

Development and validation of a questionnaire measuring factors associated with physical activity in adolescents

Desenvolvimento e validação de um questionário para mensurar fatores associados à atividade física em adolescentes

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Abstract

Objectives: to develop a questionnaire to measure factors associated with physical activity (PA) in adolescents and analyze its reliability and validity.

Methods: a total of 248 adolescents from 14 to 19 years old took part in this study. The factors associated with PA measured were: attitude, self-efficacy, social support of PA and perceived environment. Cronbach's alpha (α) and intraclass correlation coefficients (ICC) were used to test reliability, and exploratory factor analysis to evaluate validity.

Results: attitude was measured as a single factor (attitude: $\alpha=0.76$, ICC=0.89); self-efficacy consisted of two factors: resources for PA ($\alpha=0.76$, ICC=0.75) and social support and motives for engaging in PA ($\alpha=0.76$, ICC=0.67); social support was measured as two factors: support for PA from friends ($\alpha=0.90$, ICC=0.89) and support for PA from parents ($\alpha=0.81$, ICC=0.91); and the environment was measured as three factors: access to and attractiveness of places to engage in PA ($\alpha=0.69$, ICC=0.82), security/safety when engaging in PA ($\alpha=0.73$, ICC=0.67), and general infrastructure of the neighborhood ($\alpha=0.70$, ICC=0.75).

Conclusions: the questionnaire exhibited satisfactory validity and reliability and can be recommended for studies investigating adolescents.

Key words *Validity of tests, Reproducibility of results, Motor activity, Questionnaires*

Resumo

Objetivos: desenvolver e analisar a fidedignidade e validade de um questionário para mensurar fatores associados à atividade física (AF) em adolescentes.

Métodos: participaram do estudo 248 adolescentes de 14 a 19 anos de idade. Os fatores associados à AF mensurados foram: atitude, autoeficácia, apoio social dos pais e dos amigos para prática de AF, ambiente percebido. O alpha de Cronbach (α) e a correlação intraclasse (CCI) foram utilizados para verificar a fidedignidade, e a análise fatorial exploratória para avaliar a validade do questionário.

Resultados: a medida de atitude continha um único fator (atitude: $\alpha=0,76$; CCI=0,89); a de autoeficácia dois fatores: recursos para prática de AF ($\alpha=0,76$; CCI=0,75), apoio social e motivos para prática de AF ($\alpha=0,75$; CCI=0,67); a de apoio social dois fatores: apoio dos amigos ($\alpha=0,90$; CCI=0,89) e dos pais ($\alpha=0,81$; CCI=0,91); a medida de ambiente três fatores: acesso e atratividade dos locais para prática de AF ($\alpha=0,69$; CCI=0,82), segurança para a prática de AF ($\alpha=0,70$; CCI=0,75) e infra-estrutura geral do bairro ($\alpha=0,73$; CCI=0,67).

Conclusão: o questionário demonstrou validade e fidedignidade (consistência interna e reprodutibilidade) satisfatórias, recomendando a sua utilização em adolescentes.

Palavras-chave *Validade dos testes, Reprodutibilidade dos resultados, Atividade física, Questionários*

Introduction

The identification of factors that may influence the participation of adolescents in physical activity, especially those that can be modified, has been a subject of interest to various researchers^{1,2} and is considered a research priority in the field of epidemiology of physical activity.¹

Interest in the subject has arisen from the fact that possible changes in levels of physical activity are not established directly. There is a need to alter one or more factors that impact physical activity for changes to occur.¹ The identification of these factors should guide the planning and development of intervention programs to increase the level of physical activity and to establish which factors should be the target of intervention and to select the best methodological intervention strategies.^{1,3,4}

It is well-documented in the literature that the participation of adolescents in physical activity is influenced by socio-demographic, biological, psychological, social and environmental factors.^{3,4} Ecological models are considered the most appropriate for studying factors associated with physical activity,⁵ as they presuppose a reciprocal interrelation between variables of multiple levels of analysis, such as the individual (attitude, self-efficacy) and the environmental (such as social support for physical activity and the characteristics of this environment).⁵

Studying factors associated with physical activity using an ecological approach requires that a great conceptual and, above all, methodological barrier be overcome. Models that apply this approach to physical activity among adults are few and far between⁵ and practically non-existent for adolescents.⁶ Therefore, the variables, their possible inter-relations and the mechanisms by which they act on physical activity have still not been firmly established for this group. Different models of analysis have already been identified in studies of adolescents.^{2,7}

Various tools are available that measure factors associated with physical activity in adolescents.⁸⁻¹¹ Most of these tools assess specific factors, such as attitude, self-efficacy, obstacles to the practice of physical activity, social support and have been tested among North American adolescents or among adolescents from a handful of European countries.^{8,9} These are lengthy questionnaires and few of them simultaneously measure individual and environmental factors.^{12,13} Those which do were designed to meet specific research objectives^{7,12} and are not applicable to other studies.

