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ORIGINAL ARTICLE

Back Pain and Body Posture Evaluation Instrument (BackPEI): development, content validation and reproducibility

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Abstract
Objectives Following a search conducted in several databases, no instrument was found that jointly evaluates the prevalence of back pain and its associated demographic, social–economic, hereditary, behavioral and postural risk factors. Thus, the present study aims to develop the Back Pain and Body Posture Evaluation Instrument (BackPEI) for school-age children and verify its validity and reproducibility.
Methods Twenty-one questions were elaborated to compose the BackPEI instrument, eight experts checked the content validity, and its reproducibility was tested by applying the questionnaire to 260 primary schoolchildren, at two different times with a 7-day interval.
Results The reproducibility data for the first 20 questions, analyzed using the kappa (k) coefficient, were classified as "very good" ($k > 0.8$) or "good" ($0.6 < k \leq 0.8$). The reproducibility data for the pain intensity question, analyzed using the Wilcoxon test and the intraclass correlation coefficients (ICC), demonstrated that there was no difference between the averages ($p = 0.251$) and the responses were highly correlated (ICC = 0.937) for these two tests.
Conclusions The BackPEI constitutes a valid and reproducible instrument which is relevant for the evaluation of back pain and its associated risk factors.

Keywords Back pain · Posture · Adolescent · Development · Questionnaire · Reproducibility

Introduction

In recent decades, the issue of back pain has become the cause of great concern, both among the scientific community and public health organizations. In developing countries like Brazil, back pain was, of those disorders that affect workers, the first cause of invalidity and invalidity payments and the cause of 12 million lost work days in 2007 (Meziat and Silva 2011). This economic and social cost has also been reported in developed countries like the USA, where it produces an annual deficit of 200 billion dollars (Balagué et al. 2007). Furthermore, besides being prevalent among adults, it is also widely seen in infants and adolescents (Detsch et al. 2007). Since the 1990s, reports in the literature have indicated levels of prevalence of back pain among children and adolescents that reach 70 % (Balagué et al. 1999; Watson et al. 2002; Korovessis et al. 2005; Shehab and Jarallah 2005; Masiero et al. 2008; Ayanniyi et al. 2011).

According to Hoy et al. (2010) and Real et al. (1999), back pain can be caused by inflammatory or degenerative diseases, congenital defects, muscular weakness, trauma, fractures, spondylolisthesis and scoliosis, among others.

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However, it is widely accepted in the literature that in more than 85 % of cases (Taimela et al. 1997), the back pain is not due to a specific single condition, but to a set of causes (Hoy et al. 2010; Real et al. 1999; Mehta et al. 2002). Within this set of causes, there are several risk factors that may be associated with the occurrence of non-specific back pain in the young, such as gender (Shehab and Jarallah 2005; Trevelyan and Legg 2006), age (Ayanniyi et al. 2011; Taimela et al. 1997; Balagué et al. 1999; Trevelyan and Legg 2006), physical exercise (Shehab and Jarallah 2005), time spent watching television, using the computer and playing videogames (Shehab and Jarallah 2005; Gunzburg et al. 1999), time spent seated (Balagué et al. 1999), time and quality of regular sleep (Auvinen et al. 2010), psychosocial factors (Ribeiro and Gómez-Conesa 2008), family history of back pain (Trevelyan and Legg 2006; Masiero et al. 2008) and educational level of the parents (Balagué et al. 1999).

Empirically, health professionals also consider the body postures adopted during activities of daily life (ADLs) as a risk factor for the occurrence of back pain, although there are few reports in the literature (Balagué et al. 1999). This is particularly true in relation to back pain and the specific postures adopted by schoolchildren during long periods of the day, such as carrying a backpack, sitting to write, using the computer, lifting objects from the floor and even the sleeping posture (Balagué et al. 1999). Thus, to establish a relation between such postures and back pain, there is a need for valid and reproducible instruments designed for investigations with this purpose. Questionnaires are an important tool in this type of research due to their ease of application, low cost and the fact that they provide the opportunity for respondents to self-report (Staes et al. 1999; Schlademann et al. 2008; Mehta et al. 2002).

