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RELIABILITY, VALIDITY AND CROSS-CULTURAL ADAPTATION OF THE TURKISH VERSION OF THE PHYSICAL ACTIVITY QUESTIONNAIRE FOR ADOLESCENTS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The small number of Turkish versions of questionnaires assess the level of physical activity of adolescents creates a need for a valid, reliable, inexpensive and practical questionnaire for large-scale studies. This study aimed to investigate the validity, reliability, and cross-cultural adaptation of the Turkish version of the Physical Activity Questionnaire for Adolescents (PAQ-A).

Methods: The 150 adolescent students between the ages of 14 and 18 years (age=15.67±0.83 years) were included in the study. Test-retest and internal consistency analyses were performed to evaluate reliability using the intraclass correlation coefficient (ICC) method. Total step counts were recorded for one week using an electronic pedometer to assess the questionnaire's convergent validity. The relationship between total score obtained from PAQ-A and total step counts recorded by the pedometer

Results: Cronbach's alpha value was found to be 0.86 for the entire questionnaire, indicating a questionnaire's high internal consistency. The ICC values for test-retest reliability were found to be within the range of 0.71 to 0.99, indicating that test-retest results were highly correlated. There was a moderate, positive and statistically significant (r=0.527, p<0.001) correlation between total score obtained from the questionnaire and total step counts measured by pedometer for one week.

Conclusion: The Turkish version of the PAQ-A is valid and reliable. Therefore, it may be advisable to use the PAQ-A to measure adolescents' physical activity levels during school periods.

Key Words: Adolescent; Physical Activity; Questionnaires; Reliability and Validity.

ADOLESANLAR İÇİN FİZİKSEL AKTİVİTE ANKETİ'NİN TÜRKÇE VERSİYONUNUN GEÇERLİK, GÜVENİRLİK VE KÜLTÜREL UYARLAMA ÇALIŞMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Adolesanlarda fiziksel aktivite düzeyini değerlendiren anketlerin Türkçe versiyonlarının sayıca azlığı büyük ölçekli çalışmalar için geçerli, güvenilir, ucuz ve kolay uygulanabilir bir anket ihtiyacı yaratmaktadır. Çalışmamızın amacı, Adolesanlar İçin Fiziksel Aktivite Anketi'nin (AFAA) Türkçe versiyonunun geçerlik, güvenirlik ve kültürel uyarlamasını belirlemekti.

Yöntem: Çalışmaya 14-18 yaşları arasında (yaş=15,67±0,83 yıl) toplam 150 adolesan öğrenci alındı. Güvenirliğin belirlenmesi için test-tekrar test ve iç tutarlılık analizi yapıldı. Test-tekrar test sonuçları, sınıf içi korelasyon katsayısı (ICC) yöntemi ile değerlendirildi. Anketin birleşim geçerliğini değerlendirmek için, elektronik pedometre ile bir hafta süresince öğrencilerin toplam adım sayıları kaydedildi.

Sonuçlar: Cronbach alfa değeri tüm anket için 0,86 olarak belirlendi. Bu değer, anketin yüksek iç tutarlılığa sahip olduğunu gösteriyordu. ICC sonuçları 0,71 ila 0,99 arasında değişmekte olup, test-tekrar test sonuçlarının yüksek derecede korele olduğu gösterildi. Anketten alınan toplam puan ile pedometre ile ölçülen bir haftalık toplam adım sayısı arasında pozitif yönde, orta düzeyde (r=0,527) ve istatistiksel olarak anlamlı (p<0,001) korelasyon bulundu.

Tartışma: AFAA'nın Türkçe versiyonu geçerli ve güvenilirdir. Bu nedenle, adolesanların okul periyotları boyunca fiziksel aktivite düzeylerini ölçmek için AFAA'nın kullanımı önerilebilir.

Anahtar Kelimeler: Adolesanlar; Fiziksel Aktivite; Anketler; Güvenirlik; Geçerlik.

INTRODUCTION

Physical activity (PA) during childhood and adolescence is beneficial to both physical and mental health. Physically active adolescents also have lower cardiovascular risk factors during adulthood (1). The World Health Organization (WHO) recommends that children and adolescents moderate-to-vigorous PA for 60 minutes daily to protect and improve their health (2). Increasing PA is a crucial component in treating several diseases, including childhood obesity and associated health conditions. Therefore, assessment of PA is a topic of the strong interest in public health research (3,4).

