Assessing Physical Activity in Obese Children: Reliability and Validity of the PAQ-C

 Mehmet Eltan[1], Tarık Kırkgöz[2]

[1]Department of Pediatric Endocrinology and Diabetes, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital, İstanbul, Türkiye
[2]Department of Pediatric Endocrinology and Diabetes, Kayseri Training and Research Hospital, Kayseri, Türkiye

ABSTRACT

Objective: In pediatric populations, the relationship between obesity and physical activity (PA) is influenced by genetic predispositions, environmental factors, and lifestyle behaviors. Despite the benefits, many children fail to meet recommended PA levels. This study aimed to determine the reliability and validity of the PA Questionnaire for Older Children (PAQ-C) and explore its potential applications in promoting PA among obese children.

Materials and Methods: 272 children and adolescents (148 obese patients and 124 healthy controls) were enrolled in this study. Descriptive statistical analysis was performed, and Cronbach's alpha coefficient was calculated to assess the reliability of the PAQ-C.

Results: The mean ages of the obese and control groups were 12.1±2.2 and 12.6±1.7 years, respectively. The average BMI SDS was 2.7±0.6 for the obese group and -0.2±1.0 for the control group. No significant difference in overall PAQ-C scores was found between the two groups (p=0.252). Notable findings included lower scores among obese children in spare time and recess activities. Additionally, lower scores in self-reported statements and overall life satisfaction were observed among obese children, although these differences were not statistically significant. Cronbach's alpha was 0.85 for the obese group and 0.86 for the non-obese group, indicating high reliability.

Conclusion: The PAQ-C is a reliable and valid tool for assessing PA levels in obese children, with potential applications in promoting PA. Using the PAQ-C, researchers, and practitioners can develop targeted interventions to increase PA levels and improve health outcomes among children.

Keywords: Obese, obesity, PAQ-C, physical activity

How to cite this article: Eltan M, Kırkgöz T. Assessing Physical Activity in Obese Children: Reliability and Validity of the PAQ-C. CM 2025;17(1):51-55

INTRODUCTION

Obesity is a multifactorial condition with profound implications for pediatric health. It is characterized by excessive adiposity resulting from a chronic imbalance between energy intake and expenditure. In pediatric populations, the relationship between obesity and physical activity (PA) is complex and bidirectional, influenced by genetic predispositions, environmental factors, and lifestyle behaviors. Regular PA plays a pivotal role in the prevention and management of pediatric obesity, serving as a cornerstone of comprehensive obesity interventions.

The importance of PA for children's health and well-being cannot be overstated. Regular PA has been linked to numerous benefits, including improved cardiovascular health, enhanced cognitive function, and a reduced risk of obesity and other chronic diseases. However, many children today do not engage in sufficient levels of PA, with studies showing that a significant proportion of children fail to meet the recommended daily PA levels. Regular PA has been shown to improve cardiovascular fitness, muscle strength, bone density, and motor skills in children. It also helps prevent chronic diseases such as obesity, type 2 diabetes, and high blood pressure, which are increasingly common in children due to sedentary lifestyles. Studies show that physically active children are more likely to maintain a healthy weight and have a reduced risk of metabolic disorders later in life.[1]

PA can be assessed using various methods, each with its strengths and limitations. Common approaches include direct observation, wearable devices such as accelerometers, physiological measures such as heart rate monitoring, and self-report surveys. Among these, self-report surveys are notable for their practicality, especially in large-scale studies. Surveys are cost-effective, easy to administer, and adaptable to different cultural and linguistic contexts. They can capture multiple dimensions of PA, including frequency, duration, and type, making them a comprehensive tool for understanding activity patterns. In addition, surveys are non-invasive and ethically favorable, with minimal participant burden, making them suitable for children of all ages. Tools such as the PA Questionnaire for Older Children (PAQ-C) are particularly valuable as they balance accessibility with meaningful insights into PA behaviors. Although subject to recall bias, surveys remain an efficient and reliable choice for assessing PA trends, particularly in studies involving large, diverse populations.

PAQ-C is a widely used self-reporting scale designed to assess the moderate to vigorous PA (MVPA) levels of children aged above 8 years.[2,3] In this study, we aimed to determine the reliability and validity of the PAQ-C and explore its potential applications in promoting PA among obese children.

MATERIALS and METHODS

A total of 272 children and adolescents (148 obese patients and 124 healthy controls) were enrolled in this study. This study was conducted in compliance with the terms of the World Medical Association Declaration of Helsinki and was approved by the University of Health Science Clinical Research Ethics Committee (decision number: 96, date 21.05.2024). Written and informed consent signed by parents or guardians were obtained from all the children participating in the study. As the study published by Cuberek et al.[4] is close concerning ethnicities, we used the factor loading values published in their article to determine the sample size. The PAQ-C is designed to assess PA levels in children aged 8 to 14 years.

