Back pain in Portuguese schoolchildren: prevalence and risk factors

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Background: Regarding children aged _10 years, only a few international studies were conducted to determine the prevalence of and risk factors for back pain. Although other studies on the older Portuguese children point to prevalence between 17% and 39%, none exists for this specific age-group. Thus, the aim of this study was conducted to establish the prevalence of and risk factors for back pain in schoolchildren aged 7–10 years.
Methods: A cross-sectional survey among 637 children was conducted. A self-rating questionnaire was used to verify prevalence and duration of back pain, life habits, school absence, medical treatments or limitation of activities. For posture assessment, photographic records with a bio-photogrammetric analysis were used to obtain data about head, acromion and pelvic alignment, horizontal alignment of the scapulae, vertical alignment of the trunk and vertical body alignment. Results: Postural problems were found in 25.4% of the children, especially in the 8- and 9-year-old groups. Back pain occurs in 12.7% with the highest values among the 7- and 10-year-old children. The probability of back pain increased 7 times when the children presented a history of school absences, 4.3 times when they experienced sleeping difficulties, 4.4 times when school furniture was uncomfortable, 4.7 times if the children perceived an occurrence of parental back pain and 2.5 times when children presented incorrect posture.
Conclusions: The combination of school absences, parental pain, sleeping difficulties, inappropriate school furniture and postural deviations at the sagittal and frontal planes seem to prove the multifactorial aetiology of back pain.

Introduction

According to literature, back pain is a severe health problem in nearly all industrialized nations.[1] Most people experience back pain at some point in their lives, but normally they deal with it by themselves and disregard the pain as a medical problem.[2] There is a distinction between specific and non-specific back pain, with the former referring to a pathological condition, whereas the latter presents, apparently, no organic cause.[3] Non-specific back pain is the most common, with a prevalence of 80–85% in the general population.[4]
In children, although the exact prevalence is unknown, back pain appears to be relatively common at school age.[5–9] The prevalence of back pain in children increases with age,[4,5,9,10] reaching its peak at around 11–13 years old.[8,11] Harreby et al.[6] report the relationship between the existence of back pain in adolescents and its occurrence among adults, adding that the presence of this disorder in adolescence increases the risk of chronicity in adulthood.[12] In the
Portuguese case, the prevalence of back pain increases with age, especially after the age of 15 years.[13]
Albeit the severity of the problem, risk factors for back pain in children and adolescents are not well established. Regarding biological factors, some authors report different prevalence values according to gender, with low back pain appearing higher in females,[4,14] whereas no association was shown with an underlying pathology. Some studies highlight a direct association between back pain and mechanical factors, such as excessive backpack load or the inadequacy of the school furniture,[15–17] where others do not find any association.[10,14].Lifestyles and psychosocial factors, such as family history of back pain, psychosomatic complaints or intensity of physical activity and a sedentary lifestyle have been related with back pain amongst schoolchildren,[5,9,18–20] although no agreement exists between authors related to the parental pain influence.
Coelho et al.[21] and Oliveira[13] reported a relation between lifestyles such as absence or high intensity of physical activity or playing video games and back pain in Portuguese adolescents.
Regarding younger children aged _10 years, the prevalence of and risk factors for back pain are even more uncertain, with only a few international studies conducted that overlap these age-groups, and none in Portugal.
For these reasons, the aim of this study was to provide evidence about the prevalence of and risk factors for back pain in Portuguese children aged 7–10 years.

Methods

Sample

From the children attending primary schools of Maia District, Portugal (n = 5200), we used a stratified sampling strategy to select 20% of this population (approximately 1100 children) to cover all villages of the district and all school years. After the postural evaluation (which was performed in children whose parents authorized the participation, n = 999), selection and analysis, we conducted a cross-sectional study, using a questionnaire to assess back pain, on the children who were still at the original school at the beginning of the new academic year (n = 662). We recorded a response rate of 96.2%, totalling 637 children (314 males and 323 females). The mean age of the sample was 9.0 years (SD = 1.0), with a minimum and maximum of 7 and 10 years, respectively.
There were no differences in prevalence, school year, BMI, age, weight and height, according to gender (table 1). Approximately26% of the parents had a college or graduate degree, 50% had a secondary education level and 22% completed the primary education.

The Portuguese Northern Regional Education Direction granted the ethical approval, and parents signed an informed consent form, allowing the participation of their children. This survey was conducted between February and March 2010.

Measures

Children completed a questionnaire to assess back pain. The questionnaire, based on those from Staes et al.,[22] both with good reliability values, (Kw = 0.70–0.93),[22] was designed to identify lifetime and point prevalence, duration of back pain, other pain manifestations and life habits. We also assessed consequences of back pain such as school absences, medical treatments or limitation of activities.