Currently, PA could be measured by a variety of objective and subjective methods, and it is necessary to have standardized, reliable, and valid instruments which could be used in many societies (5,6). It is also essential to use non-invasive, easy-to-use, and time-saving instruments in children and adolescents (3,7).

In response to the need for a valid and feasible self-report measure for large-scale research with adolescents, the Physical Activity Questionnaire for Adolescents (PAQ-A) was developed by Kowalski et al. (8) and validated for adolescents aged 14 to 20 years. The PAQ-A is a nine-item, 7-day self-report recall questionnaire designed to measure general moderate-to-vigorous PA levels during the school year (8). It consists of eight questions structured to discern low (score 1) to high (score 5) PA during the last seven days and a ninth question to identify adolescents who had an unusual activity during the previous week, but this question is not used as part of the summary activity score. The result is the average value of the points obtained, with higher scores indicating a higher PA level (3, 8).

A systematic review which examined the validity, reliability and responsiveness of 61 versions of PA questionnaires in youth demonstrated that none of the questionnaires included in the review had acceptable levels of reliability and validity according to the guidelines described in the Qualitative Attributes and Measurement Properties of Physical Activity Questionnaires (QAPAQ) (7,9). In addition, Biddle et al. (10) reviewed different self-report PA instruments developed for use in children and adolescents and compared them to assess their suit-

ability and feasibility for population surveillance systems and tracking trends over time. The authors identified 20 activity-based instruments, of which three were supported by most of the expert group, namely the Physical Activity Questionnaire for Older Children (PAQ-C) and the PAQ-A, Youth Risk Behavior Surveillance Survey, and Teen Health Survey. These PA measurement instruments were neither found to be reliable or valid nor easy-to-use. However, the PAQ-A is regarded as one of the most suitable self-report tools for examining PA in these populations (7,10). It was initially developed in Canada but has been widely used in other parts of the world including African countries (i.e., Nigeria and Ghana) (9,11,12) Europe (i.e., Netherland and the United Kingdom), and in specific youth populations including adolescents with cerebral palsy (3, 13).

Best of our knowledge, validity and reliability of the questionnaire in Turkish adolescents have not been evaluated, yet. In the present study, therefore, we aimed to translate and adapt an existing English version of the PAQ-A into Turkish and test the reliability and the convergent validity of the PAQ-A against an electronic pedometer among Turkish adolescents.

METHODS

Study Design

This study was conducted at Gazi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation in Ankara, Turkey, between December 2016 and June 2017. Before study initiation, all participants and parents and/or legal guardians were informed about the study's nature and written informed consent was obtained. Gazi University, Faculty of Health Sciences, Ethics Committee (Approval Date: 10.02.2017 and Approval Number: 2017-65) approved the study protocol. The study was conducted following the principles of the Declaration of Helsinki.

Study Population

A total of 150 adolescents from the Republic Vocational Technical Anatolian High School, Ankara, Turkey, were included in the study. The sample size was calculated based on previous validity and reliability studies which recommend that the number

of sample size should be five times the number of items in the questionnaire (14). The school was selected because students were willing to cooperate with their physical education teachers who received a pedometer training. All students were informed about the aim of the study. Inclusion criteria were as follows: age between 14 and 18 years and having no orthopedic disease or injury, limiting PA. Those who had a severe illness during the study period or failure to complete all parts of the study (missing questionnaire or measures) and had a body mass index (BMI) ≥35 kg/m2 were excluded from the study.

A ProForm SP-50 pedometer (Hefei Merrybody Sports Co., Ltd., Anhui, China) used to assess PA. It is a small device that senses body motion and counts the footsteps (15). The pedometer is a reliable and valid tool for adolescents (16). The pedometer was placed on the right side and attached either a belt/waistband on the anterior thigh midline. Pedometers were worn during all waking hours, except for bathing or swimming, and removed before going to sleep at night. The inclusion criterion was a pedometer recording of at least 10 h per day for a total of seven days, of which one had to be a weekend day (6, 17).