In an attempt to find such instruments, a search was carried out in several databases (Scopus, Pubmed and Scielo) for articles that validated instruments and epidemiological articles that used such instruments to assess back pain and its risk factors. Among the articles that validated instruments, Real et al. (1999) designed a questionnaire to evaluate the prevalence of back pain and its associated risks factors, such as body mass, height, time spent watching television, sports practice and frequency, alcohol consumption and smoking, among others. However, only 50 adolescents participated in the validation of this instrument and body posture was not considered among the risk factors. Similarly, Watson et al. (2002) and Skoffer and Foldspang (2008) also tested the reproducibility of their questionnaires with only 25 and 17 schoolchildren, respectively. Among the epidemiological studies that have aimed to determine the prevalence of back pain and its associated factors in school-aged children, a number of specific questionnaires have been developed (Sato et al. 2008; Troussier et al. 1992; Grimmer and Williams 2000; Masiero et al. 2008). However, those questionnaires lack details and there are errors in the validation procedures, which hamper the reproduction of these methods in other studies. Hence, no valid and reproducible instrument has been found that jointly evaluates the prevalence of back pain and the posture adopted during ADLs as one of the risk factors associated with school-age children.

The present study aims to develop a new instrument, the Back Pain and Body Posture Evaluation Instrument (BackPEI), for school-age children and verify its validity and reproducibility. It is important to develop a valid and reproducible questionnaire in order for researchers to be able to use an instrument capable of evaluating a wide range of risk factors associated with back pain in school-age children. Thus, given that unsuitable postural habits during ADLs may be a risk factor for the occurrence of back pain, it is important to investigate them in depth during infancy and adolescence (Ayanniyi et al. 2011). So, actions designed to reduce the high incidence of back pain in adults may be considered by the public health authorities.

Methods

The BackPEI was developed in 11 steps: (1) field research conducted in two schools with the aim of recording, through observation, the most practiced ADLs and their mode of execution by school-age children; (2) a literature review in which the object was to identify the most practiced ADLs and their mode of execution by school-age children; (3) a literature review in which the object was to identify the existing instruments for the evaluation of back pain, specifically for school-age children; (4) drafting the first version of the BackPEI; (5) evaluation of the scientific content of the first version of the BackPEI by eight experts on back pain, body posture or human biomechanics; (6) drafting the second version of the BackPEI, incorporating suggestions made by the experts; (7) submission of the revised BackPEI to the experts for evaluation of the scientific content; (8) application of the BackPEI to a target group of school-age children to qualitatively identify their understanding of the questions; (9) drafting of the final version of BackPEI; (10) verification of the reproducibility of the questionnaire based on a testing and re-testing procedure; and (11) translation into English.

This study was approved by the Ethics and Research Committee of the Federal University of Rio Grande do Sul under the number 19,832 and was in accordance with the Helsinki Declaration.

Table 1 Description of the risk factors and the reference studies that served as a basis for selecting and elaborating the questions contained in the Back Pain and Body Posture Evaluation Instrument (BackPEI) (Teutônia, Brazil, 2012)

Risk factors	Questions	Reference studies
Demographic	Age and gender	Detsch et al. (2007) and Masiero et al. (2008)
Behavioral	Level of physical exercise and the practice of competitive physical exercise	Gunzburg et al. (1999), Bejia et al. (2006) and Real et al. (1999)
	Number of hours spent per day watching television and using the computer	Mehta et al. (2002), Robbins et al. (2009), Gunzburg et al. (1999), Bejia et al. (2006) and Real et al. (1999)
	Number of hours spent sleeping and the habit of reading and/or studying in bed	Auvinen et al. (2010) and Paananen et al. (2010)
	Posture in relation to sleeping, sitting in a chair to write, sitting in a chair to talk, using a computer and lifting an object from the ground	Limon et al. (2004) and Detsch et al. (2007)
	Means of transport used to transport the school material and mode of transporting the school bag	Detsch et al. (2007), Mehta et al. (2002), Candotti et al. (2012), Bejia et al. (2006) and Real et al. (1999)
Socio-economic	Type of school and schooling of parents and/or responsible adults	Detsch et al. (2007) and Masiero et al. (2008)
Hereditary	Occurrence of back pain in parents	Gunzburg et al. (1999) and Masiero et al. (2008)