Lifetime prevalence was defined as the proportion of children who suffer an episode of back pain at any time in their lives, and point prevalence as the proportion of children who had suffered back pain during the previous week. An anatomical drawing[23] was used to identify the localization of pain. The severity of the pain was self-rated using a 100-mm visual analogue scale, rated from 0 (no pain) to 10 (much pain).[24]

The reliability of the questionnaire was established with a test– retest measure with 200 children aged 6–10 years, selected by convenience sampling from schools not participating in this study. The concordance between the two measures varies between K = 0.36–0.97 ($P < 0.001$), showing that the questionnaire was reliable for this sample. Because the questionnaires had to be read aloud to the younger children, we considered the validity from Staes et al.,[25] which tells that there is a good agreement between a self-rated questionnaire and an interview, using the same questionnaire.

For posture assessment, we used photographic records with a biophotogrammetric analysis.[26] We took three photographs of each child in the orthostatic position: anterior, right side and posterior.

A tripod (Hama 4161 Tripod Star 61) was positioned 3m away from the child and at a height equal to half of the child's stature. The pictures were obtained with a Nikon D60 10 megapixels camera.

Stickers were placed at glabella, tragus, acromion, C7, T3 and L4 spinous process, inferior angle of the scapula, anterior and posterior superior iliac spine, greater trochanter of the femur, joint line of the knee, centre of the patella, lateral and medial malleolus, the fibular head and the fifth metatarsal tuberosity.[26,27]

The photogrammetric analysis was conducted in the postural evaluation software SAPo v 0.681_, which has good reliability

Table 1 Characteristics of the sample, according to gender ($n = 999$)

	Gender		Total	Test	*P*
	Male (49.99%)	Female (50.09%)			
School year, n (%)					
1st	115 (11.5)	118 (11.8)	23.3		
2nd	149 (14.8)	148 (14.7)	29.5		
3rd	132 (13.2)	139 (13.8)	27.0		
4th	105 (10.5)	97 (9.7)	20.2	0.529*	0.912
BMI, n (%)					
Normal weight	362 (36.2)	359 (36.0)	72.2		
Overweight	135 (13.5)	143 (14.3)	27.8		0.672**

	Gender		Total	Test	*P*
	Male	Female			
Age (years) mean (SD)	8.97 (0.98)	8.92 (0.99)		−0.851***	0.397
Weight (Kg) mean (SD)	30.73 (7.52)	30.61 (8.01)		−0.237***	0.812
Height (cm) mean (SD)	130.19 (8.19)	129.29 (8.71)		1.658***	0.098

*Chi-square; ** Fisher's exact test; ***T-test.

values.[28] One examiner evaluated all cases and, to test the reliability of the measures, another blind examiner evaluated approximately 150 children. The inter-rates values obtained, given by the intraclass correlation coefficient (ICC), were good (ICC > 0.80).

Procedures

All children completed the questionnaire during class time.

Questions were read aloud to younger children by the researcher to facilitate their understanding of what had been asked.

To obtain the posture photographic registers, participants, in bathing suits and barefoot, were instructed to pose on a mat with footprints to mark their position. The anatomical landmarks were marked with 1 cm black circular adhesives and polystyrene spheres fixed with double-face adhesive tape. The following variables were analyzed: head alignment, acromion alignment, alignment of the anterior and posterior superior iliac spine, horizontal alignment of the scapulae, vertical alignment of the trunk, hip angle, vertical body alignment and horizontal pelvis alignment.[26] The results of the postural assessment were dichotomized (0 = no problems; 1 = sagittal or frontal problems) to facilitate the analysis.

Descriptive statistics was performed to represent the back pain data. Chi-square and student t analysis were used to characterize children.

To evaluate the predictors of the possibility of occurrence of back pain in children, including age, posture, family history of back pain, school furniture adequacy and psychosomatic complaints (sleeping problems, lack of appetite, school absences because of back or abdominal pain), we used the logistic regression analysis.

