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Reliability and Validity of the Modifiable Activity Questionnaire for an Iranian Urban Adolescent Population

Maryam Delshad[1], Arash Ghanbarian[2], Nasrollah Rezaei Ghaleh[1,3], Golshan Amirshekari[1], Sahar Askari[1], Fereidoun Azizi[1]

[1]Endocrine Research Center, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [2]Prevention of Metabolic Disorders Research Center, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [3]Max Planck Institute for Biophysical Chemistry, Gottingen, Germany

Correspondence to:
Dr. Arash Ghanbarian, Prevention of Metabolic Disorders Research Center, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences, P.O. Box: 19395-4763, Tehran, Iran. E-mail: Ghanbarian@endocrine.ac.ir

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ABSTRACT

Background: The purpose of this study was to evaluate the validity and reliability on the Persian translation of the Modifiable Activity Questionnaire (MAQ) in a sample of Tehranian adolescents.

Methods: Of a total of 52 subjects, a sub-sample of 40 participations (55.0% boys) was used to assess the reliability and the validity of the physical activity questionnaire. The reliability of the two MAQs was calculated by intraclass correlation coefficients, and validation was evaluated using Pearson correlation coefficients to compare data between mean of the two MAQs and mean of four physical activity records.

Results: Intraclass correlation coefficient was calculated to assess the reliability between two MAQs and the results of leisure time physical activity over the past year were 0.97. Pearson correlation coefficients between mean of two MAQs and mean of four physical activity records were 0.49 ($P < 0.001$), for leisure time physical activities.

Conclusions: High reliability and relatively moderate validity were found for the Persian translation of the MAQ in a Tehranian adolescent population. Further studies with large sample size are suggested to assess the validity more precisely.

Keywords: Persian, physical activity, questionnaire, reliability and validity

INTRODUCTION

Promotion of physical activity levels is one of the most three important and effective strategies for reducing the risk of noncommunicable diseases. Few studies have shown more than 80% of the Iranians physically inactive, and other local studies also report similar patterns in Iranian youth.[1]

Physical activity can be estimated objectively or subjectively.[2] Various criterion measures, such as doubly labeled water (DLW), motion sensors, heart rate monitors, accelerometer, and activity records have been used to determine the relative validity of physical activity questionnaires.[3] The DLW method is the most suitable approach for this task.[3] Questionnaires are common subjective forms of measuring physical activity in

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epidemiological researches. Those are relatively feasible, fast, and cheap to produce and administer.[4] Intensity, frequency, and duration, together define the total volume of an activity.[5] A self-report questionnaire is the only practical method of collecting a broad range of data from a large number of children and adolescents, but it is still important that the questionnaire items provide acceptably accurate data.[6]

The Modifiable Activity Questionnaire (MAQ), developed originally by Kriska *et al*., is a self-reported questionnaire[7] that records frequency and duration of different levels of physical activity and has been modified to measure physical activity during leisure time periods. They found Spearman correlation coefficient was 0.37 (ages 10–20) for the past year leisure time physical activity, and it showed that test-retest reliability of the past year leisure time could be reliable in all age groups.[8] They also examined the validity of the past week MAQ leisure time physical activity and showed a moderate-to-high validity (ρ =0.80 and 0.62, respectively; both $P < 0.05$). Results from Schulz study showed that Spearman correlation coefficients for past-year leisure time (0.56) and total (0.74) physical activity were significantly related to total energy expenditure assessed by DLW.[9]

Because the patterns of physical activity and accuracy of self-reports may differ across cultural/ethnic backgrounds or gender, it is necessary to use reliable and validated instrument in each study population.[10] However, it has been shown that the MAQ was designed to be modified easily to maximize the ability to assess physical activity in different population or cultures.[11]

Few questionnaires have been tested on the Iranian urban adolescent population for evaluation of physical activity. The purpose of this study was to describe the validity and reliability of a Persian translated MAQ in a sample of Tehranian adolescents.

METHODS

Study population

Within the framework of Tehran Lipid and Glucose Study (TLGS), a prospective study of an urban population in district no. 13 of Tehran, Iran, aimed at investigating the prevalence of non-communicable disorders and risk factors in an Iranian population,[12,13] the evaluation of the MAQ was conducted as a cross-sectional study. Based on the minimum size required for validity studies and an attrition rate of 30%, a sample of at least 40 boys and 40 girls, was randomly selected from the TLGS population. However, the sample size was satisfactory to the following formula, too (α =0.05, β =0.1 and r = 0.40).

$$n=\left[\frac{(z_{\alpha/2}+z_{\beta})}{0.5\times \mathrm{In}[(1+r)/(1-r)]}\right]^2+3.$$

Inclusion criteria were aged 12–18 years old, willingness to participate in the study, and ability to read and write. Fifty-two adolescents (51.9% boys) accepted an invitation to fill the physical activity questionnaire in 2002. For validity, we excluded those who did not complete at least three physical activity records, and a total of 52 subjects, the validity of the MAQ was assessed in 40 individuals (55.0% boys).

