PUBLIC HEALTH RESEARCH

Reliability and Validity of the Physical Activity Questionnaire for Older Children (PAQ-C) In Malay Language

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ABSTRACT

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Introduction	Physical activity assessment in children is the first step in assessing the relationship between activity and health, as well as the determinants of childhood physical activity and changes in activity level.Physical Activity Questionnaire for Older Children (PAQ-C) is self- administered questionnaire to assess physical activity among older children. The objective of this study was to determine the validity and reliability of Physical Activity Questionnaire for Older Children in Malay language PAQ-C (M).
Methods	The validation study was done among 73 students aged 10 to 17 years old. The PAQ-C was translated into Malay language using forward and backward translation. The evaluation of the psychometric properties included internal consistency, test-retest reliability and criterion validity. Reliability of PAQ-C (M) was determined using Cronbach alpha and intra-class correlation coefficient (ICC). The PAQ-C (M) was administered twice in one week interval to assess test-retest reliability. Criterion validity was assessed between PAQ-C (M) and 3 Day Physical Activity Recall (3DPAR).
Results	The internal consistency of PAQ-C (M) assessment calculated in this study was α = 0.75 and α = 0.77 for assessments one and two, respectively. The ICC between individual items of PAQ-C (M) was 0.59 to 0.91, indicating moderate to good correlation. The Spearmen correlation coefficient between PAQ-C (M) and 3DPARwas acceptable (*r*=0.60, p<0.01).
Conclusions	In conclusion, the findings of this study suggest that the PAQ-C (M) has moderate to good reliability and validity in assessing physical activity among older children and adolescents. Future validation of PAQ-C (M) against different measures such as accelerometer is recommended.
Keywords	Physical Activity Questionnaire for Older Children (PAQ-C) - PAQ-C reliability - PAQ-C validity - PAQ-C Malay language.

INTRODUCTION

Physical activity is the most variable component of energy expenditure, providing a major outlet for daily caloric usage. Children and adolescents who participate in higher levels of physical activity are less likely to display risk factors for chronic disease[1, 2] and more likely to have positive outcomes in weight regulation.[3] The American Heart Association recommends that children and adolescents participate in at least 60 minutes of moderate to vigorous physical activity every day. [4] Another guideline from Canada suggests that a minimal target of 60 minutes per day may be appropriate.[5]

Physical activity assessment in children is a first step in assessing the relationship between activity and health, as well as the determinants of childhood physical activity and changes in activity level. Self-report physical activity questionnaire is the most practical method in epidemiological research of older children due low to cost, ease of administration and relatively low participant's burden.[6] However, the use of these instruments may give problem in accurate assessment of physical activity among children and adolescents because of the incorrectly interpreting questions and accurately recalling activity.[6] Questionsframed within a shorter period of time will improve the accuracy of recall and ability of self-report instruments to capture meaningful physical activity data on children and adolescents.[7]

A number of instruments have been developed to assess physical activity levels in children and youth populations. One valuable questionnaire for use on children and adolescents was the Physical Activity Questionnaire for Older Children (PAQ-C). The PAQ-C was developed by Kowalski and colleagues which initially used in the Saskatchewan Pediatric Bone Mineral Accrual Study. [8] This instrument was developed to assess levels of moderate to vigorous physical activity (MVPA) during the last 7 days in older children ages 8-14 years. The self- administered questionnaire consists of nine structured questions. The PAQ-C was designed for large-sample studies and can be completed in a classroom setting. It takes approximately 10 to 15 minutes for a student to complete the PAQ-C. Each item was scored using a five-point scale, with higher scores indicating higher levels of activity. A mean score of 1 indicates low physical activity and a mean score of 5 indicates high physical activity. PAQ-C was designed to be used during the school year, rather than summer vacation or school holiday periods.[8, 9]

Evidence supported that the PAQ-C is a reliable and valid measure of general physical activity levels in children during the school year. Crocker et al. (1997) examined the PAQ-C's test re-test reliability, internal consistency, and sensitivity to gender differences.[8] Forty-three boys and forty one girls (age 9-14years) completed the PAQ-C twice during school hours with one week in between assessments. The PAQ-C was relatively stable over the one-week assessment period (males, $r = 0.75$ and females, $r = 0.82$).Other investigator reported that the instrument correlated with physical activity as measured by Leisure time Exercise Questionnaire, activity rating and 7 day physical activity recall (r= 0.46 - 0.57).[10] The results of these studies provide support for the reliability and validity of the PAQ-C.[8, 10, 11]

Since existing information about degree of validity and reliability on physical activity questionnaire among children and adolescents is seldom presented properly or critically reviewed, it is particularly important that valid measures of physical activity be used in studies of specific population.[12] The aim of this study is to determine the validity and reliability of Physical Activity Questionnaire in Malay language. The PAQ-C was chosen because it is short in length, can be self-administered and easily understood by the respondents in various settings purposely for epidemiologic research. So far, there is an English version of PAQ-C questionnaire; however, there is no such instrument in Malay version. Considering the difference of Asian and Western population, hence, testing the validity and reliability of physical activity questionnaire in a specific population for which the instrument is intended to be used would be greatly useful.

