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Prevalence of sufficient levels of physical activity in adolescents: comparison between the measure obtained using simplified and detailed questionnaires

Prevalência de níveis suficientes de atividade física em adolescentes: comparação entre a medida obtida de um questionário simplificado e a de um detalhado

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Abstract – This study aimed was to compare the prevalence of sufficient levels of physical activity produced by a measure of the simplified questionnaire compared to a detailed questionnaire and analyze the concordances between these measures in adolescents. This is cross-sectional study with 2,859 adolescents high school students (57.8% female, 14-19 years old), from the city of João Pessoa (PB), Northeast, Brazil. Physical activity was measured by two questionnaires: a simplified instrument, containing a single question and a detailed questionnaire. Adolescents engaging in physical activity ≥300 minutes/week were classified as sufficiently physically active. Agreement between the two measures was evaluated by the Kappa statistic (k) and sensitivity and specificity measures using the results of the detailed questionnaire as reference. The prevalence of adequate levels of physical activity was lower in the simplified questionnaire (20.1%; 95%CI: 18.6-21.6) compared to the detailed questionnaire (50.2%; 95%CI: 48.4-52.7). Inter-questionnaire agreement was slight (almost all with k<0.30). Sensitivity of the simplified questionnaire was low (from 26.4%, 95%CI: 22.9-30.0; to 40.9%, 95%CI: 37.0-45.0), and specificity was high (from 92.3%, 95%CI: 86.9-96.0; to 94.3%, 95%CI: 92.0-96.1). Conclusions: the agreement between the prevalence of sufficient levels of physical activity measured by a simplified and detailed questionnaire was low. Simplified questionnaires should be used with caution because they can underestimate the prevalence of levels of physical activity in adolescents.

Key words: Adolescent; Motor activity; Sensitivity; Specificity.

Resumo – *O estudo teve como objetivo comparar as prevalências de níveis suficientes de atividade física produzida pela medida de um questionário simplificado e a de outro detalhado, e analisar a concordâncias entre estas medidas, em adolescentes. Estudo transversal conduzido com 2.859 adolescentes do ensino médio com idade entre 14 e 19 anos (57,8% do sexo feminino), João Pessoa (PB), Nordeste do Brasil.. Dados sobre atividade física foram obtidos utilizando um questionário simplificado e outro detalhado. Foram classificados como suficientemente ativos adolescentes com prática de atividade física ≥300 minutos/semana. A concordância entre as medidas dos questionários foi avaliada pelo índice Kappa (k) e medidas de sensibilidade e especificidade, tendo como referência a medida do questionário detalhado. A prevalência de níveis suficientes de prática atividade física do questionário simplificado (20,1%, IC95%: 18,6-21,6) foi inferior a do questionário detalhado (50,2%, IC95%: 48,4-52,7). A concordância entre as medidas dos questionários foi leve (k variando de 0,21 a 0,34). A sensibilidade da medida de atividade física do questionário simplificado foi baixa (variou de 26,4%, IC95%: 22,9-30,0; a 40,9%, IC95%: 37,0-45,0) e a especificidade alta (variou de 92,3%, IC95%: 86,9-96,0; a 94,3%, IC95%: 92,0-96,1). Concluiu-se que as prevalências de níveis suficientes de prática de atividade física foram mais baixas na medida simplificada comparada a detalhada e a concordância entre elas foi leve. É preciso ter cautela na utilização de questionários simplificados e na comparação dos níveis de atividade física produzidas por essa medida e a de questionários detalhados.*

Palavras-chave: *Adolescência; Atividade motora; Especificidade; Sensibilidade.*

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INTRODUCTION

In epidemiological studies with large samples, measuring levels of physical activity has been mainly achieved through the use of questionnaires due to their low cost, high applicability and the possibility of adaptation to the study objectives and characteristics of the target population[1,2].

Several questionnaires to measure physical activity were developed and tested in adolescents[2]. The selection of a physical activity questionnaire, among those that are available, depends on several factors such as availability of human and financial resources, measure temporality (for example, last day, week, month or last three months, year, typical week), domains to be measured, method of application, purposes and characteristics of the target population, instrument size, way to express the final result (score, minutes / week MET / minutes per day or week, kcal / kg / day), reproducibility and validity levels[1].