The reliability of the MAQ was assessed in those same subjects who accepted the invitation. From those, 40 participants were completed two MAQs and included for testing the reliability. The methods and objective of the study were explained to the adolescents and written informed consent was obtained from the parents. The study protocol was approved by the Ethic Committee of the Research Institute for Endocrine Sciences of the Shahid Beheshti University of Medical Sciences.

Measurements

The modifiable activity questionnaire

The first part of the Persian translated questionnaire consisted of questions about frequency (none, 1–2, 3–5, 6–8, 9 or more times) of participation in different activities (heavy and light exercise) during school leisure time, the number of hours spent in sedentary activities (watching television, sitting in front of a computer or video games) and indicated the number (none, one, two, three four or more times) of sport team engaged during past year.

The second part of the questionnaire included questions about 15 Iranian popular and common activities during leisure time and time spent in each activity. The number of months a year and time per week that every activity was performed also asked, due to seasonal practice of some activities.

The original version of the MAQ was first translated from English into Persian in the same structure and then translated back from Persian into English using a back-translation technique. Based on Iranian culture, some physical activities in the original questionnaire were replaced to represent common and popular Iranian physical activities, but the main structure of the questionnaire was unchanged. The process was supervised by a native English editor.

All the modifications, as well as back-translations, were approved by the author of the original MAQ by E-mail.

The same Persian translated questionnaire was used in both the test and the retest. Data were completed by the adolescents, with trained interviewers' assistance,

when needed. We ask individuals to record the activities in which they had participated at least 10 times during the past 12 months in their leisure time and to identify the frequency (how many days in the past week) and duration (how long) for each physical leisure time activity. Total number of minutes per year, were summed for each physical activity and eventually physical activity calculated for every each activity by computing total number of minutes per year and then divided by 60 and 52 to estimate the hours per week of total leisure time physical activity. Metabolic equivalent task (MET)-h/week was computed as below:

MET-h/week = (MET * months per year * time per month * minute per time)/(60 * 52).

MET-h/week of leisure time activity is calculated as the MET intensity multiplied by the hours of each leisure time activity. One MET corresponds to the resting metabolic rate, and it is set at 3.5 ml of oxygen consumed per kilogram body mass per minute (1 kcal/kg/h). The number of METs represented to each activity were calculated using the average metabolic cost for each activity.[14]

Reliability

The reliability analysis was based on data from participants who completed the MAQ twice, with 1-month interval.

Convergent validity

Physical activity recall questionnaires have been found to be accurate, nonreactive, and practical for use with large study population.[15,16] One such questionnaire is the Stanford 7-day activity recall questionnaire, which was developed to record the duration and intensity of recent leisure time physical activity it has been found to have adequate test-retest reliability and validity.

A 7-day physical activity questionnaire was completed by subjects, who documented recorded all the activities performed throughout in one sample week in every season, preferably in the middle of each season. Participants were trained how to record the activities and for convenience, the whole 24-h were divided into 3 intervals in our questionnaire; 8 a.m–2 p.m, 2–10 p.m and 10 p.m to 8 a.m (24 h) of the next day. They were asked to record all leisure time activities during each of these intervals.

To evaluate convergent validity of the MAQ, the physical activity record questionnaires completed each mid-season in were compared with the mean of the two MAQs.

Statistical analysis

Using the Q-Q plot test and the mean of MET-h/week distribution was normal, so we used parametric tests. Height and weight were measured by standard anthropometric techniques and body mass index (BMI) was defined as weight (kg) divided by height squared (m^2). Descriptive results are reported as means ± standard deviation (SD) values for age, sex, weight, height, BMI, MET-h/week from both MAQ and from the four physical activity records. To compare the means of two MAQs, we used the *t*-test. Since there was no significant difference between the two MAQs, the mean of two MAQs was used for the comparison with four physical activity records. Test-retest reliability of the two MAQs was examined using intraclass Correlation coefficients (Cronbach's α). Intraclass correlation coefficient is classified as follows: Below 0.20 poor; 0.21–0.40 fair; 0.41–0.60 moderate; 0.61–0.80 substantial; and values 0.81–1 show perfect agreement.[17] Because of the normal distribution of means, the validity was assessed using Pearson correlation coefficients to compare means of two MAQs and those of four physical activity records.

