ORIGINAL ARTICLE

Psychometric properties of the Malay-translated General Practice Physical Activity Questionnaire among shipyard workers

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ABSTRACT

Background: The General Practice Physical Activity Questionnaire (GPPAQ) is a validated and reliable screening tool to measure the level of physical activity in adults. However, it has never been translated and validated in Malaysian population. This study aimed to translate the GPPAQ into Malay language and to evaluate the psychometric properties of the Malay-translated GPPAQ among shipyard workers.

Methods: The original English version of GPPAQ was translated forward and backward into Malay version by experts. The final version of the Malay-translated GPPAQ was then tested for validity and reliability. A cross-sectional study design was performed and systematic random sampling was used to select respondents. Construct validity and internal consistency of the Malay-translated version were tested using exploratory factor analysis and Cronbach's alpha respectively.

Results: Sixty-two male shipyard workers participated in this study. The GPPAQ showed good factor loading values for all items (0.608-0.834). The exploratory principal component factor analysis delineates all seven items into two factors with variance of 41.65%. The Cronbach's alpha value was good with 0.81, 0.84 and 0.76 for total scale, factor 1 and factor 2 respectively.

Conclusion: The Malay-translated version of GPPAQ has high psychometric properties. Therefore, it is a valid instrument to assess physical activity among Malaysian working population, particularly in male shipyard workers.

KEY WORDS:
Physical activity questionnaire, validity, internal consistency, Malay-translated GPPAQ, shipyard workers, Bahasa Melayu

INTRODUCTION

Physical activity is defined as movement of the body generated by skeletal muscles that requires vitality consumption.[1] Increase physical activity had resulted in very significant health improvements by improving bone and functional health, controlling and reducing body weight, thus offers protective effect against many chronic diseases.[2] Regular and adequate physical activity level in adult was reported as able to protect and reduce the risk of hypertension, coronary heart disease, stroke, diabetes, breast and colon cancer, depression, atherosclerosis, premature death and the risk of falls.[1,3-6]

Despite numerous beneficial effects of physical activity, about 1/3 of adults worldwide were still inactive. The World Health Organization (WHO) reported that in 2008, about 31% of adults (≥15 years old) worldwide was insufficiently active (men 28% and women 34%).[7] The Malaysian National Health and Morbidity Survey 2011 (NHMS 2011) reported that 35.7% of adults in Malaysia aged more than 16 years old were physically inactive.[8] Findings from The Malaysian Non-Communicable Disease Surveillance-1 (MyNCDS-1) study that used International Physical Activity Questionnaire (IPAQ) as their measurement tool showed an increased prevalence of physical inactivity in men (55.4%) and women (65.1%).[9]

In 2015, the WHO reported insufficient physical activity is the leading cause for about 21-25% of breast and colon cancers, 27% of diabetes and 30% of ischemic heart disease burden.[1] Physical inactivity causes 9% of premature death2 and the fourth leading risk factor for global mortality (6% of deaths globally).[1] In view of gender, male workers were more prone to get chronic diseases (51.5%) compared to female workers (48.5%).[10] About 67% workers were suffering from chronic diseases and the prevalence was higher among those with certain additional risk factors.[10]

Numerous tools such as accelerometers, doubly labeled water and pedometers are being used in physical activity measurement. However, in large-scale community study, questionnaire is the most suitable instrument due to their relatively low cost. One of the questionnaires that have been widely used by medical practitioners in the National Health Services system in the United Kingdom is the General Practice Physical Activity Questionnaire (GPPAQ). The original English version of GPPAQ is a validated screening instrument used to measure level of physical activity in adults (16-74 years) in primary health care setting. It classifies physical activity into 4-level of Physical Activity Index (PAI), which is Active, Moderately Active, Moderately Inactive and Inactive. This PAI is associated with cardiovascular disease, and it has

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Table I: Socio-demographic characteristics of the respondents (Total, n=62)