Preliminary analyses showed no violations on the assumptions of regression, but because we have found outliers in our first analysis, we tested the model with and without outliers. The logistic

Table 2 Postural problems, sadness, sleeping difficulties, back pain, absence to school and parental pain according to the age of the children

	Age				X^2	*P*
	7	8	9	10		
Posture, *n* = 999						
Normal n (%)	65 (70.7)	184 (77.0)	208 (70.3)	288 (77.4)		
Altered n (%)	27 (29.3)	55 (23.0)	88 (29.7)	84 (22.6)	6.054	NS
Back pain, *n* = 637						
Yes n (%)	10 (15.9)	18 (10.3)	27 (11.7)	25 (15.2)		
No n (%)	53 (84.1)	157 (89.7)	203 (88.3)	144 (84.8)	2.655	NS
School furniture adequacy, *n* = 637						
Yes n (%)	53 (83.9)	131 (74.9)	170 (73.9)	104 (61.5)		
No n (%)	10 (16.1)	44 (25.1)	60 (26.1)	65 (38.5)	14.582	0.002
Perceived parental pain, *n* = 637						
Yes n (%)	35 (55.6)	123 (70.3)	169 (73.5)	132 (78.2)		
No n (%)	28 (44.4)	52 (29.7)	61 (26.5)	37 (21.8)	12.257	0.007
Sadness, *n* = 637						
Yes n (%)	5 (6.5)	7 (4.0)	21 (9.1)	13 (8.2)		
No n (%)	58 (93.5)	168 (96.0)	209 (90.9)	155 (91.8)	4.217	NS
Sleeping difficulties, *n* = 637						
Yes n (%)	27 (42.9)	59 (33.7)	48 (20.9)	43 (25.7)		
No n (%)	36 (57.1)	116 (66.3)	182 (79.1)	126 (74.3)	16.014	0.001
Lack of appetite, *n* = 637						
Yes n (%)	13 (19.4)	25 (14.3)	59 (25.4)	39 (23.5)		
No n (%)	50 (80.6)	150 (85.7)	171 (74.6)	130 (76.5)	8.120	0.044
Absence because of back pain, *n* = 637						
Yes n (%)	2 (3.2)	5 (2.9)	11 (4.8)	14 (8.2)		
No n (%)	61 (96.8)	170 (97.1)	219 (95.2)	155 (91.8)	5.792	NS
Absence because of abdominal pain, *n* = 637						
Yes n (%)	16 (25.4)	55 (31.4)	92 (40.0)	74 (43.9)		
No n (%)	47 (74.6)	120 (68.6)	138 (60.0)	95 (56.1)	10.265	0.016
Absence because of headache, *n* = 637						
Yes n (%)	19 (83.9)	51 (74.9)	80 (73.9)	68 (61.5)		
No n (%)	44 (16.1)	124 (25.1)	150 (26.1)	101 (38.5)	5.202	NS

Table 3 Logit coefficients of the logistic regression model of the variable 'children back pain' according the absences to school because of back pain, school furniture adequacy, sleep difficulties, perceived parental pain and children posture

Variables	B	S.E.	X^2_{Wald} (d.f)	*P*	Exp(B)	95% CI (Exp(B))
Absences to school because of back pain	1.855	0.458	16.442 (1)	<0.001	6.392	2.61; 15.67
School furniture	1.431	0.318	20.303 (1)	<0.001	4.184	2.24; 7.80
Sleep difficulties	1.328	0.318	17.436 (1)	<0.001	3.775	2.02; 7.04
Perceived parental pain	1.519	0.506	9.008 (1)	0.003	4.569	1.69; 12.32
Posture	1.002	0.319	9.855 (1)	0.002	2.724	1.46; 5.09
Constant	−5.637	0.612	84.918 (1)	<0.001	0.004	

Table 4 Logit coefficients of the adjusted logistic regression model of the variable 'children back pain' according the absences to school because of back pain, absences to school because of abdominal pain, school furniture adequacy, sleep difficulties, perceived parental pain and children posture

Variables	B	S.E.	X^2_{Wald} (d.f)	*P*	Exp(B)	95% CI (Exp(B))
Absences to school because of back pain (1)	1.974	0.455	18.809 (1)	<0.001	7.197	2.95; 17.56
Absences to school because of abdominal pain (1)	0.687	0.311	4.866 (1)	0.027	1.987	1.08; 3.66
School furniture (1)	1.486	0.315	22.295 (1)	<0.001	4.421	2.39; 8.19
Sleep difficulties (1)	1.471	0.309	22.705 (1)	<0.001	4.356	2.38; 7.98
Perceived parental pain (1)	1.567	0.507	9.566 (1)	0.002	4.792	1.78; 12.94
Posture (1)	0.934	0.314	8.863 (1)	0.003	2.545	1.38; 4.71
Constant	−5.496	0.605	82.621 (1)	<0.001	0.004	

regression omitting outliers was 3 per cent (89.4%) more accurate classifying cases than the logistic regression with all cases (86.6%).
Thus, we decided to interpret the logistic regression model without outliers (n = 616).
Statistical analysis was performed using IBM SPSS Statistics 19.0
(IBM Corporation).

