Nutrición Hospitalaria

Original/*Deporte y ejercicio*

Reliability and validity of an adapted version of the ALPHA environmental questionnaire on physical activity in Spanish youth

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Abstract

Introduction: **Previous studies suggest that the physical environment is associated with youth physical activity levels.**

Objective: **The present study aimed at assessing the reliability and validity of an adapted version of the ALPHA environmental questionnaire (short version) to adults for application with Spanish youth.**

Methods: **The reliability was evaluated in a sample (n = 190, 80 girls, 14.08 ± 1.38 years) using the Intraclass Correlation Coefficient (ICC) and Weighted kappa. In other sample (n = 140, 61 girls, 13.03 ± 1.40 years) the validity was assessed using the Spearman correlation (rho) for its association with self-reported and objective (accelerometers) physical activity (PA).**

Results: **The test-retest reliability showed ICC = 0.69 for the total questionnaire score, ranging from k = 0.42 to 0.77 for individual items. The total score showed significant correlations with PA reported by PACE questionnaire (rho = 0.18, p = 0.040), the Finnish Physical Activity Index (rho = 0.26, p = 0.002) and active commuting for girls (rho = 0.34, p = 0.010), as well as vigorous PA measured by accelerometry (rho = 0.18, p = 0.038).**

Discussion: **The adapted version of the ALPHA environmental questionnaire has moderate to good reliability and acceptable validity to assess environmental factors that may influence PA in youth.**

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Key words: *Accelerometry. Adolescents. Environment. Neighborhood.*

FIABILIDAD Y VALIDEZ DE UNA VERSIÓN ADAPTADA DEL CUESTIONARIO AMBIENTAL ALPHA PARA LA ACTIVIDAD FÍSICA EN LA JUVENTUD ESPAÑOLA

Resumen

Introducción: **Estudios anteriores sugieren que el entorno físico está asociado con los niveles de actividad física de la juventud.**

Objetivo: **El objetivo de este estudio fue valorar la fiabilidad y validez de una versión adaptada del cuestionario ambiental ALPHA de adultos (versión corta) para su aplicación en población juvenil española.**

Métodos: **La fiabilidad del cuestionario se evaluó en una muestra (n=190; 80 chicas; 14.08±1.38 años) mediante el Coeficiente de Correlación Intraclase (CCI) y el índice Kappa ponderado. En otra muestra (n=140; 61 chicas; 13.03±1.40 años), se evaluó la validez del cuestionario mediante la asociación con la actividad física (AF), tanto auto-reportada como medida con acelerometría, a través de la correlación de Spearman (rho).**

Resultados: **La fiabilidad test-retest mostró un CCI = 0.69 para la puntuación total del cuestionario, y un coeficiente Kappa de *k* = 0.42 a 0.77 en los ítems individuales. La puntuación total mostró correlaciones significativas con la AF auto-reportada mediante el cuestionario PACE (rho = 0.18; p = 0.040), el Índice Finlandés de Actividad Física (IFAF) (rho = 0.26, p = 0.002) y el transporte activo (rho = 0.34, p = 0.010 en chicas), así como con la AF vigorosa medida con acelerometría (rho = 0.18; p = 0.038).**

Discusión: **La versión adaptada del cuestionario ambiental ALPHA, presenta una fiabilidad de moderada a buena y una aceptable validez para evaluar los factores ambientales que pueden influir en la práctica de AF de los jóvenes.**

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Palabras clave: *Acelerometría. Adolescentes. Ambiente. Vecindario.*

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Abbreviations

ALPHA: Assessing Levels of Physical Activity and fitness at population level
ANOVA: Analysis of Variance
BMI: body mass index
FPAI: Finnish Physical Activity Index
ICC: Intraclass Correlation Coefficient
PA: physical activity
PACE: Physician-based Assessment and Counseling for Exercise
k : weighted Kappa
rho: Spearman correlation
r: Pearson correlation

Introduction

Today, the impact of physical activity (PA) on the prevention and treatment of a varying group of diseases is unquestionable[1]. Physical inactivity is, according to the World Health Organization, the fourth most important risk factor for global mortality[2]. In young populations, only 23% of 11 year old adolescents meet the recommendation of engaging in 60 minutes of daily PA with a moderate to vigorous intensity[3].

