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School children's backpacks, back pain and back pathologies

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ABSTRACT

Objective To investigate whether backpack weight is associated with back pain and back pathology in school children.

Design Cross-sectional study.

Setting Schools in Northern Galicia, Spain.

Patients All children aged 12–17.

Interventions Backpack weight along with body mass index, age and gender.

Main outcome measures Back pain and back pathology.

Results 1403 school children were analysed. Of these, 61.4% had backpacks exceeding 10% of their body weight. Those carrying the heaviest backpacks had a 50% higher risk of back pain (OR 1.50 CI 95% 1.06 to 2.12) and a 42% higher risk of back pathology, although this last result was not statistically significant (OR 1.42 CI 95% 0.86 to 2.32). Girls presented a higher risk of back pain compared with boys.

Conclusions Carrying backpacks increases the risk of back pain and possibly the risk of back pathology. The prevalence of school children carrying heavy backpacks is extremely high. Preventive and educational activities should be implemented in this age group.

INTRODUCTION

Back pain is currently a health problem of school children which can limit daily-life activities. Sedentary lifestyle is possibly the most important factor determining back pain among school children. According to the 2006 Spanish National Health Enquiry, 11.8% of students aged 10–15 classified themselves as sedentary.¹ Sedentarism along with lack of physical activity contributes to a lower muscular tonicity of the back. Some studies have shown that an individual with back pain in adolescence is more likely to develop low back pain in adult life or that heavy backpacks can cause neck, shoulders and back muscular problems, such as scoliosis.^{2,3} Experts recommend that school children should not carry loads exceeding 10% of their body weight.⁴

The objective of this study is to analyse the influence of backpack weight on back pain and back pathologies.

SUBJECTS AND METHODS

This is a cross-sectional analytic study among school children aged 12–17 for the academic year 2005–2006 in Northern Spain. Eleven schools in the area took part in the study.

What is already known on this topic

- ▶ School backpacks have been associated with back pain and it is thought that they can create back pathology in adult life.
- ▶ Prevalence in back pain and backpack weight of school children is highly variable among countries.
- ▶ There are very few studies analysing the relationship among backpack weight and back pathology in school children.

What this study adds

- ▶ In all, 61.4% and 18.1% of participants carried backpacks exceeding 10% and 15% of their body weight, respectively.
- ▶ Those carrying the heaviest backpacks presented a 50% higher risk of back pain and a close to significant risk of back pathology.

School children were weighed twice on digital scales with an integrated height metre (SECA 764, Spain); the first time without overcoats and objects posing an extra weight (such as mobile phones, keys, coins) but with the backpack they were carrying that day and the second time without the backpack. Height was obtained placing children's backs against the height metre with joint heels. The weighting day was known by academic authority but not by school children and it was randomly chosen.

School children's parents or legal tutors fulfilled a questionnaire on their children's lifestyle with special emphasis on frequency of sports activities (at school) and duration of sedentary activities performed at home. Presence of a lesion or pathology previously diagnosed by a physician (such as scoliosis, kyphosis) and presence of back pain for more than 15 days in the previous year were also ascertained.

We compared the characteristics of initially included school children with those finally analysed. Two logistic multivariate models were used, having each one as the main dependent variable the presence or absence of pain during more than 15 days in the previous year and the presence or absence of back pathology. In both models, the main independent variable was

Table 1 Relationship between the school bag weight and back pain for more than 15 days

Variable	Back pain n (%)		OR (CI 95%)
	No	Yes	
School bag weight			
First quartile	248 (23.9)	83 (22.8)	1
Second quartile	278 (26.8)	87 (23.9)	1.0 (0.7 to 1.4)
Third quartile	258 (24.8)	85 (23.4)	1.1 (0.7 to 1.5)
Fourth quartile	255 (24.5)	109 (29.9)	1.5 (1.1 to 2.1)
Body mass index			
First quartile	268 (25.8)	87 (23.9)	1
Second quartile	264 (25.4)	82 (22.5)	0.8 (0.6 to 1.2)
Third quartile	257 (24.7)	96 (26.4)	1.0 (0.7 to 1.4)
Fourth quartile	250 (24.1)	99 (27.2)	1.1 (0.8 to 1.5)
Perform some type of sports activity			
No	472 (45.7)	181 (49.7)	1
Yes	561 (54.3)	183 (50.3)	1.0 (0.8 to 1.3)
Sex			
Boy	528 (50.8)	145 (39.8)	1
Girl	511 (49.2)	219 (60.2)	1.6 (1.3 to 2.1)
Age (continuous variable)	–		1.2 (1.1 to 1.3)

the school bag weight classified in quartiles. Adjustment variables were gender, age (continuum), body mass index (quartiles) and sport activities (yes/no). Results were obtained with Statistical Package for the Social Sciences, v17.0 (SPSS). The Burela Hospital Ethics Committee approved the study protocol.

