ORIGINAL ARTICLE

VALIDITY AND RELIABILITY OF PHYSICAL ACTIVITY SCALE FOR ELDERLY IN MALAY LANGUAGE (PASE-M)

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ABSTRACT

Physical Activity Scale for the Elderly (PASE) is a simple, valid and reliable questionnaire that can be administered to quantify older adults' physical activity levels during daily living. However, PASE in Malay language for use among older population is not available. The objective of our current study was to evaluate the reliability and validity of the Malay translated Physical Activity Scale for Elderly (PASE-M) for the use among older adults. Objective results of physical activity were obtained by wearing continuously an accelerometer for one week among a population of older adults in Malaysia who speak Malay language. Participants completed PASE-M twice, on day-8 (PASE-M1) and day-15 (PASE-M2). Concurrent validity between PASE-M1 and accelerometer results was assessed using Spearman's rank correlation coefficient. Test-retest reliability for one week interval of PASE-M was tested using Spearman's rank correlation coefficient and Intra-class correlation coefficients (ICC). Forty-four community-dwelling older adults (12 men and 32 women; mean age ± SD= 66.95 ± 5.34) participated in this study. However, only 33 participants (8 men and 25 women; mean age ± SD= 66.64 ± 5.51) were able to achieve the minimum accelerometer wearing time and filled up the PASE-M questionnaire for two times with one weeks interval. The results showed the PASE-M score was significantly correlated with vector magnitude (VM) counts (r=0.54, p<0.01), time in moderate-to-vigorous physical activity (MVPA) (r =0.55, p<0.01), energy expenditure (r =0.53, p<0.01) and walking steps (r=0.39, p<0.05). A high reliability (ICC = 0.96) was demonstrated between first and the subsequent administration of PASE-M (p<0.01, 95% CI: 0.92-0.98). The PASE-M is a valid and reliable questionnaire to assess physical activity level for Malaysian community-dwelling older adults.

Keywords: *older adults, physical activity, questionnaire, accelerometer, validity, reliability*

INTRODUCTION

Physical inactivity has been reported to cause 6% of the burden of disease from coronary heart disease[1]. Regular physical activity provides strong protective benefits against coronary heart disease but only 30% of individuals older than 65 report exercising regularly[2]. Worldwide, there were 600 million older adults in 2000, but this number is likely to double to 1.2 billion by 2025 and two billion by 2050[3]. There is an urgent need to predict older adults' physical inactivity early and support them to develop an active lifestyle to minimize the prevalence of physical inactivity associated with increase age[4-5].

Accurate assessment of physical activity is important. The Doubly Labeled Water Method is the most accurate and valid method to estimate total energy expenditure through activity[6]. However, the method is costly and manpower intensive. Furthermore, it does not provide information on the type and duration of physical activities performed during daily living[7]. Accelerometers provide minute-by-minute measurements of movement over several days or weeks to access patterns of movement or inactivity in older adults' free-living environment. Other practical and accurate methods to validate physical activity include questionnaires. These questionnaires are easy to complete and analyze older adults' participation intensity.

The Physical Activity Scale for the Elderly (PASE) is a recall questionnaire developed for older adults. It comprises of 12 items addressing the leisure, physical, household and work related activities over the past week. PASE assesses intensity, frequency and duration of physical activity and can be self or interviewer-administered. It is easy to administrate, low cost, especially suitable for low-

intensity activities such as light household performed by older person. It is commonly used for epidemiological studies and in large-scale trials[8]. PASE questionnaire has a reasonable validity to classify level of physical activity of healthy older adults when compared with Doubly Labeled Water Method[9]. Other objective measures include wearing an accelerometer to compute physical activity to level of sedentary, light, moderate and vigorous intensities. Results from accelerometers have also been shown to validate physical activity questionnaire[10]. Other questionnaires developed to assess physical activities include International Physical Activity Questionnaire (IPAQ-M)[11] and Global Physical Activity Questionnaire (GPAQ-M)[12]. But these questionnaires are not designed to measure physical activity levels of older adults.