The research aimed at identifying potential determinants of the PA habits is of interest as a guide for the design of strategies that encourage the promotion of PA on different population groups. However, in the past, the current line of research has been directed towards the study of individual factors such as socio-demographics and personal characteristics or determined psychological and behavioral aspects. Nonetheless, in the last several years, research investigations have adopted an Ecological Perspective[4] thereby demonstrating an interest in analyzing the mechanisms and factors through which the environment can influence PA[5].

The influence of environments on PA habits in youth has been investigated primarily in the United States and Australia[6], providing specific evaluation tools to measure environments adapted to the physical and environmental characteristics of these countries. However, those characteristics differ considerably from those of European countries, thus a questionnaire applicable to the European context was developed on the Assessing Levels of Physical Activity and fitness at population level project (ALPHA) to evaluate the environmental correlations with PA for adults[7]. However, no versions of this tool have been evaluated for youth populations yet. The objective of this study is, therefore, to evaluate the validity and reliability of an adapted short version of the adult ALPHA environmental questionnaire for its use with the Spanish youth.

Methodology

Study design and participants

In carrying out this study, two samples of adolescents were formed. The first sample (reliability) included 190 adolescents (80 girls) belonging to two public high schools of Madrid, Spain, and aged between 12 and 18 years. All the subjects completed an adapted version of the ALPHA environmental questionnaire[6] and took the test again one week later under uniform conditions. The second sample (validity) totaled 140 adolescents (61 girls) between 12 and 17 years belonging to four public high schools of Madrid, Spain. In addition, subjects of the validity sample completed the Physician-based Assessment and Counseling for Exercise questionnaire (PACE)[8], the Finnish Physical Activity Index (FPAI)[9], and two questions about walking and cycling in leisure time. The participants were measured with standardized equipment and procedures, and information was obtained regarding their age at the moment of evaluation. The body mass index (BMI) was calculated as weight (kg)/height^2(m). Also, the youth wore an accelerometer for seven consecutive days.

Participants and their parents or legal guardian were informed and written signed consent was obtained for all participant and their parents or legal guardian. The study protocols were approved by the Ethics Committee of the *Hospital Puerta de Hierro* and the Bioethics Committee of the National Research Council (Madrid, Spain).

Adaptation of the APLHA environmental questionnaire for adolescents

The ALPHA environmental questionnaire was designed in the ALPHA project[7]. Two versions of the questionnaire were developed, a long version consisting of 49 items and a short version consisting of 11 items, and evaluated using a Likert scale from 1 (strongly disagree) to 4 (strongly agree). In both versions, "neighborhood" was defined as "the area around your home that you could walk in 10-15 minutes, approximately 1.5 km"[6].

The APLHA environmental questionnaires have been validated in European adults[6]. The short version showing test-retest reliability of 50-83% agreement, and an Intraclass Correlation Coefficient (ICC) of 0.73. To establish its validity for identifying potential environmental factors that could influence PA, the authors calculated a total score through the sum of the individual items, previous recodification of item 5. The total score and PA measures showed the correlation of r=0.21(women) with the total minutes of auto-reported bicycle use as active commuting during the week and a r=0.34 and 0.25 (men) with auto-reported values of moderate to vigorous PA and of PA on leisure-time, respectively. Regarding the PA measured with accelerometers, only significant correlations were found in women with total PA (r=0.26) and moderate to vigorous PA (r=0.28)[6].

Reliability and validity of an adapted version
of the ALPHA environmental questionnaire
on physical activity in Spanish youth

Nutr Hosp. 2014;30(5):1118-1124

1119

We adapted the study for adolescents based on the short version of the adult ALPHA environmental questionnaire (see Appendix A). Two items from the adapted short version of the questionnaire were extracted from the long version of the original questionnaire (items 4 and 7)[6]. The questionnaire provides a score that is the sum of items that compose it and that presuppose factors that increase PA, except items 3 and 5, which demonstrate an inverse association with adolescent's PA and has to be codified inversely.