Data collection took place in the hospital in July and August 2024. Participation was voluntary and a questionnaire was given to those who wished to answer the questions. Before answering the questions, participants were told that this was not an examination, that all data would be used for scientific study, and that the answers would not affect their lives or treatment in any way. As participants completed the questionnaire, their date of birth height, and weight were recorded in the Excel file. Members of the research team showed the PAQ-C items, explained the items, and clarified any doubts the participants had.

The children with apparent disabilities and those who reported sick or any event that prevented them from performing normal physical activities in the preceding 7 days were excluded. The questionnaire consists of several items that evaluate different dimensions of PA over the previous seven days. The PAQ-C consists of 9 items, each scored on a scale from 1 to 5, where a score of 1 indicates low PA and a score of 5 indicates high physical activity. The overall PAQ-C score is calculated by summing the scores from all items and then taking the mean, which provides a composite score reflecting the child's PA level.

Statistical Analysis

The characteristics of participants were described as mean and standard deviation (SD). Descriptive statistical analysis was performed for all quantitative variables, and analysis of normal distribution was performed using the Kolmogorov-Smirnov test. For numerical comparisons between two independent groups, the independent samples t-test or Mann-Whitney U-test was used, depending on the normal distribution of the parameters. Cronbach's alpha coefficient of internal consistency or reliability was calculated. The reliability coefficient of the scale was considered reliable if it was 0.70 or higher. The analyses were performed using SPSS 22.0 (Chicago, Illinois). Additionally, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were conducted to evaluate the suitability of data for factor analysis. The level of significance was set at $p<0.05$.

RESULTS

A total of 148 obese patients (72 females and 76 males) and 124 healthy controls (61 females and 63 males) were enrolled in this study. The mean ages of the obese and control groups were 12.1±2.2 years and 12.6±1.7 years, respectively. The average BMI SDS was 2.7±0.6 for the obese group and -0.2±1.0 for the control group.

No significant difference in sum PAQ-C scores was found between the two groups (p=0.2376). However, lower scores among obese children in spare-time activities were notable. There was no significant difference in physical education activities (p=0.4712), but lower scores in recess activities for obese children (p=0.1036). Additionally, while not statistically significant (p=0.0696), lower scores among obese children in self-reported statements and overall life satisfaction were found. No significant difference in weekly activities was observed in our study (p=0.5015).

Cronbach's alpha for the overall sample was 0.85 for the obese group and 0.86 for the non-obese group, indicating

Table 1. Descriptive statistics for the investigated variables in the study

	Obese female	Non-obese female	p	Obese male	Non-obese male	p	Obese group	Non-obese group	p
Age (years)	12.61±2.0	12.9±1.7	0.3667	11.9±2.1	12.3±1.5	0.5489	12.1±2.2	12.6±1.7	0.1996
BMI SDS	2.9±0.7	-0.04±0.9	<0.001*	2.5±0.5	-0.34±1.1	0.0017*	2.7±0.6	-0.2±1.0	<0.0001*
PAQ-C total score	20.3±6.9	20.6±7.4	0.83	24.3±6.7	25.9±6.7	0.2157	22.3±7.0	23.4±7.6	0.265
PAQ-C sum score	2.26±0.78	2.29±0.82	0.80	2.69±0.75	2.93±0.74	0.0946	2.48±0.77	2.61±0.84	0.2376
Spare-time activity	2.5±1.1	2.6±1.1	0.7536	2.7±1.3	2.5±1.1	0.2926	2.7±1.2	2.6±1.2	0.252
Physical education	3.3 ±1.1	3.2±1.3	0.7555	3.7±1.0	4.0±1.2	0.1644	3.5±1.1	3.6±1.3	0.4712
Recesses	2.12±0.9	2.2±1.1	0.6879	2.9±1.4	2.4±1.3	0.0003*	2.5±1.2	2.3±1.2	0.1036
Lunch	2.23±1	2.1±1.2	0.4009	2.7±1.3	2.6±1.3	0.0575	2.5±1.2	2.3±1.3	0.2244
After school	2.2±1.3	2.14±1.3	0.7916	2.5±1.3	2.5±1.3	0.2801	2.3±1.3	2.6±1.3	0.1977
Evenings	1.7±1.1	1.9±1.1	0.2797	2.0±1.3	2.6±1.2	0.1627	1.8±1.2	2.2±1.2	0.0107*
Weekend	2.1±1.2	2.1±1.2	0.9018	2.5±1.2	2.8±1.4	0.3366	2.3±1.2	2.4±1.3	0.3929
Statement	1.8±0.9	2.1±1.1	0.2639	2.4±1.1	2.7±1.3	0.1639	2.1±1.1	2.4±1.2	0.0696
Weekly activity	2.3±0.9	2.3±1.6	0.9028	2.8±0.9	3.0±1.1	0.2262	2.6±0.9	2.7±1.1	0.5015

*: Statistically significant. BMI: Body mass index; SDS: Standard deviation scores; PAQ-C: Phsyical activity questionnaire for older children

high reliability. In this study, a KMO value of 0.803 was reported, indicating that the items were adequately correlated for factor analysis. All features of the subjects (age, BMI, and PAQ-C) were presented in Table 1.