PASE has been translated to a Chinese version and found to be reliable for use in older Chinese population[13]. Malay is spoken by more than 250 million people worldwide mainly in Malaysia and Indonesia. Older adults aged 60 and over in Malaysia represented 4.2% of the population in year 2000 and are projected to increase to 15% by 2030. To our best of knowledge, there is no valid and reliable Physical Activity Scale for Elderly questionnaire in Malay language for use among older population in Malaysia.

We evaluated the reliability and validity of the Physical Activity Scale for Elderly translated in the Malay language (PASE-M) with objective results of physical performance using an accelerometer for one week among a population of older Malay speaking adults in Malaysia.

METHODOLOGY

Participants

This study is part of a large scale population based longitudinal study 'Towards Useful Ageing'(LRGS TUA). Randomly 44 Malay speaking community-dwelling older adults aged 60 years and above, ambulant with and without walking aid, with Barthel Index scores of 20/20, MMSE scores above 23 and TUG below 13.5 seconds were recruited from a senior citizen's club name list at Klang Valley area. This sample size was deemed sufficient to demonstrate significant moderate correlation according to power analysis using G-power (version 3.1.9.2) with power = 0.8. Detail explanation of the study was provided to all participants and written informed consent was obtained. The study was approved to be ethically sound by the Medical and Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM 1.5.3.5/244/NN-060-2013).

Participants' age, educational level, working status, marital status, living companions, medication, chronic diseases status, recent fall history and Body Mass Index (BMI) were recorded.

Measurements

Physical Activity Scale for the Elderly (PASE)

PASE is an easy to score questionnaire that assess physical activity in older adults[9]. PASE assesses the frequency, duration and intensity of various activities done in the past seven days. The PASE questionnaire comprised of 10 questions quantifying six "leisure time activity", three "household activities" and one "work-related activity". It takes five minutes to complete the PASE questionnaire. Scores were computed by using NERI Research Institute scoring manual and stratified by gender.

When compared with Total energy expenditure and Resting Metabolic Rate over a 2-week period using the Doubly Labeled Water Method both measures were significantly correlated with the PASE score (r = 0.68 and r = 0.58, respectively). Therefore, PASE discriminates categories of physical activity reasonably well and is suitable for epidemiologic studies. However, PASE does not accurately measure individual metabolic activity[9].

Permission to translate the original PASE to Malay version (PASE-M) was received from NERI Research Institute. The original PASE English version questionnaire was translated into Malay language. Translation was made through these steps: forward translation, expert panel, back-to back translation, pre-testing and cognitive interviewing and final version of questionnaire. Forward translation was done by two people who were in physiotherapy field. An expert panel consist of two bilingual experts from physiotherapy field was selected to identify and resolve inadequate translation concepts or expression. Back-translation was conducted by a local Malaysian independent translator whose mother tongue is English and has no knowledge on the questionnaire. Pre-testing with reliability of one-week interval was carried out on 20 older adults compromising of 10 males and 10 females around Klang Valley. Cronbach alpha for PASE-M in one-week interval was 0.84. Lastly, the final version of PASE-M was produced.

The first wave of PASE-M (PASE-M1) was administrated through an interview to determine their leisure, household and occupational activities performed in the past seven days. The second wave of PASE-M (PASE-M2) was administrated again through an interview one week later.

Accelerometer Measures

Accelerometer provides objective and valid measure of time spent in physical activity at different levels of intensity. The accelerometer detect activity counts per minute (CPM) to and is classified as sedentary, light, moderate and vigorous intensity activity. Using the Actilife software, we were able to calculate the time performing moderate-to-vigorous physical activity (MVPA), energy expenditure and walking steps per day. It can also measure the acceleration in vertical, antero-posterior and medio-lateral axis. ActiGraph GT3X+ is a reliable instrument with good inter-instrument reliability (ICC: 0.97; $p < 0.001$) and good intra-instrument reliability[14]. Energy expenditure (kcals) was calculated based on Algorithms of "Freedson Tri-axial Vector Magnitude (VM3) (2011)"[15] while MVPA (minutes) was calculated by using the Algorithms of "Freedson Adult VM3 (2011)"[15] based on vector magnitude. Vector magnitude counts and walking steps were also calculated from the Actilife software.

