Reliability and Validity of the Modifiable Activity Questionnaire (MAQ) in an Iranian Urban Adult Population

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Abstract

Background: The purpose of this study is to evaluate the validity and reliability of a Persian translation of the Modifiable Activity Questionnaire (MAQ) in a sample of adults from Tehran, Iran.

Methods: There were 48 adults (53.1% males) enrolled to test the physical activity questionnaire. A sub-sample included 33 participants (45.5% males) who assessed the reliability of the physical activity questionnaire.The validity was tested in 25 individuals (48.0% males). The reliability of two MAQs was calculated by intraclass correlation coefficients. The validation study was evaluated with the Spearman correlation coefficients to compare data between the means of 2 MAQs and the means of 4 physical activity records.

Results: Intraclass correlation coefficients between 2 MAQs for the previous year's leisure time was 0.94; for occupational, it was 0.98;and for total (leisure and occupational combined) physical activity, it was 0.97. The Spearman correlation coefficients between the means of the 2 MAQs and means of the 4 physical activity records was 0.39 ($P = 0.05$) for leisure time, 0.36 ($P = 0.07$) for occupational, and 0.47 ($P = 0.01$) for total (leisure and occupational combined) physical activities.

Conclusions: High reliability and relatively moderate validity were found for the Persian translated MAQ in adults from Tehran. However, further studies with larger sample sizes are suggested to more precisely assess the validity of the MAQ.

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

Introduction

Recent interventions have been designed primarily to increase the level of physical activity in adults because the role of physical activity behavior has been confirmed as an important factor for health.[1] In large epidemiological studies, selecting the proper assessment tool is a challenging task for researchers[2] and there are several different techniques used to assess physical activity, such as questionnaires, diaries, 7-day recall, movement sensors and doubly labeled water.[3] The gold standard method is the doubly labeled water that measure total energy expenditure, but it is not suitable for large population studies because that is complicated and expensive.[4] For practical reason and in the absence of inexpensive, readily available, relatively noninvasive, valid and reliable technology for measuring physical activity in large numbers of free-living humans, most epidemiological studies rely on questionnaires to assess physical activity.[4,5] Questionnaires are both comprehensive and easy to use in longitudinal studies, they are generally well accepted by individuals and easy to administer to a large number of study participants at a low cost so it is the most widely used method to assess usual physical activity patterns in population studies.[6]

Physical activity includes multiple social domains (household, occupational, transportation related, leisure time), and recent researches have augmented the importance of assessing activities encountered in daily life.[7] The health risk associated with physical activity differs according to the different dimensions such as type of activity, duration and intensity. So, it is important that physical activity questionnaires assessing professional, domestic and leisure time activity, differentiate the intensity of activity and addressing the usual individual energy expenditure.[4] The Modifiable Activity Questionnaire (MAQ) assesses current (past year and past week) physical activity during occupation and leisure time, as well as extreme levels of inactivity due to disability.[6] This questionnaire was designed for easy modification to maximize the ability to assess physical activity in a variety of populations.[6] Because physical activity patterns and accuracy of self reports may differ across cultural/ethnic backgrounds or gender, it is necessary to use reliable and validated the instrument in each study population.[8] Few questionnaires have been tested on the Iranian urban adult population for evaluating physical activity. This paper describes the study of the validity and reliability of the Persian translated MAQ in a sample population of Tehranian adults.

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Accepted for publication: 13 July 2011

Methods

Study population

The Tehran Lipid and Glucose Study (TLGS) were designed in order to investigate the prevalence of non-communicable disorders

and their risk factors in a sample of Iranian population. The participants of the present study were selected from the framework of the TLGS, a prospective study among urban population in district No. 13 of Tehran, Iran.[9] Based on the least sample size needed for validity[10] and an attrition rate of 30%, we invited 40 males and 40 females, aged 19 years and over with Stratified Random Sampling. According to the following formula for reliability sample size, considering $\alpha = 0.05$ and $\beta = 0.1$, the above mentioned sample size was satisfactory for reliability test, too.

$$n=\left[\frac{(z_{\alpha/_2} + z_{\beta})}{0.5 \times In[(1+r)/(1-r)]}\right]^2 + 3$$

Forty eight adults (53.1% were males) accepted the invitation to fill the physical activity questionnaire in 2002 (response rate, 60%). For validity, we excluded those who did not complete at least three physical activity records. So, of a total of 48 subjects, the validity of the physical activity questionnaire was assessed in 25 individuals (48.0 % were males). The reliability was assessed in those same subjects who accepted the invitation. From those, 33 participants (45.5% were males) were completed two MAQs and included for testing the reliability.