Translations and Cultural Adaptation

After the author and publisher's permission, the translation and cross-cultural adaptation of the original questionnaire were performed following the published guidelines (18). First, two translations of the PAQ-A from English into Turkish were performed by two independent translators fluent in English, but whose native language is Turkish. One of the translators was aware of the process and familiar with the questionnaires' concept, and the other was uninformed of translation objective to keep the language easy for individuals without the knowledge of technical terminology. Both Turkish translations were, then, compared with each other and the original English version for inconsistencies. After discussing possible discrepancies, a consensus was reached by the synthesis of two translations. In addition, two back translations of the questionnaire's Turkish version into English were performed by two bilingual translators blindly and independently. Bilingual translators were unaware

of the study, and their native language was English (native speakers). Following the evaluation of the resultant translations for English-Turkish language and cultural adaptation by the Expert Committee, the questionnaire's pre-final version was provided. The committee consisted of a physiotherapist, an English linguistic scientist, a Turkish philology specialist, and two bilingual translators. The final stage of the adaptation process was the test of the prefinal version. This process aimed to establish whether this version could be understandable and useful to assess the intended parameters. The comprehensiveness of the questionnaire was evaluated in a pilot group of 30 adolescents. They were asked about the comprehensibility of each questionnaire item. After the pilot group completed the questionnaire, the committee established the final form of the questionnaire based on the findings.

Due to the particular cultural circumstances, some modifications were performed in the translation process. The first question was adjusted according to the socio-cultural conditions and available sports activities in Turkey. Unusual activities were removed (i.e., baseball, street hockey, and floor hockey), while activities regularly practised in Turkey (i.e., ping pong, folk dance, and tennis) were added.

Reliability

Test-retest reliability and internal consistency have been considered as two common forms of reliability (19). Test-retest reliability evaluates stability over time by administering the same test to the same individuals at two time points. In the present study, the reliability of the PAQ-A was evaluated by asking each adolescent to complete the questionnaire one week after first taking it, using a test-retest design. The two administrations' responses were collected for data analysis, and the intraclass correlation coefficient (ICC) was used to evaluate test-retest reliability. Higher coefficient values indicate higher reliability and a lower standard error of measurement. The ICCs may vary from 0.00-1.00, where values of 0.60-0.80 are considered the evidence of good reliability, and those above 0.80 indicate excellent reliability.

The questionnaire's internal consistency relating to its homogeneity was also analyzed in our study. The

degree of the inter-relatedness among the items of a questionnaire is usually assessed by Cronbach's alpha (α) (20). For internal consistency, values equal or greater than 0.70 is considered to be indicative of a reliable questionnaire, and the value of Cronbach's α should be above 0.80 for acceptance as a high internal consistency (7,20).

Validity

The validity of the questionnaire was assessed in terms of construct validity. For construct validity, convergent validity was tested. Objective measurement of PA was assessed using an electronic pedometer to assess convergent validity. Many previous studies have shown that pedometers are an excellent proxy to PA, which can be applied to large groups of individuals and allow results from research studies to be readily translated into PA levels (15).

Convergent validity was measured by comparing the total PAQ-A score with other measurement recorded by the pedometer simultaneously and analyzed using the Spearman correlation coefficient. The Spearman correlation coefficients were calculated as follows: r ≥0.75-1.0, excellent; 0.70-0.75, very good; 0.60-0.70, good; 0.40-0.60, moderate; 0.30-0.40, low-to-moderate, and 0.05-0.30, poor (21).

Procedure

On Day 1, each participant was informed about the study and age, body weight, and height were noted. On the same day, each participant received a personal demonstration of the pedometer placement and use by trained professionals (physical education teachers).

Adolescents were asked to wear the pedometer for seven consecutive days. On Day 8, the adolescents completed the PAQ-A form. They were asked

to recall their recent activity during the past seven days. One week after the first completion, 40 participants were asked to re-fill the questionnaire.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean±standard deviation (SD), median (min-max) or number and frequency, where applicable. In this study, an ICC ranging from 0.00 to 1.00 was used to evaluate test-retest reliability, and the coefficient of internal consistency was assessed with a Cronbach's α value of 0 to 1. Convergent validity was measured using the Spearman correlation coefficient. A p-value of <0.05 was considered statistically significant, with a 95% confidence interval (CI).