The absence of validated Brazilian tools for eval-

uating factors associated with physical activity in adolescents led to the design of a questionnaire to measure the attitude, self-efficacy, social support and perceived environmental characteristics related to the physical activity. These factors have been shown to be associated with physical activity in adolescents^{3,4} and are conducive to ecological modeling.⁵

The present study was carried out with the aim of developing a questionnaire to measure factors associated with physical activity and to assess their psychometric properties in adolescents in the Northeast of Brazil.

Methods

The tool was designed in five stages: a) selection of variables; b) selection of items or questions; c) evaluation by specialists; d) a pilot study; and e) evaluation of the psychometric properties of the tool.

Systematic revisions^{3,4} helped to identify and define factors associated with physical activity in the individual (attitude and self-efficacy) and the environment (social support for physical activity and perceived environmental characteristics) included in the questionnaire. These also helped to identify the questionnaires and scales used to measure factors associated with physical activity in adolescents.

The items containing the questions were extracted and adapted from other questionnaires or scales developed and tested for adolescents,^{2,8-10,12,14-17} which were selected by way of a process of translation and back-translation.

The first version of the questionnaire was sent to six researchers in the fields of physical education, psychology and statistics with broad experience in the design and validation of such tools, for them to assess the relevance of the items, the language and the measurement scales adopted. They were also asked to suggest the addition of other items that they deemed relevant.

Subsequently, a pilot study was carried out among school children who did not participate in the main study ($n=79$, 58% female, 14-19 years of age, attending high school, in one private and one public school). Six or eight adolescents were randomly allocated to the groups, separated by gender, with a view to investigating the following aspects of the questionnaire: language, relevance of the items, clarity and objectivity of the questions. The groups were coordinated by a trained intern following a previously established routine.

In the final stage, a cross-sectional study was carried out with adolescents aged between 14 and 19

years, from public and private schools, in the municipality of João Pessoa, in the Brazilian State of Paraíba, to evaluate the psychometric properties of the questionnaire (reliability: internal consistency and retest-retest reproducibility; factorial validity). The sample was selected in two stages: the random selection of schools (four public and two private schools); the random selection of classes (18 classes, one for each grade).

The minimum sample size was determined using an intraclass correlation coefficient greater or equal to 0.20 (reproducibility) and factor loading greater or equal to 0.40 (factorial validity), Type I error of 5%, Type II error of 20% and an additional 30% to compensate for drop-outs and refusals. This resulted in a sample of 195 subjects for the analysis of reproducibility and 260 subjects for factor analysis of questionnaire.

Data collection was carried out by a trained team (April/May-2009) of students from the Physical Education department, supervised by the researcher in charge (JCFJR). The interns received a manual containing the study protocol and conducted a pilot study, under the same conditions as the main study, as a way of standardizing data collection.

The adolescents themselves responded to the questionnaire, in their classrooms, during class time, as previously instructed by an intern. Two other interns circulated to help and clear up any doubts the adolescents may have had.

The adolescents who did not participate, either because their parents or guardians did not permit them, or because they were not in school on the day of the data collection, were considered to be losses.

To characterize the study sample, the adolescents responded to questions on demographic (sex and age) and socioeconomic aspects (schooling of mother and father [primary school incomplete, primary school completed, high school incomplete, high school completed, higher education incomplete, higher education completed], economic class, possession of material goods, number of paid servants in the household and schooling of head of household. The individuals were grouped into the following classes: A1 [highest], A2, B1, B2, C1, C2, D and E [worst]), in accordance with the categories of the Associação Brasileira das Empresas de Pesquisa (ABEP).¹⁸

The section dealing with attitude to physical activity contained five items: two to measure affective or emotional aspects and three to measure the instrumental aspects of attitude. A four-point semantic differential scale was used, with the following binary pairs of adjectives: safe-unsafe,

fun-boring, important-trivial, healthy-harmful, good-bad.¹⁹

Self-efficacy was measured using 12 items^{8,10,17} with a *Likert* of four points, varying from 1 "I strongly disagree" to 4 "I strongly agree". The items were written in such a way as to incorporate the obstacles to the practice of physical activity frequently reported by the adolescents.²⁰

The social support scale had 12 items, covering different kinds of social support for physical activity - instrumental or direct, psychological, instructional - which the adolescents could receive from parents or friends.^{12,14} Based on a typical or normal week, the adolescents reported the frequency (never, rarely, often, always) with which parents and friends encouraged, engaged in, helped them, commented on, talked about or joined them in engaging in physical activity and transported them or provided transport to the locations where they engaged in physical activity.

The environment scale contained items measuring the following aspects of the neighborhood: a) security; b) infra-structure; c) access and appeal of the location for engaging in physical activity.^{2,9,12,15,16} In responding to these questions the adolescents were told to consider a distance of up to ten minutes' walk from their homes.¹⁵ A four-point *Likert* scale was also used (1 "I strongly disagree" to 4 "I strongly agree").