The research ethical committee of Research Institute for Endocrine Sciences of the Shahid Beheshti University of Medical Sciences approved this study protocol and an informed written consent was obtained from each participant.

Measurements
The modifiable activity questionnaire
The original version of the MAQ[11] was translated into Persian and then back-translated into the English. Based on Iranian culture, minor adaptations to fit in the current context in terms of usual leisure time physical activity performed by Iranian people were made. All the modifications, as well as translations, were approved by original MAQ author through email communication. Data were collected by the participants, assisted by trained interviewers when needed. Participants were asked to report the activities that they had participated at least 10 times during the past 12 months in their leisure times and then identified the frequency and duration for each leisure time physical activities. Total number of minutes per year, calculated for every physical activity were summed and then divided by 60 and 52 to estimate the hours per week of total leisure time physical activity. The calculation of MET-h/wk is summarized as below:

MET-h/wk= (MET × months per year × time per month × minute per time) / (60×52)

MET-h/wk of leisure time activity was calculated by multiplying the number of hours per week of each leisure time activity to metabolic equivalent (MET). One MET is set at 3.5 ml of oxygen consumed per kilogram body mass per minute (1kcal/kg/h) and represents the resting metabolic rate. The numbers of METs corresponding to each activity were calculated using the average metabolic cost for each activity.[12]

According to the questionnaire, individuals had to identify the number of month and hours participated in physical activity at work (standing, house work, work activities more intense than standing) over the past year. The assessment of occupational ac-

tivity was based on using the number of hours per week of light, moderate and hard intensity activity, summed to express hours per week of occupational activity over the past year. Final occupational (MET-h/wk) activity was calculated by multiplying the number of hours per week of each three categories of occupational activity to MET values.[12] Total physical activities was expressed in hours of activity per week or MET-h/wk by adding leisure time physical activity to occupational activity.

Reliability
Participants completed the MAQ twice, with an interval of four weeks to evaluate the reliability. The standard time frame for test-retest studies is one to two weeks. But, a four-week interval was chosen because of the practical issues. The subjects were a part of a large scale community-based study (the TLGS) and there were difficulties in recruiting them for shorter intervals.

Validity
All participants were asked to complete a weekly record form of physical activity and record all the activities in one typical week in every season, preferably in the middle of each season. They were trained how to record the activities. For convenience, the whole 24-hours were divided into 3 intervals in our questionnaire; 8 – 14, 14 – 22 and 22 to 8 am of next day. They were asked to record any activities during each interval, including leisure time and occupational activities. The physical activity record questionnaires completed in the middle of each season and were compared with mean of two MAQs to evaluate the convergent validity of the MAQ.

Statistical analysis
Using the P-P plot test, the distribution of mean of MET-h/wk wasn't normal, so we used non-parametric tests. Data from both MAQs and from the four physical activity records were reported as mean ($\pm$ SD) values for age, weight, height, BMI (Body Mass Index), MET-h/wk. Mann-Whitney test was used to compare the means of two MAQs. Since there was no significant difference between two MAQs, we used the mean of two MAQs to be compared with four physical activity records. Intraclass Correlation Coefficients were used to calculate the reliability of the two MAQs. Intraclass Correlation Coefficients estimates ≥ 0.7 were considered asacceptable reliability.[13] To evaluate the convergent validity, Spearman Correlation Coefficients were used to compare means of two MAQs and means of four physical activity records.

Results

The mean ($\pm$ SD) values of age, weight, height, BMI and the percentage of sex and education levels for participants are presented in Table 1. The mean age of the participants was 39.5 ± 14.7 yr and 45.5% were men. Average BMI was 25.9 ± 4.7 kg/m² and the prevalence of normal weight, overweight and obesity were 35.5%, 45.2% and 19.4%, respectively. All subjects were literate. Table 2 shows the estimations of MET-h/wk measured by physical activity record questionnaires and two MAQs. Based on two MAQs, the mean of MET-h/wk for leisure time, occupational and total (leisure and occupational combined) physical activities were 23.4, 52.3 and 75.7, respectively. Besides, the mean of total MET-h/wk was 86.3 MET-h/wk according to the data derived from physical activity records of four seasons. For past year leisure time, occupational and total (leisure and occupational combined) physical ac-

Table 1. Main characteristics of study population

Measurement	mean	SD	Minimum	Maximum
Age (year)	39.5	14.7	19.0	66.0
Sex (men)*	45.5%	-	-	-
Weight (kg)	72.1	14.8	43.0	98.0
Height (cm)	166.6	9.9	150	185
BMI (kg/m²)	25.9	4.7	18.3	35.1
Education (academic) †	9.1%	-	-	-
*= Sex presented as percentage; † = The percentage of individuals who were graduated from university.				