METHODS

Sample and Recruitment

Respondents aged 10 to 17 years old were recruited using convenience sampling among the staff's children or relatives who are working at National Heath Institutes, Kuala Lumpur. Inclusion criteria were absence of physical illness or disabilities that would limit physical activity and had ability to read and write well in Malay language.The evaluation of the psychometric properties included internal consistency, test-retest reliability and criterion validity.

Sample size calculation for correlation was used for validity test.[13] By using power of study $(1-\beta) = 0.2$, significance level $(\alpha = 0.05)$ and coefficient of correlation (r= 0.5), 29 subjects were required. As for reliability test, 'Sample size table for Clinical Studies' was used to calculate sample size[14]. Based on a previous study by Kowalski et al,[10] test retest reliability of PAQ-C (intra class correlation coefficient) was 0.75-0.82. Using Table 14.5: sample size to observe a given 1CC, for an assumed ICC = 0.75, a desired 95% CI width 0.2), 75 subjects were required for reliability study.[14] This study was approved by the Medical Research and Ethics Committee, Ministry of Health (NMMR-14-228-19748).

Procedure

PAQ-C was translated into Malay language using forward and backward translation methods proposed by Acquadro et al (2008).[15] The original PAQ-C was translated to Malay version by two independent translators. The Malay translated version was then back translated into English version by two different translators who were fluent in Malay language and with English as their mother tongue. The two versions of translation were found to be comparable before the translated questionnaire was pilot tested to reduce any confusion prior to data collection.

Field testing of data collection was carried out from April 2014 until July 2014. Instruction to fill in questionnaires was given to parents and participants before both of them were required to sign a consent form. For the purpose of test retest reliability, the PAQ-C in Malay language [PAQ-C (M)] was administered within one week after the initial interview. On first visit, participants had to answer socio-demographic and PAQ-C (M) questionnaire. They were also requested to record a self-report instrument, the 3-day physical activity (3DPAR) beginning with the most recent day. Participants have to administer 2 days on weekdays and 1 day on weekend to ensure both weekdays and weekend activities were included. At the second visit on after the seven day period, 3DPAR sheet were collected from participants. During this visit, participants were then administered the PAQ-C (M) again for test-retest reliability.

Measures

The Physical Activity Questionnaire for Older Children (PAQ-C)

The instrument wasadapted from Kowalski et al. consist of nine items and show good internal consistency with α = 0.79 to 0.89.[8] Item 1 was on leisure time activity of the adolescents during the last 7 days. The adolescents were required to respond to an activity checklist and were scored on a 5-point scale ranging from "no" activity being scored as 1 and "7 times or more" being scored as 5. The mean of all activities on the activity checklist was calculated to form a composite score for item 1. Items 2 to 7 were on activities of the adolescents during physical education (PE) class, recess, lunch, after school, evenings and weekends. For Item 8, the adolescent had to describe the best about activity for the last 7 days and scored on 5 point scale. For item 9, the adolescents were asked on the frequency of participating in daily physical activity (e.g. playing sports, games, dancing) in the previous week. Once the sum of scores from items 1 to 9 was calculated, the final PAQ-C activity summary score was obtained by taking the mean of these 9 items. A mean score of 1 indicates low physical activity, whereas a mean score of 5 indicates high physical activity[9]. Further, the mean scores were classified into three categories of either 'low'(1-2.33), 'moderate' (2.34-3.66) or 'high' (3.67-5.00).[16]

The 3-Day Physical Activity Recall (3DPAR)

The 3-Day Physical Activity Recall (3DPAR) instrument requires the recall of activity performed during each of the three previous days, beginning with the most recent day.[17] Each day is segmented into 30 minutes time blocks (7:00 a.m. to midnight). For each day, students entered the main activity in which he or she participated during each 30 minutes period. The main activity was defined as the activity that occupied the majority of the 30 minutes period. After participants completed the instrument, METs values were assigned using compendium of physical activity based on the activity and intensity level.[18] METs values were then summed over each of the 3 days (2 weekdays and 1 day weekend) for a measure of total daily physical activity (METs day^{-1}). The number of blocks in which the primary activity was 3 METs or greater were counted to provide index of daily participants in moderate-to vigorous physical activity (MVPA) and 6 METs or greater were counted as vigorous physical activity (VPA). The 3DPAR self-administered instrument provides valid and reliable assessments of physical activity among Singaporean adolescents. [19]