PACE questionnaire

This questionnaire is composes of two questions that assess how many days of the previous week and from any given week the adolescent does at least 60 minutes of PA[10]. The average of the responses to both questions allowed us to assess PA. The questionnaire has been validated in the adolescent Spanish population[11], demonstrating moderate correlations (rho~0.40) with PA assessed using accelerometers.

FPAI questionnaire

The FPAI was developed for the longitudinal follow-up of PA patterns within the study Cardiovascular Risks in Young Finns[8]. It consisted of a 5-point questionnaire related to the duration, frequency and intensity of extracurricular sport physical activity and participation in competitions. Piéron et al.[12] adapted the questionnaire to Spanish youth and pointed out elevated values of internal consistency (α =0.76-0.86).

Walking and cycling in leisure-time

Each participant was asked how many times they have gone walking or cycling during their leisure-time in the last 7 days. Each question was answered using a 5-point Likert-scale (1=never, 2=1-2 times, 3=3-4 times, 4=5-6 times, 5=7 times or more). Afterwards, the average of the responses to both questions calculated.

Accelerometers

PA was objectively assessed by the Actigraph GT1M, GT3X and GT3X+ (ActiGraphTM, LLC, Fort Walton Beach, FL, US) accelerometers. The epoch duration was set at 30 Hz and their data were subsequently converted into 2-second epoch in the download. The use of 3 different models of accelerometers did not imply any methodological problems since the outputs are comparable without needing additional calibration[13,14].

Participants wore accelerometers on their backs, at the height of the waist, and adjusted with an elastic band for 7 consecutive days, removing it only for water-based activities and for sleeping. The inclusion criteria was an activity monitor recording of at least 3 days with at least 10 wear hours per day[15].

The data generated by the accelerometers was analyzed using Actilife 6 software (ActiGraphTM, Pensacola, FL, US). The valid days were identified by the removing of periods of 60 minutes continuous of zeros, considering that when a measure of movement was not produced it meant that the participant was not wearing the accelerometer. The final variables included in the analysis were the daily average time (min/day) during which PA was performed at moderate and vigorous intensity and the sum of both. The cut off points for adolescents used were the ones proposed by Freedson et al.[16] according to age.

Statistical analysis

The descriptive statistics from the studies are shown as the average and the standard deviation. The differences between sexes were analyzed through the Analysis of Variance (ANOVA) and the Chi-square test analyzed the differences regarding the meeting of the recommendations of PA. The test-retest reliability of the items was calculated through the weighted Kappa (k), given that it quantifies different degrees of disagreement between the response categories, an aspect that the simple Kappa obviates[17]. The ICC was calculated for the total score of the adapted ALPHA environmental questionnaire. To classify the results obtained on the weighted Kappa, categories proposed by Landis and Koch[18] were used: $k<0.40$ low, $k=0.41$-0.60 moderate, $k=0.61$-0.8 good and $k>0.81$ very good. ICC estimates >0.75 were considered as good reliability scores, between 0.50-0.75 as moderate reliability and <0.50 as poor reliability[19]. To establish the association between variables from the adapted ALPHA environmental questionnaire using the PA measured with accelerometers and the self-reported questionnaires (PACE, FPAI and walking and cycling in leisure-time), a Spearman correlation (rho) was used. All analyses were performed with the IBM SPSS software v.17.0 for Windows and the statistical significance of values was established as p<0.05.

Results

From the 207 adolescents who formed the first sample, 17 were excluded from the study (6 girls), because they did not answer any question from the questionnaire. The final sample included 190 adolescents (80 girls) (Table I). In the second sample 140 adolescents were included, since 15 participants did not meet accelerometry inclusion criteria (Table I).