RESULTS

The sample initially included 2135 school children and 1403 (65.7%) were analysed. There were no differences between analysed and excluded school children. The mean age of participants was 14 years and 92.2% used a backpack with two shoulder straps. Mean school bag weight was nearly 7 kg. In all, 61.4% of participants carried school bags exceeding 10% of their body weight and 18.1% exceeded the 15% of their body weight; 25.9% reported to have had back pain for more than 15 days in the previous year. The most frequent pathology was scoliosis (70% of the pathologies reported) followed by low back pain and contractures (10% each).

Participants carrying school bags on the highest quartile had a 50% higher risk of back pain for more than 15 days (OR=1.50 CI 95% 1.06 to 2.12) (table 1). Girls had a higher risk of back pain and an increased risk with age was observed. When analysing the relationship between school bag weight and back pathology there was a non-significant association for those weights on the highest quartile (OR=1.42 CI 95% 0.86 to 2.32). Girls had a higher risk of back pathology and the risk of back pathology was observed to increase with age (table 2).

DISCUSSION

Children carrying the heaviest backpacks have a higher risk of suffering from back pain and a higher risk of back pathology. Most school children carry backpacks exceeding the recommended weights.

Many studies have found that backpacks alter posture and gait significantly, produce modifications in the head-neck angle, shoulder asymmetry and even lumbar lordosis. These biomechanical alterations could induce the appearance of chronic pain and back pathologies in the long term.

Table 2 Relationship between the school bag weight and back pathology

Variable	Back pathology n (%)		OR (CI 95%)
	No	Yes	
School bag weight			
First quartile	297 (23.7)	34 (22.8)	1
Second quartile	325 (25.9)	40 (26.8)	1.2 (0.7 to 1.9)
Third quartile	311 (24.8)	32 (21.5)	1.0 (0.6 to 1.7)
Fourth quartile	321 (25.6)	43 (28.9)	1.4 (0.9 to 2.3)
Body mass index			
First quartile	321 (25.6)	34 (22.8)	1
Second quartile	307 (24.5)	39 (26.2)	1.1 (0.6 to 1.7)
Third quartile	314 (25.0)	39 (26.2)	1.0 (0.6 to 1.6)
Fourth quartile	312 (24.9)	37 (24.8)	1.0 (0.6 to 1.6)
Perform some type of sports activity			
No	584 (46.8)	69 (46.3)	1
Yes	664 (53.2)	80 (53.7)	1.2 (0.8 to 1.7)
Sex			
Boy	612 (48.8)	61 (40.9)	1
Girl	642 (51.2)	88 (50.1)	1.5 (1.0 to 2.2)
Age (continuous variable)	–		1.3 (1.1 to 1.4)

Between 20% and 45% of young people aged 14–18 have back pain for more than 15 days. A study performed in Northeast England in 2002 showed a low back pain prevalence of 24%, with girls posing a higher prevalence compared with boys.⁵ Another study performed in Italy by Negrini and Negrini³ found that 11-year-old children carried backpacks as heavy as 20% of their body weight, and also that 58.4% had experienced back pain more than once in their lifetime.

Girls are more prone to experience back pain and back pathology than boys, although there are no differences on backpack weight by gender. Grimmer *et al*⁶ observed that girls were more prone to have changes in the craniovertebral angle when carrying a backpack and this association became stronger with age.

The cross-sectional design of the present study is a limitation, as it limits the causal inference of its findings. In this type of study, it is difficult to measure past events such as pain lasting more than 15 days. Other factors that have not been studied such as poor physical fitness, poor back posture, structural scoliosis and hypermobility cannot be excluded as the real cause of back pain. It is possible that backpacks were carried frequently with one strap instead of two with this fact acting jointly with weight in back pain incidence. The strength of this study is the sample size, which allows for precise estimations adjusted by sex, age, body mass index and sports activity.

The results obtained have strong implications. Many children transport excessively loaded backpacks, an excess which would not be allowed for workers in employment. We strongly encourage the medical and educational community to start advising parents and school children about the risks posed by heavy school bags and the fact that this risk can be easily reduced.

Contributors All authors contributed equally to the writing of the manuscript. PRO, ARR, FBG and MPR designed the study. DGF, AFA and ICN performed the statistical analysis. All authors interpreted the results and discussed the most relevant information to be communicated.

Competing interests None.

Ethics approval Approval provided by the Burela Hospital Ethics Committee.

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