RESULTS

Characteristics of Participants

A total of 150 adolescent students were included in the evaluation part of the study. The students' mean age was 15.67±0.83 (range, 14 to 18) years and 63 (42%) of them were females. A total of 53 (84.1%) of 63 female students and 46 (52.9%) of 87 male students who participated in the study did not have regular sports habits. Of 150 participants, 99 (66%) had no regular sports habits. The mean BMI of the participants was 21.19±3.60 kg/m2. Demographic and clinical characteristics of the participants are summarized in Table 1.

Reliability

The mean age of 40 students selected for the test-retest reliability analysis was 15.95±0.88 (range, 14 to 18) years. The ICC values (95% CI) for test-retest reliability were found to be within the range of 0.71 to 0.99. Test-retest correlation of the total score of the questionnaire was record-

Table 1: Demographic and Clinical Characteristics of Participants.

Variable	Girls (n=63)	Boys (n=87)	Total (n=150)	p
	Mean±SD	Mean±SD	Mean±SD	
Age (years)	15.68±0.80	15.66±0.86	15.67±0.83	0.652
Height (cm)	165.52±5.10	173.31±8.23	170.04±8.05	<0.001*
Weight (kg)	55.40±8.45	65.97±13.17	61.53±12.54	<0.001*
BMI (kg/m²)	20.21±3.01	21.90±3.86	21.19±3.60	0.008*

*p<0.05. Mann-Whitney U Test. BMI: Body Mass Index.

Table 2: Intraclass Correlation Coefficient Values.

PAQ-A	Intraclass Correlation Coefficient
Q.1. Spare Time Activity	
1.1. Skipping	0.90
1.2. Rowing/Canoeing	0.80
1.3. In-Line Skating	0.97
1.4. Tag	0.96
1.5. Walking for Exercise	0.93
1.6. Bicycling	0.96
1.7. Jogging or Running	0.96
1.8. Gymnastics	0.80
1.9. Swimming	0.99
1.10. Ping Pong	0.94
1.11. Dance	0.95
1.12. Football	0.97
1.13. Badminton	0.78
1.14. Skateboarding	0.88
1.15. Soccer	0.97
1.16. Folk Dances	0.82
1.17. Volleyball	0.97
1.18. Tennis	0.98
1.19. Basketball	0.96
1.20. Ice Skating	0.71
1.21. Cross-Country Skiing	0.72
1.22. Ice Hockey	0.94
Q.2. Activity During Physical Education Classes	0.94
Q.3. Lunch-Time Activity	0.92
Q.4. After-School Activity	0.80
Q.5. Evening Activity	0.86
Q.6. Weekend Activity	0.85
Q.7. Activity Frequency During the Last 7 Days	0.80
Q.8. Activity Frequency During Each Day Last Week	
8.1. Activity Frequency for Monday	0.93
8.2. Activity Frequency for Tuesday	0.91
8.3. Activity Frequency for Wednesday	0.89
8.4. Activity Frequency for Thursday	0.89
8.5. Activity Frequency for Friday	0.92
8.6. Activity Frequency for Saturday	0.78
8.7. Activity Frequency for Sunday	0.81
Total Mean PAQ-A	0.87

PAQ-A: Physical Activity Questionnaire for Adolescents, Q: Question.

ed as 0.87. According to the ICC values, test-retest results were highly correlated. The ICC values are shown in Table 2.

The Cronbach's α value of the PAQ-A was calculated as 0.86, indicating a questionnaire's high internal consistency. When each question and statement was excluded, the Cronbach's α value of the questionnaire ranged between 0.85 and 0.86. Cronbach's α values are shown in Table 3.

Validity

Convergent validity results showed that the correlation of the PAQ-A was found to be moderately, but statistically significantly correlated with the pedometer measurements (r=0.527, p<0.001). The correlation values of the PAQ-A based on the pedometer measurements are shown in Table 4.