Statistical analysis

All statistical analyses were performed using Statistical Packages for Social Sciences (SPSS version 19.0). The participant's characteristics, gender, ethnicity and age group were summarized using descriptive statistics. Descriptive analysis was also done to estimate the proportion of physical activity level among the participants in the first and second administration. Internal consistency of PAQ-C (M) was determined using Cronbach alpha. Test retest reliability assesses the consistency of the measurement in which the same respondent administered the same questionnaire at different time or occasion. Regarding test-retest reliability, intra-class correlation coefficients (ICC) were calculated for the repeated administrations of the PAQ-C(M).[20] ICC represents the proportion of total variance accounted for by the variability between measures. An ICC of >0.70 is considered acceptable.[21] The Spearman correlation coefficient was used to assess the agreement between PAQ-C (M) and 3DPAR score. The following interpretation was applied to each agreement value based on Landis and Koch[22]; less than 0.20 considered as poor agreement, 0.21-0.40as fair agreement, 0.41-0.60as moderate agreement, 0.61-0.80as substantial agreement and more than 0.81as almost excellent agreement.

RESULTS

Descriptive statistic

A total of 79 respondents participated in the field testing, however only 73 respondents completed the whole questionnaire. The non-response rate was small, less than 5% for the overall data. For this reason, no special measure was used to deal with the missing data.

From 73 respondents, there were more females (65.8%) than males (34.2%) in the sample; comprising of 80.8% Malays, 11.0% Chinese and 8.2% Indians. By age category, 24.7% of the respondents were 10-12 years old, 50.7% were 13-15 years old and the rest 24.7% were 16-17 years old (Table 1).

Table 1 Socio demographic characteristics of respondents

Characteristics	n (%)
Sex	
Male	25 (34.2)
Female	48 (65.8)
Age Group	
10-12 years old	18 (24.7)
13-15 years old	37 (50.7)
16-17 years old	18 (24.7)
Ethnicity	
Malays	59 (80.8)
Chinese	8 (11.0)
Indian	6 (8.2)

Physical activity level was categorised into two categories (low and moderate/high) and it was assigned based on their physical activity scores. From the first PAQ-C (M), 56.2% of the female respondents were classified in the low physical activity category while 60.0% male respondents were in the moderate/high physical activity category. From the second PAQ-C(M), 36.0% of the male respondents were reported in the low physical activity level and 41.7% of the female were classified in the moderate/high physical activity level (Table 2). There was no significant different of physical activity level between male and female respondents ($p>0.05$).

Table 2 Mean score and distribution of physical activity level by sex from PAQ-C(M)

	First Administration			Second Administration		
Sex	Mean ±SD	Low n (%)	Moderate/ High n (%)	Mean ±SD	Low n (%)	Moderate/ High n (%)
Male	2.53 ±0.56	10 (40.0)	15 (60.0)	2.66±0.51	9 (36.0)	16 (64.0)
Female	2.36± 0.62	27 (56.2)	21 (43.8)	2.26±0.64	28 (58.3)	20 (41.7)

No significant different between sex

Table 3 shows descriptive data on 3DPAR variables. Overall, mean METs score and self-reported VPA was high during weekend (Saturday or Sunday) with 58.94±8.76 METs score/day and 1.15±1.12 blocks/day, respectively. The mean METs score over the 3 days recall was 57.13±5.21.

Table 3 Descriptive data from 3 Day Physical Activity Recall (3DPAR)

	Mean METs score (METs score/day±SD)	Number of MVPA blocks (blocks /day±SD)	Number of VPA blocks (blocks/ day±SD)
Day 1	55.85± 5.35	2.28±0.81	0.89±1.18
Day 2	56.52 ±6.03	2.38±0.97	0.81±1.18
Day 3	58.94± 8.76	2.06±1.59	1.15±1.12

3 day average	57.11±35.21	2.24±0.74	0.95±0.88

Abbreviations; METs, metabolic equivalent in multiples of resting energy expenditure; MVPA, moderate-to vigorous physical activity, VPA; vigorous physical activity

Internal consistency.
Result of the internal consistency of PAQ-C(M) assessment calculated from a sample of 73 respondents in this study was α = 0.75and α = 0.77 for assessments one and two, respectively. Corrected item total ranged from 0.33 to 0.99 for assessment one and 0.25-0.67 for assessment two.