Back Pain and Body Posture Evaluation instrument (BackPEI)

The BackPEI questionnaire was developed based on field research and the content of other questionnaires used in several published studies (Table 1). Based on earlier research, the questionnaire is designed to identify the presence of back pain in the 3 months prior to its application (Schlademann et al. 2008; Mannion et al. 2005; Skoffer and Foldspang 2008; Ashraf et al. 2008) and includes questions on the occurrence, frequency and intensity of the pain.

The intensity of the pain was assessed using the visual analog scale (VAS), which consists of a 10-cm horizontal line in which "0" means "No Pain" and "10" means "The Worst Pain I Can Imagine" (Baeyer 2006; Mannion et al. 2005; Korovessis et al. 2005; Robbins et al. 2009; Mohseni-Bandpei et al. 2009).

Besides pain, this questionnaire also assesses risk factors associated with back pain. Table 1 shows a detailed description of demographic, socio-economic, hereditary and behavioral risk factors and the reference studies that served as a basis to choose the questions included in the BackPEI.

The positions illustrated in the photographs included in each question regarding posture in ADLs (questions 9–14) were chosen based on the mechanics of the spine and the postures recommended by Back Schools for the corresponding ADLs (Cardon et al. 2000; Heymans et al. 2005). However, the field research contributed considerably by revealing the positions most commonly adopted by school-age children in each posture. It was decided to use photographs because they aid in the identification of the respondent with the image (Cardon et al. 2000), facilitating the perception of their own posture in the ADLs. Furthermore, considering that gender differences have been identified in postural habits (Dunk and Callaghan 2005), using one model of the BackPEI for boys and another for girls was also intended to facilitate body awareness.

Content validation procedure

Eight experts in the areas of body posture, back pain or biomechanics of human movement assessed the BackPEI by responding to three questions concerning the instrument as a whole: (1) "regarding the clarity, ease of understanding and applicability of the BackPEI, in general, do you consider it *well suited, suitable or unsuitable*?"; (2) "regarding the objective of evaluating body posture in ADLs from photographs, do you consider the BackPEI *well suited, suitable or unsuitable*?"; (3) "regarding the objective of evaluating back pain and its associated factors, do you consider the BackPEI *well suited, suitable or unsuitable*?"

In addition, the experts assessed each question in the BackPEI individually by answering the question: "regarding the clarity, ease of understanding and applicability, do you consider this question *well suited, suitable or unsuitable*?" In all the alternatives, in the case that the experts marked "unsuitable" or "suitable", the reason for this assessment was requested. Accordingly, at the end of the assessment there was a space of 15 lines, in which the experts could spontaneously assess the questionnaire, providing criticism and/or remarks.

Based on the assessments provided by the eight experts, the initial version of the BackPEI was altered and restructured to form a second version. This version was again submitted to the same experts. The data originating from both assessments are presented in "Results" of this

paper. The BackPEI was then applied to a group of 20 5th to 8th grade primary school pupils to qualitatively identify the understanding of the questions, which showed that there was no need for changes. A final version of the BackPEI containing 21 questions was completed based on the assessments made by the experts. In this version (see Electronic supplementary material 1 and 2), the first 20 questions are closed, so that the respondent can only choose one alternative. The last question (number 21) uses a VAS to assess the intensity of the pain.