In population surveys on health, simplified questionnaires have often been used due to the limited number of questions and easy implementation, requiring less human and financial resources, and the possibility of being easily incorporated into the data collection instrument[3-5]. In general, these instruments are composed of one or two questions related to physical activity practice recommendations for a given population group[3-6]. It allows identifying people who meet or not a certain level of practice[4,5,7-9].

In 2001, Prochaska et al.[5] validated a simplified questionnaire to assess physical activity in adolescents (Patient-Centered Assessment and Counseling for Exercise Plus Nutrition - PACE +). This questionnaire consists of a question directed to identify how many days of the week adolescents practiced physical activities of moderate / vigorous intensity that together totaled at least 60 minutes / session per day, considering a typical week and the last seven days. This instrument showed high reproducibility levels and moderate validity[5]. In Brazil, it has been adapted and tested in young people in the cities of Recife (PE) and Florianópolis (SC) and showed high levels of reproducibility and low of validity [4].

The PACE + questionnaire and its adaptations have been applied with young people in various countries[1,8,9], including Brazil[7,10-12]. It is believed that simplified instruments underestimate the prevalence of sufficient levels of physical activity in adolescents due to their physical activity pattern, characterized by the involvement in different activities, with significant variations in frequency, intensity and duration[13,14]. It is argued that these instruments are less sensitive to short-duration and sporadic physical activities, and also require that the intensity, frequency and duration measures are summarized in a single response[13,14].

Marked discrepancies in the prevalence of levels of physical activity have been identified between simplified and detailed questionnaires in studies with adults[3,15], but this analysis has not been conducted in adolescents. In general, lower prevalence of physical activity practice has been identified in simplified questionnaires compared to detailed questionnaires.

Therefore, it remains unknown whether this instrument underestimates or overestimates the prevalence of sufficient levels of physical activity compared to the detailed questionnaire. In this sense, the aim of this study was to compare the prevalence of sufficient levels of physical activity produced by the measure of a simplified questionnaire compared to a detailed questionnaire and analyze the concordances between these measures in adolescents.

METHODOLOGICAL PROCEDURES

This study is part of a broader survey with adolescents aged 14-19 years from public and private high schools in the city of João Pessoa (PB) aimed at determining the level of physical activity and analyze associated factors (individual and environment) in adolescents[16].

The following parameters were considered for the sample size calculation: target population estimated at 32,112 high school students, estimated prevalence of 50% (sufficient levels of physical activity); maximum acceptable error of three percentage points; confidence level of 95%; design effect equal to two points (deff = 2); 30% increment for losses and refusals, resulting in a sample of 2,686 students.

The clustering sampling was obtained in two stages: systematic selection of 30 schools, with probability proportional to size and proportionally distributed according to type of school (public and private) and municipal region (north, south, east, west); random selection of 135 classes proportionally distributed per shift (day and night) and grade (1st, 2nd and 3rd grades of high school). Detailed information on the sample selection process has been previously described[16].

Data collection was carried out between May and September 2009 by a previously trained team through a pre-tested unidentified questionnaire filled by students in classroom, at the regular time, following previous instructions provided by the collection team.

To characterize the sample, the following information was measured: sex, age, economic class and paternal and maternal education. Economic class was established as proposed by the Brazilian Association of Research Companies[17], gathering individuals into classes A1, A2, B1, B2, C1, C2, D and E. Paternal and maternal education was categorized as follows: incomplete primary education, complete primary education, complete high school, complete higher education.

Physical activity measurement was performed by two questionnaires, a simplified questionnaire and a detailed questionnaire, applied on the same day and by the same data collection team. The simplified questionnaire (adapted version of PACE +) consisted of a single question: "In the last week, on how many days did you practice physical activities of moderate / vigorous intensity that together totaled at least 60 minutes per day?", with scale response ranging from none to seven days per week[4]. Adolescents were asked to consider all physical activities throughout the day (leisure, commuting, school, work, home), lasting at least 10 minutes, performed

continuously or intermittently in week previous to data collection (last week).