The test-retest reliability analysis is shown in table II. The weighted Kappa for each individual item reveals a moderate to good reliability (k=0.42-0.77). The ques-

Table I
Characteristics of the samples

	Sample 1 (reliability)			Sample 2 (validity)		
	All (n = 190)	Boys (n = 110)	Girls (n = 80)	All (n = 140)	Boys (n = 79)	Girls (n = 61)
Age (years)	14.08 (1.38)	14.22 (1.44)	13.90 (1.27)	13.11 (1.46)	13.16 (1.51)	13.03 (1.40)
Weight (Kg)	55.51 (12.55)	60.16 (12.90)	49.02 (8.60)*	54.14 (12.05)	55.18 (13.37)	52.78 (10.02)
Height (m)	1.66 (0.10)	1.70 (0.10)	1.61 (0.08)*	1.60 (0.10)	1.62 (0.12)	1.57 (0.07)*
Body mass index (Kg/m²)	20.00 (3.42)	20.81 (3.71)	18.85 (2.58)*	21.06 (3.29)	20.86 (3.27)	21.32 (3.33)
ALPHA Score (10-40)	24.25 (3.93)	23.98 (4.19)	24.61 (3.54)	23.44 (2.81)	23.44 (2.71)	23.44 (2.95)
Self-reported PA						
PACE + (1-7)	-	-	-	3.37 (1.61)	3.58 (1.66)	3.11 (1.52)
FPAI (5-15)	-	-	-	10.83 (2.43)	11.24 (2.27)	10.30 (2.55)*
Active commuting (1-5)	-	-	-	1.95 (0.82)	2.00 (0.90)	1.88 (0.69)
Accelerometry						
Moderate PA (min/day)	-	-	-	59.66 (14.10)	61.88 (13.77)	56.78 (14.12)*
Vigorous PA (min/ day)	-	-	-	18.65 (10.80)	21.81 (11.32)	14.56 (8.55)*
Moderate to vigorous PA (min/ day)	-	-	-	78.31 (21.17)	83.69 (21.49)	71.34 (18.73)*

Values are showed as mean (standard deviation); PA: Physical activity; FPAI: Finnish Physical Activity Index. * denotes statistical significant differences between sexes.

Table II
Test-retest reliability of the adapted ALPHA environmental questionnaire for youth

	Weighted Kappa (n = 190)
Item 1: Abundance of houses	0.77
Item 2: Nearby shops and walkable	0.64
Item 3: Nearby public transportation stops	0.46
Item 4: Alternative paths	0.47
Item 5: Traffic insecurity	0.53
Item 6: Neighborhood security	0.42
Item 7: Pleasant environment	0.51
Item 8: Sport equipments	0.51
Item 9: Active commuting to school	0.46
Item 10: School sport facilities	0.54
Total score: Intraclass Coefficient Correlation	0.69

tion about delinquency (item 6) presented the lowest test-retest reliability (k=0.42), while the abundance of detached houses and proximity of shops (items 1 and 2, respectively) demonstrated the best test-retest reliability (k=0.77 and 0.64 respectively). This moderate reliability is coherent with the ICC=0.69 found for the total score in test and retest.

The total score of the adapted ALPHA questionnaire obtained low but significant correlations with the PA measured with the self-reporting tools and with the vigorous PA measured with accelerometers for the total sample (rho=0.18, p=0.40) . The PACE questionnaire also demonstrated significant correlations in the total sample and for the girls (rho=0.18 and 0.28, p<0.05, respectively). The question about walking and cycling in leisure time only demonstrated significant correlations in girls (rho=0.34, p=0.010). In the FPAI, significant correlations were found in the total sample (rho=0.26, p=0.002) as well as both sexes (rho=0.25 boys and 0.32 girls, p<0.05) (Table III).