Procedure

All 44 participants were loaned an accelerometer to wear for seven consecutive days. Detailed procedure and the do and don't' s of wearing the accelerometer was provided verbally and in written to all participants. The accelerometer was secured on participants with a fabric elastic band placed around the waist with the meter on the right side of pelvis. Participants wore the accelerometer at all times for seven days except during sleep, bathing and water based activities. To increase compliance, phone calls were made to all participants every morning to identify problems. On the eight day, the accelerometers were collected back and the first wave of PASE-M (PASE-M1) were administrated through interview, according to the physical activity done in the past 7 days when the participants were wearing the accelerometer. To evaluate test-retest reliability, second wave of PASE-M (PASE-M2) were administrated through interview with same participants after a week later (15th day), recalling their activity during the accelerometer-wearing period.

Data Analysis

The Mann-Whitney U and chi-square tests (X2-test) were used to examine the differences of sociodemographic data between males and females. Concurrent validity was determined using Spearman's rank correlation coefficient for PASE-M1 (Day-8) scores (leisure, household, work-related and overall) and accelerometer parameters (vector magnitude (VM) counts, time in moderate-to-vigorous physical activity (MVPA), energy expenditure and walking steps). One-week test-retest reliability of PASE was examined using Spearman's rank correlation coefficient and intra-class coefficients (ICC) with 95% confidence interval between PASE-M1 and PASE-M2 scores. The statistical package, SPSS for Windows version 21.0.0.0 (IBM SPSS Software, Chicago, IL, USA) was used for statistical analysis. $P < 0.05$ was considered to be statistically significant.

RESULTS

Forty-four older adults of Malay ethnic (11 males and 33 females) participated in the study. However, only data of 33 participants (8 males and 25 females) with the mean age (standard deviation) of 66.64 (5.51) years was included in the final analysis. One data set was not retrievable due to faulty accelerometer and data of ten participants did not meet the minimum accelerometer wearing period. The characteristics of the participants are as summarized in Table 1.

Table 1: ***Characteristics of participants***

Variables	Males (*n*=8)		Females (*n*=25)		Total (*N*=33)		*p*-value
	n	%	n	%	n	%	
Age mean ± SD	68.25 ± 5.42		66.12 ± 5.55		66.64 ±5.51		0.18[a]
Age Group							0.79[b]
60-64	3	37.5	13	52.0	16	48.5	
65-69	3	37.5	8	32.0	11	33.3	
70-74	1	12.5	1	4.0	2	6.1	
75 or above	1	12.5	3	12.0	4	12.1	
Education Level							0.15 [b]
No schooling	-	-	3	12.0	3	9.1	
Primary	2	25.0	17	68.0	19	57.6	
Secondary	6	75.0	5	20.0	11	33.3	
Tertiary	-	-	-	-	-	-	
Currently Working							0.75 [b]
Yes / Volunteering work	5	62.5	14	56.0	19	57.6	
No	3	37.5	11	44.0	14	42.4	
Marital Status							0.03 [b]
Married	8	100	15	60.0	23	69.7	
Single/Divorced/Widowed	-	-	10	40.0	10	30.3	
Living with							0.30 [b]
With someone else	8	100	22	88.0	30	90.9	
Alone	-	-	3	12.0	3	9.1	
No. of Medication Types							0.91 [b]
None	2	25.0	4	16.0	6	18.2	
1	2	25.0	4	16.0	6	18.2	
2	1	12.5	6	24.0	7	21.2	
3	2	25.0	6	24.0	18	24.2	
4 or more	1	12.5	5	20.0	6	18.2	
No. of Chronic Diseases							0.92 [b]
None	2	25.0	4	16.0	6	18.2	
1	2	25.0	5	20.0	7	21.2	
2	1	12.5	7	28.0	8	24.2	
3	1	12.5	3	12.0	4	12.1	
4 or more	2	25.0	6	24.0	8	24.2	
Recent Falls History							0.05 [b]
Yes	-	-	9	36.0	9	27.3	
No	8	100	16	64.0	24	72.7	
Body Mass Index							0.69 [b]
Underweight	-	-	1	4.0	1	3.0	
Normal	3	37.5	7	28.0	10	30.3	
Overweight	2	25.0	11	44.0	13	39.4	
Obese	3	37.5	6	24.0	9	27.3	

Notes: p-value : mean differences between males and females; a Mann-Whitney U test; b X2-test

Table 2 depicts the concurrent validity between PASE-M1 scores and accelerometer measures. The overall PASE-M1 scores were significantly correlate with VM counts, time in MVPA, energy expenditure and walking steps (rs =0.39-0.55).