Results

Postural problems were found in 25.4% of the children, whereas back pain occurred in 12.7% of the children. Sleeping difficulties and school absences because of abdominal and headaches were the more reported issues (28.8% and >30.0%, respectively).
No statistically significant differences according to gender were found.

In table 2, the results of posture- and pain-related variables according to age can be seen. The 7- and 10-year-old groups register the highest values of back pain, whereas postural problems are more prevalent on the 8- and 9-year-old groups. The prevalence of postural problems and back pain, presence of sadness and school absences because of back pain or headaches do not vary among age groups, but other factors do seem to depend on the children's age.

Both the perceived parental pain and the adequacy of the school furniture increase with age (55.6% in the 7-year-old group vs. 78.2% for the 10-year-old group, for the former case, and 10.1% vs. 38.5%, for the latter). Complaints of sleeping difficulties, in its turn, are more common among younger children, whereas lack of appetite and absence to school because of abdominal pain, by opposition, are more prevalent in older children.

To evaluate the predictors of the possibility of occurrence of back pain in children, we used a logistic regression model. A previous logistic regression analysis using the Enter method (table 3) shows a statistically significant effect on the Logit of a child having back pain ($G_2(9) = 103.338$; $P < 0.001$; $X_{2\ HL}(8) = 6.096$; $P = 0.637$; $R_{2\ HL} = 0.154$; $R_{2\ N} = 0.320$). However, only the variables school absences because of back pain (OR = 6.392; 95% CI 2.61–15.67), school furniture adequacy (OR = 4.184; 95% CI 2.24–7.80), sleeping difficulties (OR = 3.775; 95% CI 2.02–7.04), perceived parental pain (OR = 4.569; 95% CI 1.69–12.32) and posture (OR = 2.724; 95% CI 1.46–5.09) show a statistically significant effect over the Logit of a child having back pain.

A new adjusted model, using the Forward:LR method, was performed (table 4).The resulting model is statistically significant ($G_2(6) = 99.196$; $P < 0.001$; $X_{2\ HL}(7) = 4.210$; $P = 0.755$; $R_{2\ CS} = 0.149$; $R_{2\ N} = 0.308$).

The new adjusted model shows that the variables school absences because of back pain (OR = 7.197; 95% CI 2.95–17.56), school furniture adequacy (OR = 4.421; 95% CI 2.39–8.19), sleeping difficulties (OR = 4.356; 95% CI 2.38–7.98), perceived parental pain (OR = 4.792; 95% CI 1.78–12.94), posture (OR = 2.545; 95% CI 1.38– 4.71) and abdominal pain (OR = 1.987; 95% CI 1.08–3.66) have a statistically significant effect over the Logit of the probability of back pain in the children.

The probability of a child having back pain (Y = 1) increases 7 times when the children presented a history of school absences with back pain complaints, 1.9 times with abdominal pain complaints and 4.3 times when the children had sleeping difficulties.

Considering the referred variables, the probability of back pain occurrence in children increases 4.4 times when the school furniture was uncomfortable, 4.7 times if the children perceive an occurrence of parental back pain and 2.5 times when children present incorrect posture.

The adjusted logistic regression model was also used to classify the sample, and 89.4% of the sample was correctly classified. This adjusted model presented a high sensitivity (87.5%) and specificity (78.5%). The model also had an excellent capacity to discriminate children with and without back pain (ROC curves = 0.903; $P < 0.001$).

Discussion

The aim of this study was to provide evidence on the prevalence of and risk factors for back pain in Portuguese schoolchildren aged 7–10 years. Our original sample of 999 children registered a drop out of almost 34% because of the amount of time between data collections. The postural assessment was conducted during a school period, whereas the questionnaire was only filled in the next period; hence, the older children, having finished basic education, were no longer available.

In this study, we opt to deal with spinal pain generally, similar to what Trevelyan et al. and Mikkelsson et al.[29,30] did, as back pain in children seems to be a general phenomena, and to consider only one location would compromise the understanding of it.

Our study shows approximately 12% life prevalence of back pain. These values are lower than the ones found in other studies on the Portuguese population, which vary from 17–20% to approximately 39%.[13,21] These are, however, from children aged _10 years, older than those in our sample. Reporting back to studies conducted in other countries with an age-group similar to ours, the values go from 18% at the age of 10 years[9] to 36% in children who are 9 years[31] and 34% in children between 8 and 10 years of age.[7]

These results show that the prevalence in our sample is among the lowest for this age-group. Comparing the 15.2%, we found for the 10-year-old group, they are close to the 18% reported by Jones et al.[32] Nonetheless, the highest value of life prevalence in our sample (15.9%) is in the 7-year-old group. We can assume that these values come from recall errors, already mentioned by Croft et al.[33] because participants can fluctuate in the way they recollect events.

