

Review

Back pain in children and adolescents: is the schoolbag a risk factor?

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Abstract

Non-specific back pain in children and adolescents is multifactorial and its prevalence is increasing. Schoolbags have been traditionally linked to back pain; and clinicians are frequently asked for advice regarding schoolbag use and specifically regarding its weight. Currently, there are various recommendations on the schoolbag use, such as the 'ideal' weight of a schoolbag to be within 10%-15% of the child's body weight, and the correct bag size, type, handling and wear. Conversely, numerous recent studies found no association between schoolbag characteristics including weight, design and carriage method and increased risk of developing back pain in the paediatric population.

The aim of this mini-review is to discuss back pain in children and adolescents and summarize recent evidence on the association between schoolbags and back pain. Overall, there is a lack of convincing evidence in the current literature regarding the association between back pain and carrying a schoolbag, and more research is needed to elucidate any possible association and risk factors.

Keywords

Back pain; children; adolescents; schoolbag; weight.



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1.	Schoolbag weight (or percentage bag to body weight / perceived weight)
2.	Schoolbag design (backpack vs. with handles or a rolling schoolbag)
3.	Schoolbag characteristics (material, width/padding of shoulder straps, additional waist belt or chest strap, compartments for even weight distribution, etc.)
4.	Method of carrying (i.e.: one shoulder vs. both shoulders, or by hand)
5.	Number of bags
6.	Duration of use

1.	Maximum schoolbag weight $\leq 15\%$ of his/her body weight.
2.	Correct Size: proportional to the child's height.
3.	Only carry necessary books and materials home each night if possible.
4.	Store items in a locker when possible.
5.	Proper backpack wear: straps on both shoulders and use of the waist strap or chest strap. (straps need to be adjusted to fit snugly - the schoolbag should rest in the middle of the child's back and the lowest part of the schoolbag in the curve of the lower back.)
6.	Distribute the weight properly: heaviest items low and near the centre of the back.
7.	Schoolbag characteristics: lightweight, wide and padded shoulder straps, padded back, waist belt or chest strap, from sturdy material (to prevent from sharp objects), multiple compartments for even weight distribution.
8.	Consider using a schoolbag with handles or a rolling schoolbag if school allows it.
9.	Correct way to pick up the schoolbag: Bending the knees to avoid back strain
10.	When required: Do not wear/lift a schoolbag. (e.g.: after surgery or an injury.) Do not ignore back pain that occurs at times other than wearing the schoolbag. Ask your doctor for advice.

Introduction

The prevalence of back pain reported by children and adolescents is overall increasing, and more specifically it increases rapidly with age through adolescence.¹⁻³ In an international survey of pain in adolescents, back pain has been reported to be as high as 27%, 37% and 47% among children aged 11, 13 and 15 years, respectively,³ and in other studies it has been found that by the age of 17 years up to 71% have experienced at least one episode of back pain.¹

Back pain can be either acute or chronic (which is often associated with overuse); traumatic or non-traumatic; and specific (i.e.: secondary to an underlying disease) or non-specific (i.e.: when there is no evident cause of the pain); with the later representing the largest group of back pain in older children and adolescents.³ Prompt differentiation between specific and non-specific back pain is vital in order to avoid unnecessary investigations but also critical delays in

case of a more sinister underlying diagnosis and for targeted therapy.

A comprehensive medical history and a thorough clinical examination are fundamental and traditionally, the presence of isolated back pain in a child has been an indication for imaging. However, recently a more conservative approach has been suggested using clinical criteria, the so called clinical "red flags" that dictate further imaging.⁴ These red flags include the presence of constant pain, night pain, radicular pain, pain lasting >4 weeks, fever, young age (<10 years); alone or in combination, as well as abnormal neurologic examination or clinical and laboratory findings suggestive of an infectious or neoplastic process. As per the American College of Radiology Appropriateness Criteria, imaging is not recommended in a child with back pain with no red flags; but in the presence of one or more red flags, the initial imaging should include spine radiographs (limited to area of interest),

with spine MRI without contrast to evaluate further if needed. Intravenous contrast may be useful if there is concern for inflammation, infection, or neoplasm; and further imaging including CT scan (limited to area of interest) and Tc-99m bone scan may be indicated in some cases.⁴