Table 2: ***Concurrent validity of PASE-M scores and accelerometer measures***

	Accelerometer Readings	PASE1 Overall	PASE1 Leisure Time Activity	PASE1 Household Activity	PASE1 Work-Related Activity
Total (n=33)	VM Counts	0.54**	0.32	0.30	0.27
	Time in MVPA (minutes)	0.55**	0.45**	0.20	0.40*
	Energy expenditure (kcals)	0.53**	0.52**	0.24	0.34*
	Walking Steps	0.39*	0.25	-0.08	0.53**
Males (n=8)	VM Counts	0.41	0.92**	-0.19	0.48
	Time in MVPA (minutes)	0.38	0.86**	-0.38	0.66
	Energy expenditure (kcals)	0.48	0.95**	-0.29	0.76*
	Walking Steps	-0.29	0.145	-0.26	-0.47
Females (n=25)	VM Counts	0.50*	0.31	0.34	0.14
	Time in MVPA (minutes)	0.51**	0.35	0.34	0.26
	Energy expenditure (kcals)	0.59**	0.45*	0.41*	0.26
	Walking Steps	0.45*	0.29	-0.17	0.61**

Note: *p<0.05; **p<0.01

Reliability between PASE-M1 and PASE-M2 was demonstrated to be excellent (Table 3). There was a significant correlation (rs =0.92, p<0.01) between overall PASE-M1 and PASE-M2 with ICC of 0.96 (95% CI: 0.92-0.98). Cohen's Kappa between overall PASE-M1 and PASE-M2 was 0.42 for overall scores.

Table 3: ***Test-retest reliability of the PASE overall and its three components scores***

		PASE1	PASE2	r_s [a]	ICCs[b]	95% CI
Total (N=33)	Overall	167.91±65.42	166.28±71.62	0.92**	0.96**	0.92-0.98
	Leisure	55.38 ± 30.69	60.69 ± 38.79	0.91**	0.84**	0.69-0.92
	Household	86.67 ± 40.77	81.82 ± 39.51	0.83**	0.86**	0.74-0.93
	Work	22.64 ± 46.15	22.18 ± 46.31	0.95**	0.99**	0.99-0.99
Males (n=8)	Overall	140.03±64.85	142.39±63.97	0.98**	0.99**	0.97-1.00
	Leisure	55.41±31.07	53.26±33.87	0.96**	0.98**	0.92-1.00
	Household	65.50±48.68	73.00±51.97	0.93**	0.97**	0.85-0.99
	Work	16.13±42.09	16.13±42.09	0.99**	1.00**	1.00-1.00
Females (n=25)	Overall	176.83±64.32	173.93±73.44	0.90**	0.95**	0.88-0.98
	Leisure	55.38±31.22	63.07±40.59	0.89**	0.81**	0.61-0.91
	Household	92.48±37.14	84.64±35.48	0.79**	0.81**	0.61-0.91
	Work	24.72±48.01	24.12±48.23	0.95**	1.00**	1.00-1.00

Note: aSpearman's rank correlation coefficient; bIntra-class correlation coefficients (ICCs) : two-way mix effect model consistency type with single measurement; * p < 0.05; ** p < 0.01.

DISCUSSION

The main aim of our study was to determine the validity and reliability of PASE–M that was first translated from the original English version. The results of our study showed that PASE-M is a reliable and valid instrument for assessing physical activity levels among older adults in Malaysia. To the best of our knowledge, PASE-M would be the first valid and reliable Malay language physical activity questionnaire specifically for older adults.

Excellent test-retest reliability (rs=0.84-0.99) was demonstrated in our study when comparing PASE-M measured in one week intervals. Our results were comparable with previous reports[16,17]. However, these reliability results are higher than the reliability report for the original PASE (rs =0.75), examined with intervals of 3-7 weeks[18]. The difference may be due to the time interval between the test retest of PASE.