The validity of the construct was analyzed using exploratory factor analysis to establish the number of factors that should be extracted. For this, the criterion suggested by Kaiser was used:²¹ factors were retained if their self-values were equal to or greater than one. Then, orthogonal varimax rotation was performed.²¹ Items with a factor loading equal to or greater than 0.4 were considered relevant.

The adequacy of the variable items for factor analysis was assessed using the Kaiser Meyer-Olkin (KMO) index, Bartlett's Sphericity Test (BST) and the measure of sampling adequacy (MSA). KMO and MSA values were considered satisfactory if they were ≥ 0.60 and BST with a level of statistical significance of $p < 0.05$.²¹

Reliability was examined using analytical procedures to determine test-retest reproducibility and internal consistency. The consistency of the scales or sub-scales was established using Cronbach's alpha (α). The α value was also estimated with each item excluded. The data used were those from the first application of the questionnaire.

Reproducibility was estimated using the repeated measurements method (test-retest), with an interval of a week between the two tests. When the question-

naire was first applied, the adolescents received an envelope containing two copies of the questionnaire, both with the same bar-code. The adolescent took out one of the copies, sealed the envelope and returned it to the intern responsible for the questionnaire. When applied the second time, the adolescent received the envelope with his or her name on it, took off the label and filled in the copy of the questionnaire, following the same instructions as the first time, provided by the same intern. The scores for each item, sub-scale and total scale were compared for the two applications of the questionnaire using the intra-class correlation coefficient (ICC). Overall scores and scores on each section were calculated, considering only those who responded to all the items for the respective factors. The sum of the scores attributed to each response to the items (numbered 1 to 4) was calculated, inverting the scale in the case of responses to items where the higher number indicated an aspect less favorable to physical activity.

The data were entered in duplicate into the EpiData 3.1, with automatic checking for consistency and breadth of values. The “validate double entry” was used to identify typing errors, which were subsequently corrected by consulting the original questionnaires.

Statistical analysis was carried out using the Stata 10.1 program. Prior to analysis, a “map” of “impossible” or “improbable” combinations of results was drawn up using the same program and the data were reviewed according to these parameters. A level of significance of 5% was adopted for two-tailed tests.

The study was approved by the Ethics Committee for Research Involving Human Beings of the Federal University of Paraíba, as part of a more broad ranging research project “Levels of physical activity and associated factors in school-age adolescents in the city of João Pessoa, PB: an ecological approach”. All adolescents aged under 18 received permission from their parents or guardians to take part in the study.

Results

Initially, 336 adolescents were selected. Of these, 14 did not agree to participate in the study and two were not given permission by their parents or guardians. The losses (n=43: absent from school when the second questionnaire was applied) and excluded (n=29: aged <14 or >9 years) totaled 72 adolescents. The final sample comprised 248 adolescents aged between 14 and 19 years. There were no statistically

significant differences for the variables analyzed between those who responded twice to the questionnaire and those who only responded the first time ($p>0.05$). Most of the adolescents studied were female (55.6%), studied in State public schools (68.1%) and were members of the middle (Class C: 44.0%) or low-income (Classes D/E: 9.1%) classes, as shown in Table 1.

Bartlett’s sphericity test, for all the questionnaire variables (attitude, self-efficacy, social support and perceived environment), rejected the null hypothesis that the correlation matrix for the data was one of identity ($p<0.001$). The results for the KMO and MSA tests were all higher than 0.60, indicating that the correlation matrix was highly appropriate for exploratory factor analysis.

Table 2 presents the results of the exploratory factor analysis of the questionnaire. The results of the factor analysis showed that the attitude measurement was a single factor, with five items, all with a factor loading greater than 0.60. The proportion of total explained variance was 51.6%.

In the case of self-efficacy with regard to physical activity, two factors were extracted: support and reasons for engaging in physical activity (six items) and resources for engaging in physical activity (four items). The proportion of explained variation for each factor was 37.7% and 13.5%, respectively. Two items were excluded for having a low factor loading: lack of time (0.34) and adverse climate (0.30). Most of the items had a factor loading ≥ 0.60 .

In the case of social support two factors were identified: the support of friends with regard to physical activity, explaining 41.5% of the total variance, and the support of parents, explaining 19.2% of the total variance, each with six items. The factor loadings were almost all greater than 0.70.

For the perceived environment three factors were identified: access and the appeal of the locations for physical activity (seven items), safety when engaging in physical activity (four items), structure and general state of maintenance of neighborhood (four items). The proportion of variance explained by each factor was 19.4%, 14.1% and 10.2%, respectively. One item was excluded from scale for having a low factor loading (<0.30 , my neighborhood is pleasant).

Table 3 shows the results of the reliability analysis (internal consistency and test-retest reproducibility) for the variables covered by the questionnaire. The internal consistency of the scales contained in the questionnaire was acceptable ($\alpha<0.70$), with Cronbach’s alpha varying from 0.75

Table 1

Characteristics of the sample.