DISCUSSION

Childhood obesity has become a major public health concern worldwide, with rates rising dramatically in recent decades. While many complex factors contribute to this epidemic, one of the primary drivers is physical inactivity among children and youth. A growing body of academic research has highlighted the strong association between sedentary behaviors and excess weight gain in children.

Paduano et al.[5] demonstrated the relationship between inactivity, overweight/obesity, and dietary habits among first-year primary school children in Italy. Similarly, Erginöz et al.[6] found that only 20% of Turkish school children aged 11–15 participated in an adequate amount of PA. Studies indicate that children who engage in more PA are less likely to be overweight or obese, while those who spend more time on digital devices are at a higher risk.[7,8] This underscores the importance of promoting PA and limiting sedentary behaviors to combat childhood obesity. Interventions aimed at increasing PA levels, especially among overweight and obese children, are critical to improving their overall health and well-being. As the research indicates, reversing the trend of physical inactivity is key to helping children maintain a healthy weight and avoid the many health risks associated with childhood obesity.

The PAQ-C is a 7-day recall instrument that asks children to report their MVPA levels over the past week. The questionnaire consists of 10 items, with 9 items used to calculate activity scores and the 10th item assessing whether the child engaged in normal activity despite being sick or having some other interference. The PAQ-C has been tested for reliability and validity in various studies conducted in Canada, the United States, Iran, the Netherlands, the United Kingdom, China, and Spain.[3,9–12] Erdim et al.[13] validated the PAQ-C for Turkish children, finding it to be a valid and reliable instrument for assessing MVPA levels in this population, with a Cronbach's alpha coefficient of 0.77 and a test-retest reliability of 0.91. Our study found Cronbach's α for the overall sample to be 0.85, aligning with these reported studies, indicating that the item/scale relationship of the PAQ-C is acceptable for obese children.

This suggests that the questionnaire can consistently measure MVPA levels over time. Additionally, the PAQ-C has been shown to have high levels of construct validity, with factor analysis revealing a two-factor structure that distinguishes between MVPA levels at school and in extracurricular activities. A PAQ-C score of 2.9 or higher for boys and 2.7 or higher for girls per question is considered to meet the MVPA guidelines.[1] Beyond its reliability and validity, the PAQ-C offers practical advantages in its ease of administration and interpretability. Its straightforward format and self-report nature make it accessible for use in both research and clinical settings, facilitating the systematic

assessment of children's PA behaviors. Moreover, the inclusion of items assessing potential disruptions to activity, such as illness, enhances the questionnaire's sensitivity to fluctuations in activity patterns and ensures a comprehensive evaluation of children's activity levels.

Despite its strengths, the PAQ-C is not without limitations. Like all self-report measures, it is subject to potential biases, including recall bias and social desirability bias, which may impact the accuracy of reported activity levels. Additionally, while the PAQ-C provides valuable insights into overall MVPA levels, it may not capture the full spectrum of PA behaviors, such as sedentary behaviors or activities of daily living. Supplementing the PAQ-C with objective measures, such as accelerometry, can address these limitations and provide a more comprehensive assessment of children's activity behaviors.

In our study, PAQ-C total scores, sum scores, and specific activities showed some variations, but the overall differences in quality-of-life metrics are noteworthy. Our findings align with similar studies in the literature, showing that obese children generally have lower levels of PA, which negatively impacts their quality of life. For instance, in the category of recess activities, obese children scored significantly lower than their non-obese peers (p=0.0003). Despite the absence of significant differences in other activities (lunch, after school, evenings, weekends), the general trend shows lower scores for obese children. However, these differences did not reach statistical significance.

Several factors may account for this finding. Firstly, both groups likely have comparable access to opportunities for PA, including participation in structured sports programs and utilization of community recreational facilities, fostering similar overall activity levels. Secondly, cultural and social norms within the shared demographic context may influence activity preferences and participation patterns, leading to convergence in observed activity scores despite weight status differences. Additionally, obese children may selectively engage in activities perceived as more manageable or enjoyable, which could mitigate differences in overall activity levels between the two groups. Methodological limitations, such as sample size constraints, may also have contributed to the lack of statistical significance. Furthermore, psychosocial factors, including familial support and peer dynamics, may play a role in shaping activity behaviors and perceptions across both groups. Finally, the absence of significant differences in activity scores despite weight status distinctions underscores the complex interplay of individual, social, and environmental factors in shaping children's PA experiences.