Test retest reliability.
The assessment of test-retest reliability for PAQ-C (M) between the first and second administrations is shown in Table 4. Reliability coefficient using average-measure intra-class correlation coefficient (ICC) total score of PAQ-C (M) was 0.82 which is considered goodcorrelation. The test-retest between individual items show that PAQ-C (M) had moderate to good correlation with ICC value between 0.59 to 0.91.

Criterion validity.
Results showed that there was a moderate and significant relationship (r= 0.60, p<0.01) found between total PAQ-C(M) scoreand METs score of 3DPAR physical activity (Table 4).

Table 4 Reliability of PAQ-C (M)

	Reliability		Validity
	ICC	95% CI	Spearmen Correlation Coefficient (r_s)
Total score activity	0.82	0.71-0.89*	0.60*
Individual Item			
Item 1 ; Checklist	0.91	0.85-0.94*	
Item 2; PE class	0.75	0.57-0.85*	
Item 3; Recess	0.86	0.78-0.91*	
Item 4; Lunch	0.76	0.62-0.85*	
Item 5; After school	0.68	0.49-0.79*	
Item 6; Evening	0.68	0.49-0.80*	
Item 7; Weekend	0.59	0.35-0.75*	
Item 8; Describes best	0.83	0.73-0.89*	
Item 9; Week summary	0.86	0.77-0.91*	

*p< 0.01

DISCUSSION

This study evaluated the reliability and validity of the PAQ-C in Malay language in a representative sample of male and female age 10 to 17 years old. To the best of our knowledge, this is the first reliability and validation study of Malay version of the PAQ-C. Therefore, PAQ-C (M) maybe useful for monitoring changes in physical activity among Malaysian children and adolescent.

Reliability
In this study we found the PAQ-C in Malay language provided reliable estimates of physical activity among older children. Our findings of standardised Cronbach alpha was 0.75 -0.77 suggest PAQ-C (M) had good internal consistency and the result was consistent with other studies. Croker et al reported the internal consistency of the PAQ-C scores using coefficient alpha were α = 0.79 and α = 0.89 for first and second assessments; 1 week apart, respectively.[8] Kathleen and colleagues conducted a study in 210 children at age 11 years old also found a good internal consistency (α = 0.72) of PAQ-C and suggested it can be used during the school year and the summer vacation.[23] Another study also presented a high internal consistency of PAQ-C from a sample of 36 students age 13 years.[16] Moore and colleagues examined the psychometric properties of PAQ-C and suggested that the internal consistency of the questionnaire could be improved and factor model could be constructed with the removal of the PAQ-C questionnaire addressing physical activity during lunch.[24]

The test-retest reliability correlation coefficients in the present study gave similar values

with the original PAQ-C studies that have found test re-test correlations ranging from 0.75 to 0.82 among 83 students aged 9-14 years old.[8] A reliability study should have an adequate time interval between the two administrations or otherwise, lower ICCs result may be observed due to actual differences in the activity pattern between the recalled days.[25] Based on our reliability result, the seven days interval time between first and second administered recalls of the respondents' physical activity was considered relatively stable. It is possible that the activities reported changed during the one-week test-retest period resulting in a higher reliability

Validity

Based on the result in this study, Spearman correlation coefficient between PAQ-C (M) and 3DPAR was acceptable (r=0.66, p<0.05). However, lowercorrelation coefficient was reported in other psychometric properties study on PAQ-C by Kowalski et al.[10] The authors reported the correlationcoefficient between PAQ-C and seven day recall interview (7DPAR) was 0.46. The higher valueof correlation coefficientsobserved in the present study may be explained by the substantially shorter recall period (3DPAR vs. 7DPAR).

Study on validation of PAQ-C shows that the instrument had a moderate correlation with physical activity as measured by an activity rating (r=0.57), the Leisure Time Questionnaire (r=0.41) and Caltrac motion sensor (r=0.39).[10] This study was limited by the availability of only a single type of criterion measure, 3DPAR. While 3DPARs have been shown to provide useful estimates of physical activity in adolescents, physical activity is a complex behavior and no single measure constitutes a perfect "gold standard'. Although other objective instruments available such as heart rate monitor, accelerometer or indirect calorimeter, 3DPAR was chosen in this study due to feasibility and cost concern.

CONCLUSION

In conclusion, the results of this study would suggest that the PAQ-C (M) has a moderate to good reliability and validity in assessing physical activity among older children and adolescents. Therefore it can be considered useful for epidemiological studies to measure physical activity in Malaysian children and adolescents as well as monitor changes and trends in physical activity.This is the first PAQ-C in Malay version developed to assess physical activity among older children and adolescents. Therefore, future validation study of PAQ-C (M) against different measures such as accelerometer is recommended.

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