Variable	N	%
Gender		
Male	110	44.4
Female	138	55.6
Age (years)		
14-15	125	50.4
16-19	123	49.6
School		
Public	169	68.1
Private	79	31.9
Level of schooling of parents		
Primary school incomplete	73	30.4
High school incomplete	51	21.2
High School completed	75	31.3
Higher Education completed	41	17.1
Level of schooling of mother		
Primary school incomplete	63	25.5
High school incomplete	56	22.7
High school completed	85	34.4
Higher education completed	43	17.4
Economic class*		
A1/A2 (best)	16	6.8
B1/B2	93	40.1
C1/C2	102	44.0
D/E (worst)	21	9.1

*Variable with the largest number of losses, n= 16 (6.5%).

(attitude) to 0.87 (social support). The levels of reproducibility for the overall score and factors or sections were equal to or greater than 0.70 for all the variables, with the exception of perceived environ-

ment, in the score for safety when engaging in physical activity (ICC=0.67) and self-efficacy, in the score relating to resources relating to physical activity (ICC=0.67).

Table 2

Exploratory factor analysis for measurement of variables relating to the individual and the environment.

Attitude regarding engaging in physical activity	Factor 1	Factor 2	Factor 3
Engaging in physical activity is unimportant/important	0.72	-	-
Engaging in physical activity is unsafe/safe	0.63	-	-
Engaging in physical activity is bad/good	0.80	-	-
Engaging in physical activity is harmful/healthy	0.68	-	-
Engaging in physical activity é boring/fun	0.75	-	-
Number of items	5	-	-
% of variance explained	51.6	-	-
Kaiser Meyer-Olkin Index	0.75	-	-
Bartlett's test	<0.01	-	-
Perception of self-efficacy regarding engaging in physical activity			
Social support and reasons for engaging in physical activity			
Tiredness, stress	0.66	-	-
Other interesting things to do	0.70	-	-
Lack of company	0.55	-	-
Invited to do other things by friends	0.67	-	-
Staying at home to watch TV, play video-games, use the computer	0.64	-	-
Demotivated, don't feel like it	0.69	-	-
Resources for engaging in physical activity			
Fees or monthly charges for engaging in physical activity	-	0.78	-
Not being able to engage in physical activity	-	0.70	-
Lack of places to engage in physical activity near home	-	0.73	-
Lack of instruction	-	0.71	-
Number of items	6	4	-
% of variance explained	37.7	13.5	-
% of total variance explained	-	51.2	-
Kaiser Meyer-Olkin Index	-	0.85	-
Bartlett's test	-	<0.001	-
Social support for physical activity			
Support of friends			
Encouraging you to engage in physical activity	0.83	-	-
Engaging in physical activity with you	0.83	-	-
Inviting you to engage in physical activity with them	0.84	-	-
Watching you engage in physical activity	0.82	-	-
Commenting positively on your performance when engaging in physical activity	0.78	-	-
Talking with you about physical activity	0.74	-	-
Support of parents			
Encouraging you to engage in physical activity	-	0.73	-
Engaging in physical activity with you	-	0.76	-
Providing or arranging transport	-	0.63	-
Watching you engage in physical activity	-	0.73	-
Commenting positively on your performance when engaging in physical activity	-	0.74	-
Talking with you about physical activity	-	0.69	-
Number of items	6	6	-
% of variance explained	41.5	19.2	-
% of total variance explained	-	51.9	-
Kaiser Meyer-Olkin Index	-	0.87	-
Bartlett's test	-	<0.001	-

continues

Table 2

conclusion

Exploratory factor analysis for measurement of variables relating to the individual and the environment.

Attitude regarding engaging in physical activity	Factor 1	Factor 2	Factor 3
Community environment regarding engaging in physical activity			
Access to and appeal of locations for engaging in physical activity			
Existence of cycle paths	0.60	-	-
Seeing other adolescents engaging in physical activity	0.55	-	-
Existence of places for engaging in physical activity	0.71	-	-
Distance of places for engaging in physical activity	0.43	-	-
Appearance of neighborhood	0.61	-	-
Existence of places you like to visit	0.61	-	-
Safety when engaging in physical activity			
Road safety for walking or running	-	0.75	-
Road safety for cycling	-	0.73	-
Security of places designed for physical activity		0.65	
Security of neighborhood		0.46	
General structure and maintenance of neighborhood			
Existence of sidewalks	-	-	0.52
Condition of sidewalks	-	-	0.77
Structure of places for engaging in physical activity	-	-	0.46
Pollution	-	-	0.73
Number of items	6	4	4
% of variance explained	19.4	14.1	10.2
% of total variance explained	-	-	43.8
Kaiser Meyer-Olkin Index	-	-	0.83
Bartlett's test	-	-	<0.001

Table 3

Reliability (internal consistency and test-retest reproducibility) of variables relating to the subject and the environment.