Testing and re-testing procedure of the final version

The procedure consisted in applying the questionnaire to the same school-age children at two different times with a 7-day interval (Staes et al. 1999; Pedhazur and Schmelkin 1991). The questionnaire was applied by a researcher, who, prior to giving permission to the respondents to begin completing the questionnaire, instructed them on how to correctly complete it. The respondents were only informed about the re-testing procedure once the initial test had been completed, thus minimizing the opportunity for the respondents to memorize their answers (Real et al. 1999).

The testing and re-testing procedures were conducted in August and September 2011 in the urban area of Teutonia, Rio Grande do Sul, Brazil. According to the census (2000), the municipality had approximately 27,000 inhabitants, the human development index (HDI) was 0.816 (the score for Brazil at the same time was 0.766) and had 11 primary schools from which 2 were selected at random. The subjects that participated in this reproducibility procedure were selected according to the following criteria: (1) they were regular students of the 5th, 6th, 7th or 8th grades of primary school; (2) they were aged between 11 and 16 years; and (3) they agreed to participate in the study by means of a free informed consent form signed by the parents or responsible adults. A A total of 260 primary schoolchildren, (143 boys, 55 %; 117 girls, 45 %) participated in the sample. Figure 1 shows the details of the sample by gender and age. In this sample, the reported prevalence of back pain was 44.6 %.

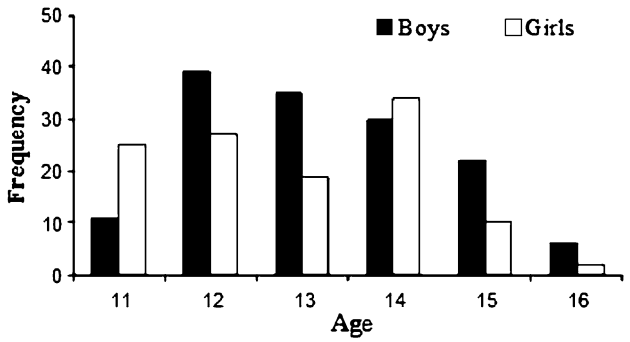

Fig. 1 Distribution of school children by gender and age (Teutônia, Brazil, 2012)

Statistical treatment

Descriptive and inferential statistics were used in the study. Frequency tables were used to analyze the content validation data of the questionnaire. The data from the BackPEI test and re-test procedures for questions 1–20 were analyzed using the unweighted kappa (k) coefficient for nominal scales (unordered categories) (Sim and Wright 2005). This statistical test has been widely recommended to evaluate consistency between categorical data (Bejia et al. 2006; Cohen 1960). The results were classified as poor ($k \leq 0.2$), fair ($0.2 < k \leq 0.4$), moderate ($0.4 < k \leq 0.6$), good ($0.6 < k \leq 0.8$) or very good ($0.8 < k$) (Schlademann et al. 2008). For a question to remain included in the BackPEI, it was required to obtain a minimum value of $k \geq 0.5$ (Staes et al. 1999; Kramer and Feinstein 1981). As it is an interval question, the agreement between the test and re-test of question 21 (pain intensity) was measured in terms of the relationship between the answers, as revealed using the intraclass correlation coefficients (ICC). The Wilcoxon test was used to compare the measures of central tendency obtained in the evaluations. The level of significance adopted was 0.05. The Statistical Package for the Social Sciences (version 18.0) was used for all the analyses.

Translation to English

The 11th and final stage of the process of developing the BackPEI questionnaire involved translating the questions to English. This was done in accordance with the recommendation of Guillemin et al. (1993) and followed the steps performed in earlier studies (Vigatto et al. 2007). Initially, the BackPEI was translated to English independently by three English language teachers. Later, the three versions were reviewed, compared and merged into a single version by a fourth English language teacher (T4), with extensive experience in translating health related papers, resident in Brazil and originally from the UK. Having the original Portuguese version of BackPEI and the final English version, two English speaking Brazilian PhD researchers, specialized in physical education, physiotherapy and public health, who had lived in English speaking countries for a minimum of 4 years, analyzed the semantic, cultural and conceptual equivalence of the two versions of the BackPEI, which can be considered equivalent to a back-translation step. Based on this process, minor adjustments were made to the English version of the BackPEI, which was then returned to the T4 for grammatical analysis. Only after completion of this process was

the final English version of the BackPEI obtained (see Electronic supplementary material 3 and 4).