Discussion

In the present study, the reliability and validity of the short version of the ALPHA environmental questionnaire adapted in Spanish youth were evaluated. The results demonstrate that the total questionnaire score has moderate test-retest reliability (ICC=0.69), with moderate to good weighted Kappa values for the 10 items that composed the scale. In addition, the total score presented significant associations with the self-reported PA through the PACE questionnaire in the total sample and in the girls, with extracurricular PA evaluated through the FPAI and with walking and cycling in girls. Using objective measure of PA, vigorous PA demonstrated significant associations in the total sample.

Reliability and validity of an adapted version of the ALPHA environmental questionnaire on physical activity in Spanish youth

Nutr Hosp. 2014;30(5):1118-1124

1121

Table III

Correlations between measures of physical activity (PA) and the adapted ALPHA environmental questionnaire for Spanish youth

	The adapted ALPHA environmental questionnaire (Total score)		
	All (n = 140)	*Boys (n = 79)*	*Girls (n = 61)*
Self-reported PA			
PACE (1-7)	0.18*	0.10	0.28*
FPAI (5-15)	0.26**	0.25*	0.32*
Leisure-time active commuting (1-5)	0.13	-0.01	0.34**
Accelerometry			
Moderate PA (min/day)	0.03	-0.01	0.04
Vigorous PA (min/ day)	0.18*	0.18	0.20
Moderate to vigorous PA (min/ day)	0.10	0.07	0.11

PACE: Physician-based Assessment and Counseling for Exercise; FPAI: Finnish Physical Activity Index; *p<0.05 **p<0.01.

In the original study about the reliability of the ALPHA environmental questionnaire in adults[6], good test-retest reliability for the total score (ICC=0.73) and values ranging from moderate to good for individual items were obtained. Similar results were found in other studies that evaluated the test-retest reliability of assessment tools of environmental determinants of PA in young people. For example, several studies in American adolescents aged 12 to 18 years found moderate to good test-retest reliability values (ICC ≥ 0.50) for neighborhood´s environmental characteristics related to PA[20-22]. Besides, another study in Australian adolescents aged 10 to 12 years obtained an agreement percentage greater than 75% for items related to the neighborhood's perceptions, although several items demonstrated poor Kappa values[23]. The aforementioned studies had ICC test-retest reliability and kappa values similar to the present study. However, we used the weighted kappa, instead of the simple Kappa, to take into account the probability of randomly matching in a response category and the degree of disagreement between the responses when these do not agree. Since, this statistic attributes more importance to disagreements between far categories (i.e. strongly agree-strongly disagree) than to disagreements between closer categories (i.e. strongly disagree-somewhat agree).

On the other hand, our results related to the validity of the ALPHA environmental questionnaire showed significant correlations with objectively measured vigorous PA. However, the original study found significant associations with objective total PA (r=0.26, p<0.01) in woman adults and objective moderate to vigorous PA (r=0.28, p<0.01) in both women and men[6]. Nonetheless, a recent systematic review by Reimers et al.[24] evaluated the measurement properties of questionnaires assessing the neighborhood environments in relation to PA in youth, and they found that only one questionnai-

re used objective measures of PA for its validity. Such questionnaire included not only environmental factors but also personal and social factors[25]. Therefore, the present study constitutes the first attempt to validate a questionnaire based exclusively on environmental factors related to youth PA using accelerometers.

In our study, the self-reported variables regarding PA demonstrated significant associations with the total score of the adapted ALPHA environmental questionnaire. In this sense, the results of the current work are similar to the ones from the original study of validity in adults[6], in which correlation values of r=0.25 were obtained from the total score and the leisure-time PA carried out in men, and the total minutes of active commuting on a bicycle per week (r=0.21) reported for women. Our results shown significant associations with the extracurricular PA measured through the FPAI for the total sample and for both sexes as well as walking and cycling for girls.