Considering the differences between genders, some authors report a higher prevalence among females,[5,9,11,14,19,34–37] whereas Burton et al. accounts for a larger number of complaints between males (52.6% vs. 34.3%), especially those who are sports practitioners.[8]

Other studies, however, and in line with our own, did not find any statistically relevant differences between genders.[7,10,31,32] Albeit the statistical irrelevance, our findings show a higher prevalence of pain among females, the same result as shown by Jones[10] and Wedderkopp et al.[7]

Our study found that complaints regarding school furniture adequacy was one of the most significant predictors for the existence of back pain, especially on children aged 9 and 10 years, seeming that as children grow older, the inappropriateness of the school furniture becomes more pronounced. The studies from Trevelyan et al.[38] and from Murphy et al.[18] also found a high association between the school furniture and back pain, where low back pain and neck pain are related with the chair back rest being too low, too far back or too curved. Low back pain was also linked to very low table tops,[34,38] which seems to confirm that bigger children present more complaints, something that was also reported by Parcells et al.[39]

The time children spent in sitting position, at school or home, has been associated with back pain.[11,40,41] Lafond et al.,[27] in their postural study with children aged 4–12 years, describe postural differences found at the sagittal plane, which can be influenced by the amount of time spent sitting, increasing postural translations that occur at the sagittal plane.[27]

Nissinen et al.[40] report, in a longitudinal study with children aged 11 years, a significant association between back pain and the trunk asymmetry. Opposite results were found by Poussa et al.[42] regarding the prediction of neck pain due to trunk asymmetry, lordosis or kyphosis. In our study, the presence of postural deviations at the sagittal and frontal planes was a predictor for back pain in the logistic regression model together with other variables.

The presence of parental pain is, in the current study, a predictor for back pain in children. The existence of a family history of complaints is associated with a higher number of complaints of pain in children.[18] In the study of Balague´ et al.,[5] the prevalence of back pain was 21% in children where one of the parents had suffered from back pain and 24% when both parents had complaints, compared with the 14% prevalence on children with healthy parents. Opposing conclusions were reported by Jones et al.[43] who did not find any association between parental and children pain.

The absenteeism from school, which can be directly connected to the consequences of back pain, is, in the logistic regression, the variable with the highest effect. In fact, both the absenteeism from school because of back and abdominal pain present high levels of odds ratio (OR) [ORffi7 and ORffi2] in complaining children compared with those without pain. Identical results were reported in several studies.[7,32,44] Jones et al.[32] refer an absenteeism of 7.8% in children with back pain, whereas Wedderkopp et al.[7] report 13% in a sample of children aging from 8 to 16 years. In the study of Roth-Isigkeit et al.,[44] among juveniles ageing 10–18 years, 48.8% of the participants reported absenteeism to school, mainly by back pain and headache.

Sleeping difficulties also appear related to back pain in our study, where children with pain present 4 times more risk of having sleeping difficulties than those without pain. The association between back pain and somatic complaints is described by many authors,[10,18,29,30,37,38] but a specific mention to sleeping difficulties is reported by Roth-Isigkeit.[44] Other somatic complaints, such as lack of appetite, or emotional complaints, such as sadness, are reported by 22.7% and 7.6% of our sample, respectively. However, none of these variables appears as a predictor for back pain when introduced in the logistic regression model.

Different studies also refer a relation between the weight of and the way the school material is carried[11,13,16,17,41] or the practice of physical exercise and back pain.[8,10,11,21,34,35,38,41] These associations, however, were not found in this study. All these studies were conducted on children older than those in our sample, which can explain the origin of the unconformity of the results obtained. Another explanation can be related with the questionnaire itself.

Although the values we obtained in the test–retest with children aged 6–10 years showed that the questionnaire was reliable for this sample, the younger children may have misinterpreted some of the questions, causing the differences.

One of the positive aspects of this study is that it combines a questionnaire with a postural observation. As far as we know, only one other study was conducted with a similar sample,[27] which evaluated the posture of 1084 children between 4 and 12 years of age, but the postural development of children were not related with back pain. Therefore, this study has in its favour the possibility of understanding the relation between postural changes and the occurrence of back pain in schoolchildren.

Conclusions

In our study, school absences, parental pain, sleeping difficulties, inappropriate school furniture and postural deviations at the sagittal and frontal planes were predictors for back pain in schoolchildren. This combination of risk factors seems to prove the multifactorial aetiology of back pain.

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