Results

This section is divided into two parts. The first is concerned with the results of the content validation procedure and the second with those of the reproducibility process.

Content validation

As the first assessment of the BackPEI was made by specialists, it was necessary to modify approximately 30 % of the questions (Table 2). The corresponding suggestions and criticisms were taken into account when preparing the second version of the BackPEI. Particularly important among them were the need to improve the structure of the questions, include more alternative answers to some questions, improve the quality of the images, alter some of the images, alter the furniture used in the images and prepare a specific BackPEI for each sex in order to facilitate the identification of the schoolchildren with the images contained in the questionnaire, since some postures are more frequently adopted by one sex than by the other.

In the evaluation of the second version of the BackPEI, there was a considerable increase in the percentage of responses "well suited" (Table 2). Out of a total of 168 responses referring to the experts' analyses of the individual questions, only 1.8 % were classified as "unsuitable". It should be noted that the three responses referred to question 21, regarding the intensity of the pain. The experts suggested that a number scale should be included, which would change the VAS into a numerical scale of pain. However, given that the VAS has been validated in previous studies involving young populations, and has been used with this age group in large-scale studies (Mannion et al. 2005; Gunzburg et al. 1999; Korovessis et al. 2005; Watson et al. 2002), it was decided to maintain the visual scale in the BackPEI, as used in a recent study among school-age children (Robbins et al. 2009).

Reproducibility

To test its reproducibility, the final version of the BackPEI was applied to 260 schoolchildren on two distinct occasions (test and re-test), separated by a 1-week interval. According to the kappa coefficient for questions 1–20 in the questionnaire, 8 were classified as "very good" and 12 as "good" (Table 3). The response rate was high, with losses of less than 5 %, and the bias index was low, with values of less than 0.005.

The results referring to question 21 ($n = 115$), regarding the intensity of the pain, show that there is no difference between the averages for the test (3.27 ± 2.29) and re-test (3.13 ± 2.28) ($p = 0.251$), and the responses for these two tests are highly correlated (ICC $= 0.937$; $p < 0.0001$).

Discussion

The current literature lacks valid and reproducible instruments designed to evaluate not only the prevalence of back pain, but also the possible risk factors associated with this condition, such as the body posture adopted by school-age children during ADLs. For this reason, the present study has attempted to produce the BackPEI, specifically for the school environment. The main contribution of the BackPEI is that it permits posture to be evaluated as a risk factor for back pain. Moreover, the use of images in two versions,

Table 2 Results of the assessments of the first and second versions of the Back Pain and Body Posture Evaluation Instrument (BackPEI) made by the eight experts (Teutônia, Brazil, 2012)

Question	Answers of the first assessment			Answers of the second assessment		
	Well suited	Suitable	Unsuitable	Well suited	Suitable	Unsuitable
Regarding the clarity, ease of understanding and applicability of the BackPEI, in general, do you consider it	5	3	0	8	0	0
Regarding the objective of evaluating body posture in ADLs from photographs, do you consider the BackPEI	4	4	0	7	1	0
Regarding the objective of evaluating back pain and its associated factors, do you consider the BackPEI	5	3	0	7	1	0
Regarding the clarity, ease of understanding and applicability of each question in the BackPEI, do you consider this question[a]	118 (70.2 %)	38 (22.6 %)	12 (7.2 %)	154 (91.7 %)	11 (6.5 %)	3 (1.8 %)

[a] The total corresponds to eight experts commenting on 21 questions (168 answers)

Table 3 Results of the kappa coefficient for the 20 questions in the Back Pain and Body Posture Evaluation Instrument (BackPEI Portuguese version) (Teutônia, Brazil, 2012)