DISCUSSION

In the present study, English version PAQ-A was translated and adapted into Turkish, and the reliability and the convergent validity of the PAQ-A

against an electronic pedometer were tested among Turkish adolescents. Our study results showed that cross-cultural adaptation was successfully completed and the PAQ-A was a valid and reliable tool for the Turkish population.

In questionnaire validity studies, it is usually recommended to use different questionnaires which are validated, accepted as a gold standard. However, to the best of our knowledge, there is no gold-standard and validated questionnaire in Turkish to as-

sess PA's level in adolescents. Therefore, the present study is valuable, as it provides evidence for the validity of the PAQ-A.

Movement sensors, such as pedometers and accelerometers, are among the most optimal methods for evaluating PA and validation of PA self-report instruments (22). Consistent with the literature, in our study, we used a commercially available pedometer, which has been extensively used in previous reports and is valid and reliable for measuring

Table 3: Cronbach's Alpha Values When Items Excluded.

PAQ-A	Cronbach's Alpha Values
Q.1. Spare Time Activity	
1.1. Skipping	0.86
1.2. Rowing/Canoeing	0.86
1.3. In-Line Skating	0.865
1.4. Tag	0.86
1.5. Walking for Exercise	0.86
1.6. Bicycling	0.86
1.7. Jogging or Running	0.86
1.8. Gymnastics	0.86
1.9. Swimming	0.86
1.10. Ping Pong	0.86
1.11. Dance	0.86
1.12. Football	0.86
1.13. Badminton	0.86
1.14. Skateboarding	0.86
1.15. Soccer	0.86
1.16. Folk Dances	0.86
1.17. Volleyball	0.86
1.18. Tennis	0.86
1.19. Basketball	0.86
1.20. Ice Skating	0.86
1.21. Cross-Country Skiing	0.86
1.22. Ice Hockey	0.86
Q.2. Activity During Physical Education Classes	0.86
Q.3. Lunch-Time Activity	0.86
Q.4. After-School Activity	0.85
Q.5. Evening Activity	0.85
Q.6. Weekend Activity	0.85
Q.7. Activity Frequency During the Last 7 Days	0.86
Q.8. Activity Frequency During Each Day Last Week	
8.1. Activity Frequency for Monday	0.85
8.2. Activity Frequency for Tuesday	0.86
8.3. Activity Frequency for Wednesday	0.85
8.4. Activity Frequency for Thursday	0.85
8.5. Activity Frequency for Friday	0.85
8.6. Activity Frequency for Saturday	0.85
8.7. Activity Frequency for Sunday	0.86
Total Mean PAQ-A	0.86

PAQ-A: Physical Activity Questionnaire for Adolescents, Q: Question.

Table 4: Correlation Values of Physical Activity Questionnaire for Adolescents with Pedometer.

PAQ-A	Total Number of Steps Per Week Recorded with a Pedometer (n=150)	
	r	p
Q.1. Spare Time Activity	0.554	<0.001*
Q.2. Activity during Physical Education Classes	0.219	0.009*
Q.3. Lunch-Time Activity	0.301	<0.001*
Q.4. After-School Activity	0.335	<0.001*
Q.5. Evening Activity	0.329	<0.001*
Q.6. Weekend Activity	0.349	<0.001*
Q.7. Activity Frequency During the Last 7 Days	0.265	0.001*
Q.8. Activity Frequency During Each Day Last Week	0.539	<0.001*
Total Mean PAQ-A	0. 527	<0.001*

*Spearman correlation analysis, correlation is significant at the p<0.01 level (2-tailed). PAQ-A: Physical Activity Questionnaire for Adolescents, Q: Question.

step count, walking distance, and walking behavior (6).