The association between the number of days that adolescents meet the recommendation of 60 minutes of daily PA (valued through the PACE questionnaire) and the total score of the adapted ALPHA environmental questionnaire (rho=0.18 and 0.25, p<0.05, for the total and for girls, respectively) differ from the results found by Rosenberg et al.[20]. These authors did not find significant correlations between the diverse sub-scales from the Neighborhood Environment Walkability Scale for Youth questionnaire and the PACE questionnaire in a sample of adolescents from 12 to 18 years old. Other studies have evaluated the relationship between the PA levels adolescents achieve through the FPAI and their perceptions on the neighborhood environment, which demonstrates significant associations with social and aesthetic factors as well as facility availability for the practice of physical sports activities (e.g. parks, bicycle lanes and public swimming pools)[26,27].

Furthermore, the differences between boys and girls, in relation to the adapted ALPHA environmental questionnaire and its relation with the PA, have been made a manifest on similar studies, thereby justifying that the proximity of recreational facilities and the perception of security and crime are the most influences in the girls PA[28-30].

In our study some limitations should be pointed out. First, there are limitations to the ability of the accelerometers to register PA, such as the inability to measure during water-based activities and the fact that the data was registered in an uniaxial form, measuring only the vertical accelerations, thus certain activities such as skating, cycling and swimming could have been misevaluated[31]. Second, the study design did not allow for a validation of the criterion of the instrument with respect to the objective measurements of the variables in the residential environment.

In summary, the adapted ALPHA environmental questionnaire presents a moderate to good level of reliability for the evaluation of environmental correlates that may influence the PA levels of youth. These findings suppose an advance on the environmental factors related to youth PA due to the use of accelerometers as a contrasting criterion for validity. Therefore, this questionnaire may be a reasonable, valid and economic method in large-scale research. Future investigations using objective measurements of built environments should validate these types of instruments in youth.

Appendix A
ALPHA environmental questionnaire for adolescents:
Please mark the answer that best applies for the area where you live (the zone with is around your home and you could walk in 10-15 minutes, with means 1-2 kilometers)

	Spanish test introduction: Marca la respuesta con la que más te sientas identificado correspondiente a la zona donde vives (esta zona es la que se encuentra en torno a tu casa y que puedes recorrer andando en 10-15 minutos, lo que representa 1-2 km a la redonda).	*Translation into the English of test introduction: Please mark the answer that best applies for the area where you live (the zone with is around your home and you could walk in 10-15 minutes, with means 1-2 kilometers).*
	Spanish adaptation for adolescents of original ALPHA items for adults	**Translated into English of adapted Spanish version of each item**
Item 1	El tipo de casa más abundante son los chalets	Most of the houses are detached or semidetached houses
Item 2	Las tiendas están cerca y vamos andando	There are shops near and we walk to them (Shops are close and we can go walking)
Item 3	Las paradas de transporte público están cerca (a unos 10-15minutos andando)	Public transportation stops are nearby (10-15 minutes walking)
Item 4	No tengo que ir siempre por el mismo camino porque hay distintas alternativas (*)	I do not always have to go for the same path because there are different options
Item 5	Pasear e ir en bici es inseguro y desagradable debido al tráfico	Walking and biking are insecure and unpleasant because of the traffic
Item 6	Cuando voy por la calle me siento seguro caminando o en bicicleta, no me da miedo que me puedan robar	When I go walking or biking on the street, I feel safe and I am not afraid that someone can steal me.
Item 7	Mi barrio tiene un ambiente agradable para caminar e ir en bicicleta (*)	My neighborhood has a pleasant environment for going walking and biking
Item 8	En casa tengo material deportivo que puedo utilizar para hacer ejercicio o deporte.	I have basic sport equipments at home that I can use for doing exercise or sport
Item 9	Mi colegio o instituto tiene instalaciones que facilitan que pueda ir en bicicleta o caminando	My school has facilities that make it easier to go walking or biking
Item 10	En el instituto tengo instalaciones deportivas para hacer ejercicio o deporte y las puedo utilizar	I have sport facilities in my school I can use it

(*) Item selected from large version of ALPHA questionnaire.

Reliability and validity of an adapted version of the ALPHA environmental questionnaire on physical activity in Spanish youth

Nutr Hosp. 2014;30(5):1118-1124

1123

Acknowledgments

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