Characteristics	n	%	Mean (SD)/Min-Max
Gender			
Male	62	100	
Age (in years)			43.7 (10.9)/22-56
Ethnicity			
Malay	54	87.1	
Indian	3	4.8	
Chinese	1	1.6	
Others	4	6.5	
Marital status			
Single	11	17.7	
Married	50	80.7	
Widower	1	1.6	
Level of education			
Never been to school	1	1.6	
Primary	5	8.1	
Secondary	37	59.7	
Tertiary	19	30.6	
Duration of work (in years)			15.1 (9.4)/1-33
Monthly income (RM)			3,612.6(3,125.5)/500-20,000
Physical Activity Index			
Active	36	58.1	
Moderately Active	13	21.0	
Moderately Inactive	8	12.9	
Inactive	5	8.1	

*SD= standard deviation

Table II: Principal Axis Factoring analysis and the total variance explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.320	47.432	47.432	2.915	41.647	41.647
2	1.565	22.355	69.787	1.168	16.693	58.340
3	0.764	10.908	80.695			
4	0.494	7.061	87.756			
5	0.373	5.332	93.089			
6	0.280	3.993	97.082			
7	0.204	2.918	100.00			

Table III: Pattern matrix from exploratory factor analysis* of the Malay version GPPAQ (n=62)

Item	Mean (SD)	Factor 1	Factor 2
The type and amount of physical activity involved in your work	3.37 (0.83)	-0.143	0.829
During the last week, how many hours did you spend on each of the following activities?			
i. Physical exercise such as swimming, jogging, aerobics, football, tennis, gym workout	1.98 (0.97)	0.691	-0.248
ii. Cycling (including cycling to work) and during leisure time.	2.15 (1.17)	0.608	0.348
iii. Walking (including walking to work), shopping etc	2.77 (1.03)	0.741	0.348
iv. Housework or childcare	2.73 (0.93)	0.685	-0.034
v. Gardening or DIY	2.55 (1.13)	0.819	-0.042
How would you describe your usual walking pace?	2.13 (0.67)	0.003	0.834

*Extraction method: Principal axis factoring; Rotation method: Promax

Table IV: Value of Cronbach's Alpha if item deleted

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The type and amount of physical activity involved in your work	14.31	18.905	0.289	0.823
During the last week, how many hours did you spend on each of the following activities?				
i. Physical exercise such as swimming, jogging, aerobics, football, tennis, gym workout	15.69	17.298	0.432	0.805
ii. Cycling (including cycling to work) and during leisure time.	15.53	13.761	0.755	0.741
iii. Walking (including walking to work), shopping etc	14.90	15.072	0.695	0.756
iv. Housework or childcare	14.95	16.604	0.695	0.783
v. Gardening or DIY	15.13	14.737	0.658	0.763
How would you describe your usual walking pace?	15.55	18.744	0.436	0.804

been used in the European countries as a screening instrument for the Vascular Risk Health Check Programme.[11]

To the best of our knowledge, not many languages had been translated from this original English version of GPPAQ. It has never been translated or validated in the Malay version. Therefore, this current study will fill this gap by translating and validating a Malay version of GPPAQ to be used in the Malaysian population, particularly among industrial workers.

MATERIALS AND METHODS

Study design and participants

A cross-sectional study design with systematic random sampling was used to select our participants. The sample size was obtained from sample to variable ratios of 10:1.[12-16] Sapnas and Zeller[17] also supported that 50 cases might have been sufficient for factor analysis.

A total of 70 respondents were selected randomly from the workers' table list provided by the Human Resource Manager. Male and female are different in physical strength and nature of job. Therefore, to control bias at the level of study design, we have selected male and working adults only to participate in this study. The inclusion of respondents was male aged between 17-74 years old. Those who were illiterate, not able to write or read in Malay were excluded from this study.

This study was approved by the Research Ethics Committee of National University of Malaysia, Kuala Lumpur (UKM 1.5.3.5/244/DLP-2013-043). Permission to carry out the study was obtained from the respective gatekeeper. All the participants were explained about the purpose of this study. All recruited respondents were consented prior to data collection.