Variables	Cronbach's alpha	ICC	CI95%
Attitude regarding physical activity			
unimportant/important	-	0.64	0.54-0.72
unsafe/safe	-	0.67	0.57-0.74
bad/good	-	0.77	0.70-0.82
harmful/healthy	-	0.64	0.54-0.72
boring/fun	-	0.86	0.81-0.88
Score for attitude	0.76	0.89	0.86-0.92
Percepção de self-efficacy para a prática de physical activity			
Social support and reasons for engaging in physical activity			
Tiredness, stress	-	0.53	0.39-0.63
Other interesting things to do	-	0.57	0.44-0.67
Lack of company	-	0.66	0.56-0.74
Invited to do other things by friends	-	0.54	0.40-0.64
Staying at home to watch TV, play video-games, use the computer	-	0.60	0.49-0.69
Demotivated, don't feel like it	-	0.60	0.47-0.68

continues

Table 3

conclusion

Reliability (internal consistency and test-retest reproducibility) of variables relating to the subject and the environment.

Variables	Cronbach's alpha	ICC	CI95%
Score for social support and reasons for engaging in physical activity	0.76	0.75	0.68-0.81
Resources for engaging in physical activity			
Fees or monthly charges for engaging in physical activity	-	0.55	0.50-0.69
Not being able to engage in physical activity	-	0.61	0.50-0.70
Lack of places to engage in physical activity near home	-	0.53	0.39-0.63
Lack of instruction	-	0.50	0.46-0.57
Score for resources for engaging in physical activity	0.75	0.67	0.58-0.75
Overall score for self-efficacy	0.81	0.78	0.71-0.83
Social support for engaging in physical activity			
Support of friends			
Encouraging you to engage in physical activity	-	0.77	0.71-0.82
Engaging in physical activity with you	-	0.77	0.71-0.82
Inviting you to engage in physical activity with them	-	0.86	0.82-0.89
Watching you engage in physical activity	-	0.73	0.65-0.79
Commenting positively on your performance when engaging in physical activity	-	0.81	0.76-0.85
Talking with you about physical activity	-	0.80	0.74-0.84
Score for social support from friends	0.90	0.89	0.87-0.92
Support of parents			
Encouraging you to engage in physical activity	-	0.82	0.77-0.86
Engaging in physical activity with you	-	0.83	0.78-0.87
Providing or arranging transport	-	0.76	0.69-0.81
Watching you engage in physical activity	-	0.83	0.78-0.87
Commenting positively on your performance when engaging in physical activity	-	0.81	0.75-0.85
Talking with you about physical activity	-	0.78	0.72-0.83
Score for social support from parents	0.81	0.91	0.88-0.93
Overall score for social support	0.87	0.92	0.89-0.95
Community environment regarding engaging in physical activity			
Access to and appeal of locations for engaging in physical activity			
Existence of cycle paths	-	0.75	0.68-0.81
Seeing other adolescents engaging in physical activity	-	0.62	0.51-0.70
Existence of places for engaging in physical activity	-	0.65	0.55-0.73
Distance of places for engaging in physical activity	-	0.60	0.53-0.69
Appearance of neighborhood	-	0.70	0.61-0.76
Existence of places you like to visit	-	0.66	0.57-0.74
Score for access to and appeal of locations for engaging in physical activity	0.69	0.82	0.78-0.87
Safety when engaging in physical activity			
Road safety for walking or running	-	0.67	0.51-0.79
Road safety for cycling	-	0.59	0.48-0.68
Security of places designed for physical activity	-	0.69	0.54-0.69
Security of neighborhood	-	0.67	0.58-0.74
Score for safety when engaging in physical activity	0.73	0.67	0.56-0.73
General structure and maintenance of neighborhood			
Existence of sidewalks	-	0.82	0.77-0.86
Condition of sidewalks	-	0.53	0.40-0.64
Structure of places for engaging in physical activity	-	0.58	0.34-0.63
Pollution	-	0.61	0.50-0.70
Score for overall structure and maintenance of neighborhood	0.70	0.75	0.68-0.81
Overall score for perceived environment	0.72	0.79	0.74-0.83

ICC= intra-class correlation; CI95%= confidence index.

Discussion

The results of this study show that the scales (attitude of adolescents regarding engaging in physical activity, self-efficacy and social support of parents and friends regarding physical activity and perceived environment) to measure the factors associated with physical activity under study were factorially valid, of satisfactory internal consistence and highly reproducible.

This study revealed a number of positive aspects that deserve mention. The study was based on a random sample of adolescents in public and private high schools, with a broad range of ages (14-19 years) and with different socio-economic characteristics, which means that the findings can more easily be generalized. The internal validity was strengthened by the use of various operational and statistical procedures, which effectively demonstrated the validity and reliability of questionnaire. Another strong point was the sample size. In terms of reproducibility, the sample used ($n=248$) had a power of 99%. For exploratory factor analysis, it is recommended that there be a ratio of 1:5 between the variables and number of subjects.²¹ Forty-one variables were analyzed, which requires a sample of at least 205 subjects, which is a figure lower than the 248 participants used here.