Table 2. Physical activity (MET-h/wk) measures obtained with the mean of two Modifiable Activity Questionnaires and the mean of four physical activity records

Measurement	Two MAQs (Mean ±S.D)*	Four physical activity records (Mean ±S.D)	ρ†	P-value†
Leisure time	23.41 ± 26.05	12.86 ± 13.81	0.39	0.050
Occupational	52.32 ± 17.56	53.97 ± 52.58	0.36	0.070
Total	75.73 ± 71.58	86.37 ± 63.55	0.47	0.017
* = Standard error; † = ρ and P-value calculated by spearman correlation coefficients				

tivity, Intraclass Correlation Coefficients were 0.94, 0.98 and 0.97 respectively. Spearman Correlation Coefficients between means of two MAQs and means of four physical activity recordsare presented in Table 2. The Spearman Correlation Coefficient was 0.39 (p = 0.05), 0.36 (p = 0.07) and 0.47 (p = 0.01)for leisure time, occupational and total (leisure and occupational combined) physical activities, respectively.

Discussion

This is the first study to assess test-retest reliability and validity of the Persian translated MAQ in samples of males and females from an Iranian urban adults. We used four physical activity records to compare MET-h/wk from the MAQs and physical activity records. The reliability assessed by Intraclass Correlation Coefficient between the results of two MAQs with a one-month interval. Our results demonstrated excellent reliability and relatively moderate validity of the MAQ among an Iranian adult sample population.

The MAQ, developed by Kriska, assesses current (past year and past week) physical activity level during both leisure and occupational time.[14–16] and it is a retrospective quantitative questionnaire that represents the most comprehensive form of physical activity recall survey. This questionnaire designed for easy modification to maximize the ability to assess physical activity in a variety of populations and it`s culture free.[16] Reliability and validity of the MAQ were previously reported in some other populations.[16,17] Measurement of total energy expenditure by the doubly labeled water method demonstrated validity of the MAQ.[17] In Kriska et al. study, spearman correlation coefficients found 0.92 (ages 21 – 36) and 0.88 (ages 37 – 59) for past year leisure time and for occupational and total (leisure and occupational combined) physical activity were 0.88 and 0.89 respectively.[14] 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 doubly-labeled water.[17] Evaluation of physical activity in middle-aged women showed that both the leisure physical activity during the past month and the past week demonstrate good stability and convergent validity.[2] In our study, validity results for leisure time

and total (leisure and occupational combined) physical activities presented relatively moderate correlation.

Gabriel et al. based on MAQ, reported that leisure physical activity during the past month and the past week was reliable and associated with physical activity and physical fitness.[2] Our results suggested a high Intraclass Correlation Coefficients between two MAQs for leisure time (0.94), occupational (0.98) and total (leisure and occupational combined) (0.97) physical activity.

As a conclusion and based on our results, the Farsi translated MAQ has a high reliability. However, the validity of the Persian version is in doubt because of our study limitations. Using four physical activity records may result in recall bias or have language and educational barriers and that cannot be gold standard to evaluate the exact validity of the MAQ. Objective activity monitors such as accelerometers, Vo_2max, and the doubly labeled water technique have numerous advantages and provides a more precise way to validate the subjective method that estimate of energy expenditure. Since those methods are complicated and expensive and are not simple to do, we used physical activity record to estimate participants' physical activity levels when those objective methods not provided. Furthermore, primarily and besides physical activity records, we had considered Vo_2max as a gold standard and objective methods to evaluate the exact validity of the MAQ in our study. However, performing Vo_2max measurement was not feasible in our study due to the lack of resources. On the other hand some previous epidemiological studies that used questionnaires have not been evaluated physical activity levels against objective measures.[18]

The small sample size of the present study and the moderately low participation rate are other limitations of this study. Moreover, we didn't have any information about non respondents to be reported.

On the other hand, as it is shown, our data were from just young, over weight and mainly not having academic education subjects (Table 1). So, data from older subjects or people with normal weight or obese or even academic educated ones may show different results.

In conclusion and considering that the original MAQ has an ability to assess the P.A. levels in a variety of different populations. The present study shows that the Persian translated version is

reliable but can be used in the TLGS Tehranian population with caution because of relatively moderate convergent validity. It can be answered quickly and requires little cooperation by the patient. However, it is suggested to perform further studies with large sample size and better gold standard to assess the validity of this tool more precisely, if it is going to be used with no doubt and in other Iranian population.

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