Instrument

General practice physical activity questionnaire (GPPAQ)

The GPPAQ is a self-administered screening tool used to measure the physical activity levels of adults (16 to 74 years). It consists of seven questions, which include the type and amount of physical activity at work, hours spend on five different activities over the past one week (none, less than 1 hour, 1-3 hours, more than 3 hours) and the speed of walking pace (slow pace, steady average pace, brisk pace and fast pace). It classifies the level of physical activity index (PAI) into four categories, namely Active, Moderately Active, Moderately Inactive and Inactive, that is correlated to cardiovascular disease risk.[11] The 4-level PAI was calculated manually using a website resource.[18]

Translation process of the original English version of GPPAQ

The original English version of GPPAQ was translated into Malay version partially replicated from previous works.[19,20] A forward-backward translation process was used in this study. The original English version was translated into Malay and back-translated into English by two medical and two language experts. The back translators were done blindly from the original GPPAQ. The translated script was checked thoroughly to ensure the terms used were correct and culturally adapted terms. The English-translated version was then compared with the original English version. The final Malay version was harmonised for any language error by the experts until an acceptable translation has been developed.

The final Malay version was preliminary tested on eight respondents who have similar characteristics with current respondents.[19] The objective was to identify any words and grammatical errors which might affect the comprehension of the respondents. After corrections had been made, the final version of the Malay-translated GPPAQ was then tested for validity and internal consistency.

Procedure of validity and internal consistency testing

The final version of Malay-translated GPPAQ was then distributed among 70 shipyard workers for validity and internal consistency testing. The questionnaire was self-administered. A research trainer was present at the study site to assist respondents if they were unclear about any questions being asked in the questionnaire. However, the GPPAQ was well received by all respondents. On the average, each respondent took approximately 30 seconds to complete the Malay-translated questionnaire.

ANALYSIS

The collected data was analysed using SPSS version 21.0. All seven items were examined for adequacy of sampling and correlations among the variables (Kaiser-Meyer-Olkin measures, KMO >0.6 with significant Bartlett's test of sphericity, $p<0.05$) to denote suitable factor for analysis. Principle component with Promax rotation was used to

extract the components and interpretation of the final solution. Items with factor loading <0.4 were suppressed. All factors eigenvalue larger than 1, which prior to the scree plot curve became approximately horizontal line were retained. All items were analysed for its illustrative meaning, especially pertaining to its relationship with the recovered factor structure. Each recovered factor was assessed for internal consistency reliability i.e., Cronbach's alpha coefficient.

RESULTS

Descriptive characteristics

The participation rate was 88.6%. About 62 male workers from a shipyard industry participated in this study. Eight respondents did not turn up on the day of data collection due to annual leaves, sickness leaves and attended work courses. The age of respondents ranged between 22 to 56 years old. The mean (SD) age was 43.7(10.9). Majority were Malay (87.1%), married (80.7%) and the highest education level was secondary school. The minimum working duration was one year while the maximum was 33 years, with monthly income between RM500 and RM20,000. Majority were active (58.1%) and minority of them were inactive (8.1%) (Table I).

Construct validity of the GPPAQ

For the exploratory factor analysis, KMO measure was 0.71 with significant Bartlett's test of sphericity ($p<0.001$). With regards to the dimensionality of the GPPAQ, two meaningful recovered factor structures were found based on the scree plot pattern and eigenvalues more than 1. The two-factor solution explained 41.65% of the cumulative variance as shown in Table II.

All items had good factor loading (0.6-0.8) which indicate convergent validity (Table III). The factor loadings are ideally >0.5 as recommended by Hair et al.[14]

Internal consistency of the GPPAQ

The internal consistency of this Malay version indicates excellent Cronbach's Alpha values. The Cronbach's Alpha coefficient was 0.81, 0.84 and 0.76 for total items, first factor and second factor respectively. The value of Cronbach's Alpha did not improve much by removing items (Table IV).

