth, and a high literacy rate (84%) [1, 39, 40]. These factors might have contributed to the utility of the Sinhalese version of the GPAQv2 as a suitable and highly useful measurement tool for PA-surveillance measures in the country's geriatric population.

This study employed a large sample size and had a high response rate. The method of data collection was face-to-face interviews; therefore, information bias might have been reduced. A large age range (60–89 years) of older people was studied. However, there was a notable imbalance in participant sex; only about 17% of the participants were men. Sri Lankan culture is such that during the day, the majority of older men go for ourdoor activities, engaged in casual work or lingering in common places. This is the major reason for the apparent sex imbalance in the sample. However, to lower this sex imbalance in the sample, the research team arranged home visits in the evenings to recruitan adequate number of older men in the survey. Hence, it was possible for the research team to survey a sample of 35 older male adults, which is an adequate sample for this study. It is unknown whether the GAPQv2 has different validity and reliability evidence in different sexes. Thus, future research in this area is warranted.

5. Conclusions

The Sinhalese version of the GPAQv2 was well accepted by community-dwelling older adults in Sri Lanka. The tool proved to be a simple and practical measure, suitable for use in community health surveys. Further, the tool has acceptable reliability and validity for use in monitoring and evaluating PA among community-dwelling older adults in Sri Lanka.

Declaration of Competing Interest

None.

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