Question	Description of question	*N* (missing data)	Agreement	Kappa value (IC 95 %)	Bias index
1	Practice of physical exercise	260 (0.0 %)	98.8 %	0.897 (0.754 a 1.000)	0.005
2	Frequency of physical exercise[a]	242 (0.0 %)	81.0 %	0.731 (0.660 a 0.794)	0.002
3	Competitive or non-competitive physical exercise[a]	242 (0.0 %)	90.9 %	0.833 (0.765 a 0.891)	0.003
4	Time spent watching TV	260 (0.0 %)	73.5 %	0.636 (0.569 a 0.704)	0.002
5	Time spent each day using a computer	258 (0.8 %)	77.9 %	0.716 (0.641 a 0.788)	0.001
6	Reading and/or studying in bed	260 (0.0 %)	83.1 %	0.722 (0.644 a 0.790)	0.002
7	Preferred sleeping position	260 (0.0 %)	92.7 %	0.871 (0.806 a 0.928)	0.001
8	Time slept each night	260 (0.0 %)	76.2 %	0.667 (0.599 a 0.732)	0.002
9	Sitting position when writing	259 (0.4 %)	72.6 %	0.638 (0.560 a 0.709)	0.001
10	Sitting position on a chair when talking	260 (0.0 %)	75.0 %	0.647 (0.576 a 0.710)	0.002
11	Sitting position when using a computer	260 (0.0 %)	70.5 %	0.624 (0.544 a 0.699)	0.001
12	Position adopted when lifting an object from the floor	260 (0.0 %)	78.8 %	0.651 (0.567 a 0.728)	0.001
13	Carrying school material	260 (0.0 %)	100.0 %	1.000 (–)	0.000
14	Mode of transporting the school backpack[b]	252 (0.0 %)	96.8 %	0.871 (0.763 a 0.951)	0.001
15	Mother's level of education	260 (0.0 %)	92.7 %	0.897 (0.849 a 0.940)	0.001
16	Father's level of education	259 (0.4 %)	92.7 %	0.892 (0.842 a 0.934)	0.002
17	Parents with a history of back pain	260 (0.0 %)	79.2 %	0.691 (0.616 a 0.768)	0.001
18	Presence of back pain	260 (0.0 %)	90.4 %	0.831 (0.769 a 0.894)	0.001
19	Frequency of back pain[c]	115 (0.9 %)	79.1 %	0.695 (0.693 a 0.697)	0.001
20	Impeding the performance of activities[c]	114 (1.7 %)	92.1 %	0.763 (0.626 a 0.879)	0.002

[a] Refers to those who answered 'yes' in question 1 ($n = 242$)

[b] Refers to those who chose 'the backpack with two straps' in question 13 ($n = 252$)

[c] Refers to those who answered 'yes' in question 18 ($n = 116$)

one for each gender, is also an innovation, since some postures are more frequently adopted by one sex than by the other (Dunk and Callaghan 2005).

With regard to the development and validity of new instruments, this study followed the recommendations proposed by Grant and Davis (1997) and Rubio et al. (2003), since: (1) the BackPEI was developed based on field research and extensive consultation in the literature; (2) the experts were selected based on their training and experience in both teaching and research; (3) the BackPEI was assessed by eight experts who received an instruction manual and a standardized assessment form and could make suggestions and/or comments and establish comparisons between the two versions; (4) in more than 90 % of the evaluations, "well suited" was chosen by the experts (Table 2); (5) quantitative and qualitative procedures were used to assess each question in the BackPEI; and (6) the ease with which the questions in the BackPEI could be understood was assessed qualitatively by applying the questionnaire to a group of target schoolchildren.

Although self-reporting is considered to be subjective, our results show that, for all the questions, the reproducibility of the results is good and valuable information can be obtained. The findings related to pain intensity (question 21) show a high level of correlation in the test and re-test procedure (ICC > 0.93). In a systematic review of the psychometric properties, interpretability and feasibility of self-reporting pain intensity measures, Stinson et al. (2006) corroborate our findings, claiming that the VAS is the best means of obtaining data on pain intensity and confirm that it has good validity and reproducibility for children from 8 years of age.