Attitude is one of the main categories in the Theory of Planned Behavior.²² Although no consensus exists regarding this concept, in the field of physical activity, attitude has been defined and operationalized, basically speaking in two ways: a) belief regarding the results of engaging in physical activity and an evaluation of the possible results;¹⁷ b) a positive or negative evaluation of physical activity.¹⁹

Recent evidence suggests that a measurement of attitude that takes into consideration both instrumental and emotional aspects, considering a positive or negative evaluation provides satisfactory overall evaluation of the attitude of adolescents regarding physical activity.¹⁹

The attitude scale assessed in the present study comprised five items, three relating to emotional aspects and the other two to the instrumental aspects of attitude. However, exploratory factor analysis revealed the presence of a single factor, and the proportion of explained variance was 51.6%. According to the criteria proposed by Hill & Hill,²¹ the internal consistency was reasonable ($\alpha=0.77$). These results were weaker than those reported by Lee *et al.*⁷ and similar to those of the study conducted by Cardon *et al.*²³ The reproducibility

was high for the attitude score ($ICC=0.89$), as mentioned above.⁷

Self-efficacy is one of the main constructs of socio-cognitive theory.²⁴ In studies of physical activity, this has been defined as the perceived confidence of the subject regarding engaging in physical activity despite the presence of barriers.⁸

The self-efficacy scale for engaging in physical activity initially had 12 items. Based on the results of the factor analysis, two items were excluded: engaging in physical activity under adverse climatic conditions and lack of time, as these had a factor loading <0.40 . The low contribution of these items can be explained by the fact that the climate is not such an important factor when engaging in physical activity in the Northeast of Brazil, and lack of time may be more an excuse than an obstacle to engaging in physical activity, and is more commonly found among adults than among adolescents.

The factor analysis identified the presence of two factors for the self-efficacy scale: factor 1 – resources for physical activity; factor 2 – social support and reasons for engaging in physical activity. The results of the study of self-efficacy regarding physical activity point in different directions. Some studies show that there is a single factor^{8,13,14} while others identify two²⁵ or three.¹⁰

Differences relating to the number of items on each scale and the aspects measured may explain many of these discrepancies. As this measure expresses the perception of subjects regarding their capacity to overcome obstacles to engaging in physical activity, differences between the obstacles reported by adolescents^{20,26} may also contribute to these results. Another factor to be considered concerns the procedures used for statistical analysis: exploratory factor analysis rather than confirmatory factor analysis, since they usually produce different results.^{8,10,25}

The self-efficacy scale had reasonable good results for internal consistency (factor 1: $\alpha=0.76$; factor 2: $\alpha=0.75$, scale overall: $\alpha=0.81$). These results are similar to those of some studies^{8,13,14} and higher than those found by Saunders *et al.*¹⁰ Some studies report results slightly higher than those of the present study.^{11,12,15,27}

In the case of reproducibility, all the items presented an ICC higher than 0.50. The reproducibility coefficients for the self-efficacy scores were higher than 0.70, with the exception of factor 2 ($ICC=0.67$). The results of the present study were similar^{7,11} or higher than those reported in other studies.^{13,15}

Support or social support is an important element

of socio-cognitive theory.²⁴ It is characterized by the provision of support by different social groups to lead the subject to adopt a certain behavior pattern.²⁴ In the case of physical activity, it has been defined as any kind of behavior or action that helps an individual to begin or to continue engaging in some kind of physical activity.¹⁴

There are different kinds of social support - instrumental / direct, emotional / psychological, instructional / informative - and it can be provided by different social groups, such as parents, friends and teachers.¹⁴ Most studies have analyzed the social support provided by parents and friends,^{3,4} since these are the groups that adolescents spend more time with and have stronger social relations with.

In the present study, the social support scale had 12 items, distributed between two factors. While factor 1 grouped together all the items relating to social support from friends, factor 2 those relating to social support from parents, each containing six items. The factor loading was high for all the items (>0.60).

The internal consistency of the factors or subscales was high (factor 1=0.90 and factor 2=0.81), and classifies as good (α of 0.80 to 0.90) according to the criteria recommended by Hill & Hill.²¹ These results are better than those of other studies that have examined the same scale in adolescents,^{2,12,13,27} with values between 0.60¹³ and 0.84²⁷ for support from friends, and 0.72¹² to 0.78² for support from parents.

The levels of reproducibility for the measures of social support were high. The ICC attained values close to (friends: ICC=0.89) or higher than 0.90 (parents: ICC=0.91). These findings were higher than those reported in other studies.^{2,12-14}

In the literature consulted it can be seen that there is no consensus as to how to measure the perceived environment regarding physical activity, especially in the case of adolescents. Measures of the environment, based on perception, involve an evaluation of how people perceive the characteristics of their local neighborhood. Normally, this is operationalized by asking questions about access to and availability of facilities relating to physical activity, road safety and personal security, and infra-structure.^{9,12}

The environment scale examined in this investigation initially comprised 15 items. One item was excluded because it exhibited a factor loading of less than 0.40 (<0.30 ; my neighborhood is pleasant). The 14 remaining items range across three factors: factor 1 - access to and appeal of the localities where physical activity can be engaged in; factor 2 - the structure and maintenance of the neighborhood; factor 3

- safety when engaging in physical activity.