The detailed questionnaire applied in this study was QAFA - Physical Activity Questionnaire for Adolescents, validated in adolescents from Northeastern Brazil (Intraclass Correlation Coefficient - ICC = 0.88; CI 95%: 0.84-0.91) and validity (Spearman's rho = 0.62, p <0.001 compared to the measure of four 24-hour physical activity recalls)[18]. Adolescents reported the frequency (days / week) and duration (minutes / day) of activities carried out for at least 10 minutes in the week before data collection (last week). The level of physical activity was estimated by the sum of the products of frequencies by the respective durations, resulting in a score in minutes per week of physical activity.

Adolescents who reported physical activities of moderate to vigorous intensities that together totaled at least 60 minutes a day, five or more days per week (5 days or more per week x 60 minutes or more per day = 300 minutes or more per week of physical activity) for the simplified questionnaire, and those with physical activity score ^{3}300 minutes / week for the detailed questionnaire were classified as sufficiently physically active. The others were classified as insufficiently active[19].

In analyzing the data, the descriptive statistics procedures, including distribution by absolute and relative frequency, mean, standard deviation and confidence intervals (CI 95%) were initially applied. The differences in the prevalence of sufficient levels of physical activity between questionnaires were evaluated by the intersection of CI 95%. To evaluate the agreement between measures obtained by the simplified questionnaire and detailed questionnaire to correctly classify adolescents as the level of physical activity (sufficiently physically active vs insufficiently physically active), the Kappa index was used (values up to 0.19 were classified as poor; from 0.20 to 0.39, slight agreement; from 0.40 to 0.59, moderate agreement; from 0.60 to 0.79, substantial agreement and values above 0.80, almost perfect[20]) and sensitivity and specificity measures, adopting as reference the measured obtained with the detailed questionnaire[21].

Statistical analyses were performed using Stata 13 software. The sample selection process (option "svyset" of this software) was considered in the descriptive analysis and Kappa index determination. The significance level adopted was less than 5%.

The project was approved by the Ethics Committee on Human Research of the Center for Health Sciences, Federal University of Paraíba (protocol no. 0062/2009). All adolescents under 18 years who participated in the survey were authorized by parents or guardians.

RESULTS

Of the 3,477 adolescents invited to participate in the study, 70 refused and 187 were losses (adolescents absent from school on three days of data collection). Among the 3,220 who responded the questionnaire, 361 were excluded (losses and refusals accounted for 17.8% of cases).

The final sample consisted of 2,859 adolescents, average age of 16.5 years; (standard deviation of 1.2 years); 57.8% female, most aged 16-19 year (89.3%), intermediate (C) -low (D,E) economic class (54.2%) and children of parents with at least complete high school (father: 50.1%, mother: 51.1%) - Table 1.

Table 1. Sociodemographic characteristics of the sample, João Pessoa (PB), 2009

Variable	n	%
Sex		
Male	1,206	42.2
Female	1,653	57.8
Age group (years)		
14-15	1,128	39.3
16-17	1,438	50.0
18-19	308	10.7
Economic class		
A	237	9.3
B	924	36.5
C	1,167	46.1
D,E	205	8.1
Paternal education		
Incomplete elementary school	877	31.5
Complete elementary school	514	18.5
Complete high school	895	32.2
Complete higher education	497	17.8
Maternal education		
Incomplete elementary school	853	30.0
Complete elementary school	538	18.9
Complete high school	906	31.8
Complete higher education	550	19.3

The prevalence of sufficient levels of physical activity produced by measuring the simplified questionnaire was statistically lower (20.1%, CI 95%: 18.6-21.6) compared to the detailed questionnaire (50.2%, CI 95%: 48.4-52.7). These differences were greater in male (28.3% vs. 66.3%) and younger adolescents (14-15 years: 18.9% vs. 51.2%) and belonging to economic classes C / D / E (20.0% vs. 50%), respectively compared to female, older adolescents (16-19 years) belonging to economic classes A / B (Table 2).

The agreement between measurements of physical activity using the simplified and detailed questionnaire was slight, with most Kappa values below 0.30, except for adolescents of high economic class (classes A / B), whose value was 0.34 (CI 95%: 0.29-0.38), also classified as slight.