DISCUSSION

The General Practice Physical Activity Questionnaire (GPPAQ) is a short physical activity measurement tool with 7-items developed in 2002 by a group of scholars from London School of Hygiene & Tropical Medicine.[11] The capability of this GPPAQ was concurred and consented by the experts that this tool is a self-explanatory questionnaire and can be completed in less than one minute without assistance. It had established acceptable level of reliability and validity among English adults aged 40-74 years.[21] To our best understanding, this current study is the first to translate and validate the GPPAQ in Malay language in Malaysian population, specifically among male working adult. There was only one published studies in English version found on testing the validity and reliability of the GPPAQ.[21]

The original English version was first piloted on 61 patients in general practice. The patients did not encounter any issues in answering those questionnaires even English was not their first and foremost dialect.[11] Practitioners who participated in the same study also concluded that the instrument was easy to use and practical in assessing physical activity because the self-administered questionnaire can be given to the patient while waiting for their queue outside the consultation room which took less than one minute to be completed.[11]

The GPPAQ examined their level of physical activity index (PAI) by merging both work-related and leisure-time physical movement. The incorporation of work and leisure-time physical movement under one questionnaire has been proven related to developing chronic disease and mortality than either component used alone.[23] A recent cohort study confirmed there was an existence relationship between the combination of work-related activity and leisure-time physical activity with all-cause death in men.[24]

Our study showed this instrument has good validity and internal consistency. Similar study was done in Coventry, West Midlands by a group of researchers from University of Warwick and they have concluded that this original English version of questionnaire has good face, construct and criterion validity.[11] Good repeatability with positive associations with both daytime vitality consumption and cardiorespiratory wellness made it suitable for use in health screening clinic.[11] The GPPAQ was previously translated in Spanish. The Spanish-translated GPPAQ also showed the instrument had a moderate percentage agreement with good validity and reliability, particularly in identifying "inactive" patients.[22]

Due to limited literature on psychometric property assessment and translation on this instrument, researchers will further discuss on the study methodology. About 62 respondents participated in this study. We used item to respondent ratio of 1:10 to select our respondent sample size.[25,26] There is several rules of thumb range from 1:3, 1:6, 1:10, 1:15 or 1:20 to decide the number of sample size.[12-16] Everitt[27] and Nunnally[28] suggested at least 10 respondents per item. Cattell[29] suggested the ratio be at least three to six respondents and Gorsuch[30] recommended at least five respondents per item.

Literature revealed there was no more stringent practice with regards to number of subjects involved for exploratory factor analysis because the nature of its data will determine the adequacy of sample size.[31,32] Generally, the stronger the data, the smaller the sample can be for an accurate analysis.[26] "Strong data" in factor analysis means uniformly high communalities without cross loadings, with a few variables loading strongly on each factor.[26] Item communalities with value of 0.8 and higher were categorised as "high",[33] although it was hardly found in actual data. More commonly were low to moderate communalities (0.40-0.70). Item communalities of less than 0.4 indicated that another factor should be added or items were not linked to each other.[26] Fortunately, our study demonstrated item communalities >0.4, meaning that our sample size selection were adequate to give an accurate analysis and outcome.

The current study demonstrated the Malay-translated GPPAQ extracted two factors with good validity, similar to findings reported in the original English version and in a previous study.[11,22] All loading items were highly fit into their respective factors (0.6-0.8) and these findings showed that the Malay-translated GPPAQ was valid for use.