In the present study, the validity correlation coefficient between the PAQ-A with the pedometer measurement was moderate (r=0.52). However, there is no consensus on how high correlations demonstrate adequate validity. Higher correlations are to be expected when the comparative constructs are more similar (20). In addition, this correlation coefficient is considerably higher than the previously reported link between the PAQ-A and accelerometer in Spanish adolescents (r=0.39) (23) and also a correlation with the accelerometer reported in a Chinese population (r=0.33) of children aged from 8 to 13 years (24). Likewise, previously reported correlations between the PAQ-C and PAQ-A with the Caltrac™ (Muscle Dynamics Fitness Network, Inc. Torrance, CA, USA) activity monitor (r=0.33 and r=0.39) were much lower than our study. In previous studies, the convergent validity of the PAQ-A was found to be 0.51 with peak oxygen uptake (3), 0.73 with activity rating, 0.57 with Leisure Time Exercise Questionnaire, 0.33 with the Caltrac™ motion sensor, and 0.59 with seven-day PA recall interview (8). Regaieg et al. (6), similar to our study, reported that the IPAQ-A assessment among Tunisian adolescents showed an acceptable validity, yielding a positive and significant correlation between the IPAQ-A scores and the pedometer step counts (r=0.66). Considering all studies' correlation values, including our study, the Turkish version of the PAQ-A seems to have an acceptable validity.

In our study, the Cronbach's α coefficients showed excellent internal consistency (α=0.86), which is higher than the original and other modified versions of the PAQ-A (3, 23). In their study, Janz et al. (25) reported that Cronbach's α of the PAQ-A ranged from 0.72 to 0.88. The Cronbach's α coefficient for the modified PAQ-A score indicated acceptable inter-item reliability (α=0.72) (9). Bervoets et al. (3) also showed acceptable reliability of PAQ-A for Dutch adolescents. (α=0.75). These findings indicate that similar to the other language versions, the Turkish version of PAQ-A is reliable.

In the literature, there is no specified exact time interval for test-retest analysis (26). The time interval between the test and retest should be long enough to prevent the recall of previous answers, but short enough to ensure that PA patterns have not changed. The most optimal time interval depends on the construct to be measured and the questionnaire's recall period. Indeed, for measuring PA during the past week, usual week or past year, a time interval of one day to three months can be reasonable (20). In the present study, a one-week time interval of test-retest was selected according to Reaigeg et al. (6) study.

In the present study, the ICC for individual items of the PAQ-A ranged from 0.71 to 0.99, which is strong evidence to support good and excellent reliability, and the ICC value was found to be 0.87 for total scores. The reliability of the PAQ-A ranged from poor (ICC=0.40) among Vietnamese adolescents to good in other studies conducted in oth-

er countries among adolescents of different races (7,9,25,27). While Aggio et al. (9) reported that the modified PAQ-A score was stable over time among British adolescents (ICC=0.78), Martinez -Gomez et al. (23) found test-retest ICC results of the total score of the questionnaire to be 0.71. The discrepancy could be attributed to the fact that the age of the participants in our study was older than those of Martinez-Gomez et al. Therefore, participants in this study may be able to remember the activities they have done in the past seven days better while answering the PAQ-A. It could be speculated that the Turkish version of the PAQ-A is reliable and stable over time, considering the ICC values of the questionnaire. Among the available validated self-report measures of PA for youth, PAQ-A is one of the most promising tools (10). The advantage of the PAQ-A is that it is an easy-to-use, relatively inexpensive, and a quick-to-administer self-report tool. The PAQ-A provides specific information about activity levels during different periods of the day (i.e., physical education, lunch, and after school) and measures the overall PA level for a whole week (7).

Nonetheless, there are some limitations to this study which warrant caution when interpreting the findings. First, the PAQ-A was designed for adolescents aged between 14 and 20 years. However, the age range of the participants recruited in the current study varied from 14 to 18 years, precluding the generalizability of the results for adolescents. Second, some authors have indicated that internal consistency is not relevant for PA questionnaires, as the items refer to different aspects of the construct; i.e., duration versus frequency or sports versus work and these items do not need to be highly correlated (20). However, we decided to include these analyses, as they allow comparison of our results with the results of other studies.

In conclusion, the PAQ-A has high test-retest and internal consistency coefficient results. Convergent validity of the PAQ-A shows a moderate level of correlation with the pedometer measurements. Based on these findings, we suggest that the Turkish version of the PAQ-A is valid and reliable. As it is time-saving, easy-to-apply, and easy-to-score, PAQ-A may be a preferable scale in PA assessment for adolescents. In this context, we believe that our

study increases the variety of PA assessment methods and contributes to a better PA level classification. Further studies evaluating the validity and reliability of the Turkish version of the questionnaire in the population at different socio-economic and socio-cultural levels and examining adolescents' PA level are warranted.

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