The sensitivity of the measurement using the simplified questionnaire was low (33.7%, CI 95%: 31.3-36.3), and slightly lower in females (26.4%, CI 95%: 22.9-30.0) in younger adolescents (14-15 years: 31.0%, CI 95%: 27.2-35.0) and economic class C / D / E (27.2%, CI 95%: 23.8-30.8). Specificity was high (93.6%, CI 95%: 92.2-94.8), with similar values for all subgroups (Table 3).

Table 2. Prevalence of sufficient levels of physical activity produced by measurements obtained using the simplified and detailed questionnaires according to sex, age group and economic class of adolescents, João Pessoa (PB), 2009

Variable	Prevalence of sufficient levels of physical activity (≥300minutes/week)					
	Measure of the simplified questionnaire			Measure of the detailed questionnaire		
	n	%	CI 95%	n	%	CI 95%
All	569	20.1	18.6-21.6	1,444	50.2	48.4-52.7
Sex						
Male	335	28.3	25.7-30.9	800	66.3	63.7-69.0
Female	230	14.1	12.4-15.8	636	38.5	36.1-40.8
Age group (years)						
14-15	210	18.9	16.6-21.1	578	51.2	48.3-54.1
16-17	295	20.8	18.7-22.9	717	49.9	47.3-52.4
18-19	64	21.1	16.5-25.7	149	48.4	42.8-53.9
Economic class*						
A/B	279	24.3	21.9-26.8	616	52.7	50.0-55.7
C/D/E	26	20.0	18.6-21.6	670	50.0	48.2-51.9

* Grouped into two levels for this analysis.

Table 3. Kappa index, sensitivity and specificity for prevalence of sufficient levels of physical activity determined using simplified and detailed questionnaire* according to sex, age and economic class of adolescents, João Pessoa (PB) 2009

Variables	n	Kappa	CI 95%	Sensitivity	CI 95%	Specificity	CI 95%
All	2,859	0.27	0.21-0.30	33.7	31.3-36.3	93.6	92.2-94.8
Sex							
Male	1,206	0.26	0.20-0.32	39.6	36.1-43.1	93.7	90.9-95.9
Female	1,653	0.23	0.16-0.27	26.4	22.9-30.0	93.6	91.9-95.0
Age group (years)							
14-15	1,128	0.24	0.18-0.28	31.0	27.2-35.0	93.8	91.4-95.6
16-17	1,438	0.29	0.21-0.37	35.6	32.1-39.3	93.7	91.7-95.4
18-19	308	0.28	0.21-0.38	35.4	27.7-43.7	92.3	86.9-96.0
Economic class**							
A/B	1,161	0.34	0.29-0.38	40.9	37.0-45.0	94.3	92.0-96.1
C/D/E	1,372	0.21	0.17-0.25	27.2	23.8-30.8	93.2	91.1-95.0

* As detailed questionnaire measurement was used as reference.
** Grouped into two levels for this analysis.

DISCUSSION

The results showed that there are significant discrepancies in the prevalence of sufficient levels of physical activity estimated from the simplified and detailed questionnaires. The simplified questionnaire showed low sensitivity to identify adolescents with sufficient levels of physical activity.

The comparison of results with literature was relatively compromised because studies comparing estimates of physical activity prevalence produced by simplified and detailed questionnaires were conducted with adults[15,22]. Among the few studies that showed results with young people (14-25 years), the prevalence of sufficient levels of physical activity obtained from the measurement using the simplified questionnaire was lower compared to measurement using the detailed questionnaire[6,23]. These findings are similar to the present study.

The Health Behaviour in School-Aged Children (HBSC)[8], held every four years by the World Health Organization with adolescents aged 13-15 years from 41 countries, the Youth Risk Behavior Surveillance System (YRBSS), held every two years with a representative sample of young people in the United States[9], and the National Survey of Student's Health (PeNSE)[7], held every two years with 9th grade students from public and private elementary schools in 26 Brazilian state capitals and Federal district, are examples of investigations that have used the simplified measure of physical activity analyzed in this study.

The HBSC[8] results indicated that only 19%-28% of male adolescents and 10%-19% of female adolescents reported the practice of physical activities for 60 minutes or more per day, five or more days a week. In 2012, data from PeNSE showed that only 20.2% of students were classified as physically active (physical activities for 60 minutes or more per day, five or more days a week)[7]. However, in YRBSS[9], the prevalence of sufficient levels of physical activity using the same cutoff point as PeNSE[7] was 49.5%.