One subscale of the environment measure showed an internal consistency of less than 0.70 (general structure and maintenance of neighborhood, $\alpha=0.69$). For the other subscales α was equal to (safety when engaging in physical activity, $\alpha=0.70$) or greater than 0.70 (access to and appeal of locations for engaging in physical activity, $\alpha=0.73$). There is no consensus as to the minimum acceptable value for internal consistency for a questionnaire or a scale. Although values of $\alpha \geq 0.70$ are widely recommended and used,^{8,9,13} values >0.60 ²⁸ have also been recommended.

Low levels of internal consistency for the perceived environment scales, especially the shorter scales, have been reported in some studies of adolescents.^{12,15} Such results may be explained, primarily, by the complexity and subjectivity involved in measuring the environment in so far as it relates to physical activity. Second, operationalization of the measure of the perceived environment regarding physical activity requires various items. For example, the Neighborhood Environmental Walkability Scale for Youth (NEWS-Y) has 68 items, divided into nine sections.⁹ In studies with adolescents, the internal consistency of the NEWS-Y scale varied from 0.72 to 0.93.⁹

The fact should also be considered that a reduction in the number of items on the environment scale may affect the internal consistency. In studies of physical activity and the environment among adolescents most scales contain few items.^{12,13} Apart from this, the items in these scales measure different characteristics of the environment, which may not be related to one another, resulting in low levels of internal consistency.¹²

It should be noted that various factors may influence the results for Cronbach's alpha, including, mainly the number of items, the variance of the test results and the distribution of scores.²⁸ Of these, it is believed that the variation in the results and the distribution of scores have contributed to the low levels of internal consistency for the environment scale. The cluster effect produced by the procedure of selecting the sample by conglomerates may also have contributed to these results.

The hypothesis that adolescents have difficulty evaluating with any degree of precision the attributes of the environment can also not be ruled out. This could be because they do not know their local neighborhood well and/or because the scale used (a four-point Likert) may not be adequate for this age-group.¹¹

The reproducibility of the scores for the perceived

environment was high ($ICC > 0.70$), except for safety when engaging in physical activity, whose ICC was 0.67, although this is a figure that may be considered acceptable. Few studies have investigated the reproducibility of the perceived environment measure in adolescents. Hume *et al.*¹⁵ observed ICCs of 0.84, 0.72 and 0.88 respectively, for the scores for access to destinations, appearance and safety. These results are slightly higher than those of the present study, although similar results have been reported in other studies.^{2,7} In other studies, the reproducibility of the two environment scales showed an ICC of equal to or less than 0.60.^{12,13}

This study has a number of limitations. The questionnaire was developed to measure multiple factors associated with physical activity in adolescents. Some more specific aspects of the constructs evaluated in this study (such as self-efficacy, perceived environment) may not have been covered in the items selected for inclusion in the questionnaire. Thus, studies that aim to provide more detailed analysis of some of the constructs in question may need more detailed instruments. Another possible limitation was the small number of schools selected for the study, which may, to some extent, reduce the individual variability of the results and, thus, lead to underestimation of the internal consistency of some scales, particularly in those categories that are prone to the greatest variation (such as, perceived environ-

ment regarding physical activity).

As there are no standard instruments for measuring factors associated with physical activity using an ecological approach, an instrument has been developed that enables simultaneous measurement of different factors associated with physical activity (attitude, self-efficacy, social support of parents and friends and perceived environment). The scales that make up the questionnaire analyzed in this study exhibit factorial validity, satisfactory internal consistency and a high level of test-retest reproducibility and is thus recommended for studies of adolescents. There is a need, however, for further studies to refine the scales analyzed here, especially those relating to the relationship between the environment and physical activity.