Our study retained factors with Eigenvalue greater than 1. There was a literature which argued that factor retention with Eigenvalues larger than 1 was a less precise technique for choosing the number of factors to hold.[34] Other alternative tests to retain the number of factors include the Scree test, Velicer's Minimum Average Partial and parallel analysis.[34] Even though Velicer's Minimum Average Partial and parallel analysis were more precise and simple to apply, but the tests were not accessible in majority of statistical software and need to use hands to do the calculations. Hence, the most practicable method we chose to use for this study was the Scree test as the best method agreed by many previous researchers.[26,35]

We confirmed this result by running multiple factor analyses and setting the number of factors to retain manually suggested by the number of factors retention obtained from the Scree test. We anticipated some correlation that might exist between factors because behaviour was a set of package that consists of multiple factors or functions that can act both dependently and independently to each other.[26] Oblique rotation was chosen in this study as it allows the factors to correlate. If using orthogonal rotation, we will lose many important data if the factors are correlated. Therefore, theoretically, oblique rotation should be the best to give more valid and repeatability result.[26] Although the factors were genuinely not correlated, the choice of oblique rotation was still safe because both orthogonal and oblique rotation give almost similar outcome.[26]

A further aspect of discordance of opinion in the factor analysis method was the cumulative percentage of variance (criterion). In the natural sciences, factors should be discontinued when no less than 95% of the variance was clarified,[36] meanwhile, in the humanities, the explained variance was commonly between the range of 50-60%.[12,36] Our study revealed the cumulative percentage of variance was 41.65% with two factors with Eigenvalue more than one, meaning 41.65% of items variance was explained by all the extracted factors. According to Williams et al.,[37] there was no specific figure of variance level, even though previous studies had proposed several percentage values.

All factor loadings in this study were within 0.6 to 0.8, which was ideal as recommended by Hair et al.,[4] although 0.3 cut-off value is commonly used in exploratory factor analysis.[37] Factor loadings of more than 0.5 for all items in a construct indicate convergent validity. We also checked for cross-loading problem of an item across factors. If two or more factors had almost comparable factor loading, it signified that the item was not specific and should be removed.[38]

In this study, factor correlations showed less than 0.85. If the value was more than 0.85, multicollinearity between factors were present, indicated that the discriminant validity was poor. This showed that the factors can be combined as they were not distinct from each other.[37]

Apart from being an indicator for internal consistency testing, Cronbach's alpha can also become an indicator for convergent validity, as it can show the extent of correlation between items in a construct. The reliability was checked for each construct. The internal consistency of this Malay version demonstrated an excellent Cronbach's Alpha values. The Cronbach's Alpha coefficient was 0.81, 0.84 and 0.76 for total items, first factor and second factor respectively. Although a higher value indicates a higher internal consistency, however, the value should not exceed more than 0.95 as it showed the items were redundant and should be removed. Ideally it should be more than 0.7,[39] or more lenient, more than 0.6 which was also accepted by some scholars.[37] None of the items were removed since the value of Cronbach's Alpha did not improve much by removing items.

Limitation of this study and recommendations

Limitation of the study was associated with the homogenous study population from male shipyard worker which may have affected the generalisability of the study. This Malay version may not be suitable for some respondents who speak different dialects such as from East Malaysia (e.g., Kelantan, Terengganu), Sabah and Sarawak. This translated questionnaire may be applicable for healthy population. It may not be suitable for non-healthy respondents. The usage of GPPAQ have not been assessed on children and young age, less than 16 years old, or adults older than 74 years. Therefore, these groups may need another appropriate instrument to measure the level of physical activity specifically to their age.[11] Based on these limitations, future studies using different sample population would be highly recommended.

This GPPAQ was not created to assess pre and post physical activity intervention.[11] Hence, further study is warranted if this instrument needs to be used to measure the successful of intervention programmes in the near future.

This questionnaire has been developed using exploratory factor analysis. To enable this questionnaire to be used in other population or subgroup, it is recommended to proceed to confirmatory factor analysis. Besides that, confirmatory factor analysis and other latent variable modeling techniques may permit scholars to do hypotheses testing through inferential techniques.[26,37]

CONCLUSION

The current study has shown that the Malay version GPPAQ is a reliable and valid instrument to determine the level of physical activity amongst male shipyard workers in Malaysia. Further studies to involve heterogeneous samples are required to enable this questionnaire to be used in various sample populations.

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