In most studies using simplified questionnaires, the prevalence of sufficient levels of physical activity was below 25% in both national[7,11], as in international studies[8,24]. In studies with the same group of adolescents that used detailed and simplified questionnaire, the prevalence of adolescents who met the recommended levels of physical activity observed using the detailed questionnaire was almost twice as that identified using the simplified questionnaire[7,11]. These findings show that the prevalence of sufficient levels of physical activity estimated from simplified questionnaires are underestimated and may vary from 10 to 30 percentage points.

In addition to the difference in the prevalence of sufficient levels of physical activity between simplified and detailed questionnaire, low agreement between them was identified, with all Kappa index values being classified as slight. Another important fact was the low sensitivity of the simplified questionnaire to estimate sufficient levels of physical activity in adolescents of this study. This is worrying, given that only three in ten adolescents with sufficient levels of physical activity identified by the detailed questionnaire were classified in a similar way by the simplified questionnaire. However, most adolescents with insufficient levels of physical activity were correctly classified by the simplified questionnaire.

Ridgers et al.[25] observed low levels of sensitivity (45.5%) and high levels of specificity (73.4%) for measurement obtained using the simplified questionnaire compared to the accelerometer (300 minutes / week). These results indicate that the simplified questionnaire proposed by Prochaska et al.[5] has low sensitivity for identifying adolescents with sufficient levels of physical activity (practice 300 minutes of physical activity per week), but has high specificity.

One explanation for the discrepancies between measurements obtained using simplified and detailed questionnaires is that most of the time, physical activity in adolescents is performed in short bouts (<10 minutes) of different intensities and with wide variations in the same day and between weekdays and weekends[13,26]. The difficulty of adolescents to

accurately inform the practice time in sporadic physical activity and, in some situations, to define what should be considered as physical activities[1,13], is another factor to be considered.

The way the physical activity score is produced in the detailed questionnaire may be another explanation for these discrepancies. In these instruments, the physical activity score is produced by multiplying the frequencies by the practice duration in each physical activity, resulting in a score in minutes per day or week. Thus, an adolescent who practiced physical activities for two days per week, 150 minutes a day, will have physical activity score of 300 minutes per week. In this case, the adolescent would be classified as sufficiently physically active. But if the same adolescent responded the simplified questionnaire analyzed in this study, he would have two days a week of practice less than 60 minutes per day, being then classified as insufficiently active. Studies with adolescents have identified low correlation between measurement obtained using accelerometers and simplified questionnaires[13,14,26], reinforcing the thesis that these questionnaires tend to underestimate the level of physical activity.

However, it is important to highlight that simplified questionnaires to measure the levels of physical activity were constructed to produce an overall measure of physical activity and are used in health surveys of the population, monitoring systems on health risk behaviors and / or as a tool used to screen levels of physical activity. However, these instruments have been used beyond the purposes for which they were designed (for example, to analyze the association between the levels of physical activity with different health outcomes, correlated factors of physical activity).

This study has some limitations that need to be considered. One was the lack of an objective measure of physical activity (accelerometry, for example) to evaluate the correlation between simplified and detailed questionnaires. However, it has important limitations: epoch size, minimum number of hours per day to define as valid day, cutoffs to define moderate and vigorous intensity activities, definition of use and non-use of equipment and number of days to compose the final measure of physical activity[27]. It was not possible to evaluate the concordance between questionnaires for adolescents who did not practice physical activities ("the so-called zeros"), as the zero in the detailed questionnaire is not having practiced physical activities in any day of the week, but in the simplified questionnaire, it is not having practiced moderate to vigorous physical activity for at least 60 minutes per day, any day of the week[5]. This study also has strengths: it used a representative sample of adolescents, the questionnaires were previously validated and applied by trained personnel following a data collection protocol, and who did not know the study hypotheses.

The prevalence of sufficient levels of physical activity was lower in the simplified measure as compared to the detailed measure, and the correlation between them was mild. We must be cautious in the use of questionnaires and comparison of levels of physical activity produced by this measure and by detailed questionnaires.

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