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References

- Bauman AE, Sallis JF, Dziewaltowski DA, Owen N. Toward a better understanding of the influences on physical activity: the role of determinants, correlates, causal variables, mediators, moderators, and confounders. *Am J Prev Med.* 2002; 23: 5-14.
- Sallis JF, Taylor WC, Dowda M, Freedson PS, Pate RR. Correlates of vigorous physical activity for children in grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Ped Exerc Sci.* 2002; 14: 30-44.
- Ferreira I, van der Horst K, Wendel-Vos W, Kremers S, van Lenthe FJ, Brug J. Environmental correlates of physical activity in youth: a review and update. *Obes Rev.* 2006; 8: 129-54.
- Van der Horst K, Paw MJCA, Twisk JWR, Van Mechelen W. A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc.* 2007; 39: 1241-50.
- Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. *Annu Rev Public Health.* 2006; 27: 297-322.
- Elder JP, Lyttle L, Sallis JF, Young DR, Steckler A, Simons-Morton D, Stone E, Jobe JB, Stevens J, Lohman T, Webber L, Pate R, Saksvig BI, Ribisl K. A description of the social-ecological framework used in the trial of activity for adolescent girls (TAAG). *Health Educ Res.* 2007; 22: 155-65.
- Lee KS, Loprinzi PD, Trost SG. Determinants of physical activity in Singaporean adolescents. *Int J Behav Med.* 2009; 17: 279-86.
- Bartholomew J, Loukas A, Jowers EM, Allua S. Validation of the physical activity self-efficacy scale: testing measurement invariance between hispanic and caucasian children. *J Phys Act Health.* 2006; 3: 70-8.
- Rosenberg D, Ding D, Sallis JF, Kerr J, Norman GJ, Durant N, Harris, SK, Saelens, BE. Neighborhood environment walkability scale for youth (NEWS-Y): reliability and relationship with physical activity. *Prev Med.* 2009; 49: 213-8.
- Saunders RP, Pate RR, Felton G, Dowda M, Weinrich MC, Ward DS, Parsons MA, Baranowski T. Development of questionnaire to measure psychosocial influence on children's physical activity. *Prev Med.* 1997; 26: 241-7.
- Wu T-Y, Ronis DL, Pender N, Faan RN, Jwo J-L. Development of questionnaires to measure physical activity cognitions among Taiwanese adolescents. *Prev Med.* 2002; 35: 54-64.
- Pirasteh A, Hidarnia A, Asghari A, Faghihzadeh S, Ghofranipour F. Development and validation of psychosocial determinants measure of physical activity among Iranian adolescent girls. *BMC Public Health.* 2008; 8: 150.

13. Norman GJ, Sallis JF, Gaskins R. Comparability and reliability of paper-and-computer-based measures of psychosocial constructs for adolescent physical activity and sedentary behaviors. *Res Q Exerc Sport*. 2005; 76: 315-23.
14. Dowda M, Dishman RK, Pfeiffer KA, Pate RR. Family support for physical activity in girls from 8th to 12th grade in south Carolina. *Prev Med*. 2007; 44: 153-9.
15. Hume C, Ball K, Salmon J. Development and reliability of a self-report questionnaire to examine children's perceptions of the physical activity environment at home and in the neighborhood. *Int J Behav Nutr Phys Act*. 2006; 3: 16.
16. Mota J, Almeida M, Santos P, Ribeiro JC. Perceived neighborhood environments and physical activity in adolescents. *Prev Med*. 2005; 41: 834-6.
17. Motl RW, Dishman RK, Trost SG, Saunders RP, Dowda M, Felton G, Ward DS, Pate RR. Factorial validity and invariance of questionnaires measuring social-cognitive determinants of physical activity among adolescent girls. *Prev Med*. 2000; 31: 584-94.
18. ABEP (Associação Brasileira de Empresas de Pesquisa). Critério de classificação econômica Brasil. [Acesso em 26 nov 2009]. Disponível em: www.abep.org.br/mural/abep
19. Hagger MS, Chatzisarantis NLD. First-and higher-order models of attitude, normatives influence, and perceived behavioural control in the Theory of Planned Behavior. *Br J Prev Soc Med*. 2005; 44: 513-35.
20. Kimm SYS, Glynn WN, McMahon RP, Voorhees CC, Striegel-Moore RH, Daniels SR. Self-Perceived barriers to activity participation among sedentary adolescent girls. *Med Sci Sports Exerc*. 2006; 38: 534-40.
21. Hair Jr J, Anderson R, Tatham R, Black W. *Análise multivariada de dados*. São Paulo: Bookman; 2005.
22. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991; 50: 179-11.
23. Cardon G, Philippaerts R, Lefevre J, Matton L, Wihndaele K, Balduck A-L, De Bourdeauduij, I. Physical activity levels in 10-to 11-year-old: clustering of psychosocial correlates. *Public Health Nutr*. 2005; 8: 896-903.
24. Bandura A. Health promotion by social cognitive means. *Health Educ Behav*. 2004; 21: 143-64.
25. Dwyer JJM, Allison KR, Makin S. Internal structure of a measure os self-efficacy in physical activity amonh high school students. *Soc Sci Med*. 1998; 46: 1175-82.
26. Santos MS, Hino AAF, Reis RS, Rodriguez-Añez CR. Prevalência de barreiras para a prática de physical activity in adolescents. *Rev Bras Epidemiol*. 2010; 13: 94-104.
27. Taymoori P, Rhodes E, Berry TR. Application of a social cognitive model in explaining physical activity in Iranian female adolescents. *Health Educ Res*. 2010; 25: 257-67.
28. Sim J, Wright C. *Reseach in health care: concepts, designs and methods*. Cheltenham: Stanley Thornes Ltd; 2000.

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