RESULTS

The mean ± SD values of age, sex, weight, height, BMI, and MET-h/week for participants are presented in Table 1. Mean age of the participants (55% boys) was 15.7 ± 1.7 year; average BMI was 22.1 ± 4.8 kg/m^2 and the prevalence of underweight, normal weight, overweight, and obese were 14.7, 52.9, 29.4, and 2.9%, respectively. The estimations of MET-h/week measured by four physical activity record questionnaires and two MAQs are presented in Table 2; based on these MAQs, the mean of MET-h/week for leisure time physical activities was 16.4. The mean of total MET-h/week derived from physical activity records of four seasons was 18.3 MET-h/week. For past year leisure time,

Table 1: Main characteristics of study population

Measurement	Mean	SD	Minimum	Maximum
Age (year)	15.7	1.7	12.0	18.0
Weight (kg)	63.5	15.2	30.0	93.0
Height (cm)	168.8	9.1	145	186
BMI (kg/m^2)	22.2	4.8	11.7	30.8

SD=Standard deviation, BMI=Body mass index

Table 2: Physical activity (MET-h/week) measures obtained with the mean of two MAQs and mean of four physical activity records

Measurement	Two MAQs (mean±SE)*	Four physical activity records (mean±SE)	$\rho^{\dagger}$	P†
Leisure time	16.4±15.3	18.3±16.0	0.49	0.001

*SE, †ρ and *P* value calculated by Spearman correlation coefficients. SE=Standard error, MET=Metabolic equivalent task, MAQ=Modifiable activity questionnaire

physical activity, intraclass correlation coefficient was 0.97. The mean ± standard error values of two MAQs were 16.4 ± 15.3 and 18.3 ± 16.0 for four physical activity records. The Pearson correlation coefficient was 0.49 ($P < 0.001$) for leisure time physical activities.

DISCUSSION

This is the first study to estimate test-retest reliability and validity of the Persian-translated MAQ in a sample of Iranian adolescents from an urban population. The present population-based study verified the reliability by intraclass correlation coefficient between the results of two MAQs and a subjective instrument (MAQ) compared to four physical activity records to assess validity of physical activity questionnaire in Iranian adolescents. Four physical activity records were used to compare MET-h/week from the MAQs and physical activity records and the findings suggested excellent reliability and convergent validity of the MAQ among an Iranian adolescents sample population.

Kriska *et al*. developed the MAQ to examine properties of the current physical activity in the past year and the past week in Pima American Indians.[8,11,17] The MAQ is a retrospective quantitative questionnaire that represents the most comprehensive forms of physical activity recall survey that designed for easy modification to maximize the ability to estimate physical activity in a variety of populations and that is culture free.[8] Some other population-based studies have reported reliability and validity of the MAQ.[8,9] Validity of the MAQ was demonstrated by the DLW method that measurement of total energy expenditure. The first step toward understanding young people's health is to have sufficient and accurate data which represents the health behavior of the young people. The most common methodological technique to understand and assess young people's health behavior are surveys, especially in epidemiological studies where the use of a self-report questionnaire is often the only feasible and economical method for the measurement of health behavior such as physical activity.[15] The reliability and validity of the self-report questionnaire measuring health behavior of adolescents are hence crucial. Aaron *et al*. examined the validity and reliability of MAQ in 100 adolescents, who completed the questionnaire at baseline, after 1-month and a year later and the results from the MAQs were compared to four physical activity records. Spearman correlation coefficients for past-year leisure time physical activity were significantly related to four physical activity records, and the results showed good validity for MAQ in adolescents.[18] In our study, validity results for leisure time physical activities presented a relatively moderate correlation.

Results from the Gabriel *et al*. study based on an MAQ, reported that leisure physical activity during the past month and the past week was reliable and was associated with physical activity and physical fitness.[19] Our results suggested a high intraclass Correlation coefficients between two MAQs observed for leisure time physical activity.

Based on our results, the Persian-translated MAQ can be used in population-based studies in Iran. However, the test-retest reliability of the Persian translated MAQ can be influenced by many factors. Recall bias is an issue in questionnaire-based evaluation of physical activity, especially when working with adolescents.[15] Active adolescents tend to overestimate, and obese adolescents are inclined to underestimate physical activity, and this can increase the variability of measurements, and leading to weaker correlations.[20]

This study has a few limitations. Although the study was conducted under carefully controlled conditions, the small size of the study population and gold standard method used may be a limiting factor and may explain the lack. However, some previous epidemiological studies that used questionnaires have not been evaluated levels of physical activity against objective methods.[21]

Objective methods such as accelerometers, $VO_{2\ max}$, and the DLW technique have numerous advantages and provide a more precise way to validate the subjective method that estimate of energy expenditure, and since these methods are complicated and expensive and are not simple to carry out, we used four physical activity records to estimate participants' physical activity levels when those objective methods not provided. We had primarily designed to evaluate the exact validity of the MAQ by $VO_{2\ max}$ as a gold standard in our study. However, due to the lack of resources to do the measurements, performing Vo_2 max measurements was not feasible.

CONCLUSIONS

The results from the present study provide an in-depth evaluation of the test-retest high reliability and convergent validity of the MAQ in the TLGS population, and show that this questionnaire can be used for evaluating physical activity levels in Iranian adolescents and it can be answered quickly, without much cooperation needed from the patient. It is suggested that the further studies can be performed with large sample size and better gold standards to assess the validity of this tool more precisely.

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