CONCLUSION

In conclusion, the PAQ-C is a reliable and valid instrument for assessing MVPA levels in obese children. The questionnaire has been adapted and validated in several cultures. The PAQ-C has several potential applications in promoting PA among children, including assessing MVPA levels, evaluating the effectiveness of PA interventions, and comparing MVPA levels across different cultures and populations. By using the PAQ-C, researchers, and practitioners can gain a better understanding of MVPA levels in children and develop targeted interventions aimed at increasing PA levels and improving overall health and well-being.

Disclosures

Ethics Committee Approval: The study was approved by the Kayseri Training and Research Hospital Non-interventional Clinical Research Ethics Committee (No: 96, Date: 21/05/2024).

Authorship Contributions: Concept: T.K., M.E.; Design: T.K., M.E.; Supervision: T.K.; Data Collection or Processing: T.K., M.E.; Analysis or Interpretation: T.K., M.E.; Literature Search: M.E.; Writing: M.E., T.K.; Critical review: T.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Informed Consent: Written informed consent was obtained from all patients.

Use of AI for Writing Assistance: No AI technologies utilized.

Financial Disclosure: The authors declared that this study received no financial support.

Peer-review: Externally peer reviewed.

REFERENCES

1. Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. Int J Behav Nutr Phys Act 2010;7:40. [CrossRef]

2. Benítez-Porres J, Alvero-Cruz JR, Sardinha LB, López-Fernández I, Carnero EA. Cut-off values for classifying active children and adolescentes using the Physical Activity Questionnaire: PAQ-C and PAQ-ACut-off values for classifying active children and adolescents using the Physical Activity Questionnaire: PAQ-C and PAQ-A. Nutr Hosp 2016;33:564. [CrossRef]

3. Benítez-Porres J, López-Fernández I, Raya JF, Álvarez Carnero S, Alvero-Cruz JR, Álvarez Carnero E. Reliability and validity of the PAQ-C questionnaire to assess physical activity in children. J Sch Health 2016;86:677–85. [CrossRef]

4. Cuberek R, Janíková M, Dygrýn J. Adaptation and validation of the Physical Activity Questionnaire for Older Children (PAQ-C) among Czech children. PLoS One 2021;16:e0245256. [CrossRef]

5. Paduano S, Greco A, Borsari L, Salvia C, Tancredi S, Pinca J, Midili S, Tripodi A, Borella P, Marchesi I. Physical and sedentary activities and childhood overweight/obesity: A cross-sectional study among first-year children of primary schools in Modena, Italy. Int J Environ Res Public Health 2021;18:3221. [CrossRef]

6. Erginöz E, Alikaşifoğlu M, Ercan O, Uysal Ö, Ekici B, Deniz Kaymak A, et al. Relationship between physical activity level and demographic characteristics, eating habits and sedentary behaviors of Turkish school children aged 11, 13 and 15. Turk Arch Ped 2011;46:12–9. [CrossRef]

7. Koca SB, Paketçi A, Büyükyılmaz G. The relationship between internet usage style and internet addiction and food addiction in obese children compared to healthy children. Turk Arch Pediatr 2023;58:205–11. [CrossRef]

8. Robinson TN, Banda JA, Hale L, et al. Screen Media Exposure and Obesity in Children and Adolescents. Pediatrics. 2017;140(Suppl 2):97–101.

9. Crocker PR, Bailey DA, Faulkner RA, Kowalski KC, McGrath R. Measuring general levels of physical activity: preliminary evidence for the Physical Activity Questionnaire for Older Children. Med Sci Sports Exerc 1997;29:1344–9 [CrossRef]

10. Moore JB, Hanes JC Jr, Barbeau P, Gutin B, Treviño RP, Yin Z. Validation of the Physical Activity Questionnaire for Older Children in children of different races. Pediatr Exerc Sci 2007;19:6–19. [CrossRef]

11. Janz KF, Lutuchy EM, Wenthe P, Levy SM. Measuring activity in children and adolescents using self-report: PAQ-C and PAQ-A. Med Sci Sports Exerc 2008;40:767–72. [CrossRef]

12. Wang JJ, Baranowski T, Lau WP, Chen TA, Pitkethly AJ. Validation of the physical activity questionnaire for older Children (PAQ-C) among Chinese children. Biomed Environ Sci 2016;29:177–86.

13. Erdim L, Ergün A, Kuğuoğlu S. Reliability and validity of the Turkish version of the Physical Activity Questionnaire for Older Children (PAQ-C). Turk J Med Sci 2019;49:162–9. [CrossRef]