The results of the testing and re-testing procedure for the first 20 questions showed a notably high level of agreement: over 70 % (Table 3). It should also be noted that the bias index values were very low and quite similar to each other (Table 3), which ensured that the observed high kappa values suffered no significant influence from the disagree rates (Sim and Wright 2005). These results suggest that the formulated questions are objective and easy to understand, expressing the perception of respondents with a high degree of certainty. Nevertheless, some results seem to be more reproducible than others. While there was 100 % agreement in both responses (test and re-test) to question 13 (carrying school material) from the 260 respondents, the lowest rates of reproducibility were found in questions that investigated the sitting posture (questions 9–11). The sitting posture, whether when watching TV,

using the computer or even when talking, seems to depend on a perception that body does not always faithfully reflect the self-image formed by the schoolchildren. By contrast, the posture adopted when carrying school material does not seem to reflect the same doubt, as there is a high degree of reproducibility. The literature has shown that the way of carrying school material seems to be well assimilated by schoolchildren, leaving no doubt about its execution (Candotti et al. 2012; Cardon et al. 2000).

The questions involving the temporal perception of a given activity (questions 4 and 8) are also among those with the lowest scores for reproducibility. It is known that an individual's subjective perception of the time involved in specific activities is highly dependent on factors such as motivation, interest and satisfaction (Staes et al. 1999; Bejia et al. 2006). Thus, the lower levels of reproducibility found with these questions precisely express that the students have greater difficulty assessing with certainty how much time they dedicate to the activities. It is worth mentioning that in the present study, a 1-week interval between the test and re-test was chosen in order that the students would not remember the responses they had given in the previous week, and it would be insufficient time for any change in habits or behavior that might interfere with the completion of the questionnaire (Pedhazur and Schmelkin 1991; Staes et al. 1999; Ayanniyi et al. 2011).

In general, the questionnaires described in the literature have some methodological problems in their development, as well as in their validation and reproducibility procedures. Most of the articles containing such questionnaires: (1) do not clearly describe the construction of the instrument, whether it was analyzed by experts and/or if it was developed based only on the experience of the researchers involved; (2) use too small a sample in the test and re-test procedures; and (3) fail to include postural habits as possible risk factors associated with back pain. Thus, the present study has sought to overcome these deficiencies by following an appropriate content validation procedure and using a sample that is considerably larger than those of previously published studies, so providing a more reliable result. Furthermore, besides the risk factors commonly evaluated in prevalence studies, the present study also includes a photograph-based evaluation of the key postural habits of school-age children. Furthermore, two versions were produced, one for each sex, which facilitate the identification of school-age children with the content of each question, their interpretation of the question and, consequently, provide for a more representative response (Cardon et al. 2000). Nevertheless, the BackPEI has some limitations: (1) as yet, the reproducibility of the English version has not been assessed, (2) the posture adopted when carrying school material is based solely on the use of the backpack with two carrying straps and (3) it does not assess posture during activities such as watching television or playing video games, which are common among school-age children.

Finally, it can be concluded that the questionnaire developed in this study, the BackPEI, constitutes a valid and reproducible instrument which is relevant for the evaluation of back pain and its associated risk factors, since, besides evaluating routinely assessed factors, it also evaluates postural habits in ADLs. Moreover, given that the assessment of postural habits depends on the interpretation of the photograph by the evaluated respondent, this instrument stands out from others because it was developed with separate versions for boys and girls and because it has been translated into English, which facilitates access to its content by other researchers. Considering that the questionnaire format is widely used in descriptive (cross-sectional or prospective studies) and epidemiological studies, the BackPEI may be applied in studies designed to evaluate back pain and its associated risk factors, particularly, bad posture in ADLs in school-age children in different regions of the world.

Conflict of interest The authors declare that they have no conflict of interest.

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