The Spearman's rank correlation coefficients between PASE-M overall score with energy expenditure results from the tri-axial accelerometer showed moderate correlation (rs=0.53, p<0.01) in our study. Results documented in a similar study (rs=0.37, p<0.05) using PASE-C were lower compared to ours[16]. In regards to the correlation between walking steps extracted from the tri-axial accelerometer and PASE-M scores (rs=0.39, p<0.05), the results were comparable with the study by Ku et al. (rs=0.40, p<0.05)[16]. There was also a moderate correlation (rs =0.55, p<0.01) between MVPA and PASE–M in the present study.

However, another study demonstrated higher values 0.65 (p=0.02) with the use of PASE-C[19]. In comparison, the reliability between PASE (original) and MVPA data from a uni-axial accelerometer was r=0.49, p<0.05[20]. Results from the correlation between Japanese version PASE a Life Corder accelerometer and energy expenditure were; rs=0.16, p<0.05; and walking steps; rs=0.17, p=0.01 with Japanese PASE scores[21]. These difference in correlation between PASE and accelerometer extracted data is expected and maybe due to the difference in study methodology, accelerometer types, wearing duration and algorithm for wear time validation and scoring.

The mean of overall PASE-M score for current study was 167.91, which is higher compared to those reported in previous study[16-21]. This may be because older adults in our study were younger comparatively to previous studies. Also, older adults in our study were actively engaged in group activities organized at the senior citizen club and almost half the participants were still working or doing volunteer jobs. Highest levels of physical activity were in household domain and this is similar to the past studies[16-,20].

Current World Health Organization (WHO) guidelines recommended 150 minutes of moderate intensity or 75 minutes of vigorous-intensity aerobic physical activity each week, done in bouts of minimum 10 minutes[22,23]. Strictly based on these guidelines, the extracted data from the accelerometer in our study demonstrated that none of the participants achieved these physical activity levels. Similar results were reported in older adults in Singapore[19] and United Kingdom[24]. Only 21.2% of older adults in our study were able to carry out MPVA in blocks of 10 minutes on at least one day per week. If the MVPA was not confined to minimum bouts of 10 minutes per day, 24.2% of the participants were able to score more than 150 minutes of MVPA ranging from 167 minutes to 530 minutes per week.

Approximately 76% of older adults in our study can be deduced to be not engaging in sufficient physical activity. Previous nationwide prevalence of physical inactivity among Malaysian older adults was reported to be 88.8% using a survey questionnaire[5]. Although physical activity among older adults is showing an increasing trend in Australia and the US in the past 10 years, inadequate physical activity levels among older adults was the main highlight in a recent systematic review[25].

In summary, our study results showed fair to moderate correlation between PASE-M and accelerometer data. These results can be explained by the fact that older adults usually have multiple short bouts and irregular physical activity and this could have affected recall of physical activity[8]. Based on our discussion, similar results are documented previously.

The strength of our study is that the accelerometer wearing time was also set to seven days to match to the PASE-M questions that require subjects recall the activity that they have done in past seven days. In addition, we utilized a tri-axial accelerometer (Actigraph GT3X+) for data collection which can capture acceleration in three planes compared the single plane in uni-axial accelerometer. The algorithm used for tri-axial accelerometer in wear time validation was specifically developed and recommended for older adults that utilizes vector magnitude and 90-min window time[26,27].

There are several limitations in our study. Firstly, almost 25% of the participants did not comply with the accelerometer wearing time and hence this data was excluded from the analysis. However, as suggested in a previous study[23] we provided written and verbal instructions to the participants regarding the wearing of the accelerometer, besides contacting participants daily in the mornings through phone calls to ensure compliance. Secondly, we are aware that accelerometers may not be gold standard in measuring physical activity and has its limitation in quantifying certain activities such as upper body movements, water-based activity and stationary ergometer such as cycling[28]. Lastly, participants were community-dwelling older adults staying in Klang Valley, Malaysia and is generally an urban living area. The findings from our study may not be generalized to institutionalized older adults and living in rural areas.

In the future studies, physical activity among Malaysian older adults in the different settings can be examined using PASE-M. It would also be interesting to explore the trends of physical activity

among older adults with large scale physical activity promotion.

CONCLUSION

The results from our study showed that PASE-M, a specifically tailored for use in older adults is a reliable and valid instrument for assessing physical activity levels among community-dwelling older adults in Malaysia.

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