Regarding the specific back pain in childhood and adolescence, there is a wide spectrum of differential diagnoses, including congenital and acquired underlying conditions that must be considered and excluded.³ Overuse-related specific chronic back pain is often associated with spondylolysis and is common in the paediatric and young athlete.^{3,4} On the other hand, non-specific back pain represents the largest group of back pain in the older child and adolescent and it is a predictor of chronic back pain in adulthood.^{3,5} Its aetiology is unknown, and several studies investigating risk factors for non-specific back pain in the paediatric population report mostly unclear associations.^{1,6} Frosch et al., in a recent comprehensive literature search identified potential risk factors for non-specific back pain in children and adolescents including high levels of sports, family history of back pain, workplace factors, and health behaviour.³ There is also evidence suggesting that psychosocial factors (e.g.: distress), female gender and smoking may increase the risk of back pain in this population.³ Furthermore, there seems to be association between back pain in children and the presence of a family member complaining of back pain, history of previous back injury, increased daily television time, and conduct and hyperactivity problems.^{7,8} However, the evidence for anthropometric factors (including height and weight), posture and lifestyle factors is controversial and of generally poor quality. Interestingly, Frosch et al. did not find any association between non-specific back pain and physical factors, including height, weight, BMI, posture, ethnicity, or socioeconomic status.³ Finally, biomechanical factors and loading are also considered as causes for back pain in children and adolescents; but the evidence is inconsistent.¹

Carrying a schoolbag, which is part of the daily activities for the vast majority of children and adolescents, has also been linked to musculoskeletal pain and especially back pain in the pediatric population.⁶ Clinicians, and especially paediatric orthopaedic surgeons, are frequently asked for advice regarding the maxi-

imum “safe” weight and preferred style of a schoolbag as well as how to carry the schoolbag to minimize the risk of back pain. Despite extensive research on this topic, there are variable recommendations regarding a safe load limit and other factors associated with carrying a schoolbag.¹ Overall, there is still no consensus within the literature and the association between schoolbag weight and the risk of back pain remains inconclusive. The aim of this mini-review is to discuss back pain in children and adolescents and summarize recent evidence on the association between schoolbag use and back pain in this population.

Association between schoolbag characteristics and back pain in students

The schoolbag, including its weight and other characteristics, is considered to be one of the biomechanical factors often implicated as a cause of non-specific back pain in children and adolescents; and traditionally schoolbags have been linked to back pain in this population.⁶⁻⁹ The main schoolbag characteristics and related risk factors for back pain in students are summarized in Table 1. Currently, there is variation regarding the recommendations for children and adolescents carrying schoolbags; and guidelines for safe maximum bag weight are mostly within 10%–15% of body weight but can vary from 5% up to 20%.¹ Biomechanical studies have suggested that even a schoolbag weight of 10% of the child’s body weight may be enough to cause changes in kinematics, body posture and muscular strain.¹ In a cross-sectional study across all schools in Malta among students aged 8-13 years, Spiteri et al. found that in over 70% of the 4005 students-participants, the schoolbag weight exceeded the recommended 10% bag weight to body ratio; and 32% of the students complained of back pain, defined mainly as low in intensity on the face pain scale-revised. The authors therefore concluded that self-reported back pain in schoolchildren is independently linked to carrying heavy schoolbags, and there seems to be an increased risk of developing back pain with every 1% increase in bag weight to body weight ratio.⁹

Other parameters, such as duration of use, schoolbag design, and method of carrying the schoolbag (i.e.: one shoulder vs. both shoulders, or by hand) are also considered as potential risk factors for back pain in children and adolescents; but the evidence is contro-

versial.^{1,3,7} Regarding the duration of schoolbag use, other factors such as location of school/class room (level, need to change class rooms during the day), school facilities (lockers), school grade, etc. may also play a role.⁹ Although some studies support a positive association between the aforementioned parameters and back pain in children; a recent systematic review failed to confirm any significant association.¹ On the contrary, the perceived weight (i.e.: child's perception of schoolbag weight) and difficulty in carrying the schoolbag seem to be associated with back pain and persistent symptoms.^{1,8}

Overall, more recent studies, including five longitudinal studies (with 1851 children and adolescents) and more than 60 cross-sectional studies, did not find any significant association between non-specific back pain in children and adolescents and carrying a schoolbag; and at present, there is no convincing evidence that aspects of schoolbags, including the schoolbag weight or its weight as a percentage of the child's body weight, increase the risk of back pain in this population.^{1,3,7} Furthermore, a possible association between schoolbag use and school absence due to back pain has not been investigated.¹ However, none of the studies investigated the association between schoolbag use and care seeking for back pain, or schoolbag use and school absence due to back pain.

Recommendations for children and adolescents carrying schoolbags

Despite the reassuring findings of recent studies confirming that there seems to be no association between paediatric back pain and carrying a school bag,^{1,3,7} an increasing awareness by the general public regarding the magnitude of load carried by students to and from school is noted. Clinicians, and especially paediatricians and paediatric orthopaedic surgeons, are frequently asked for advice regarding the maximum "safe" weight and preferred type of a schoolbag as well as the 'correct' way to carry the schoolbag. Currently there are various published recommendations for children and adolescents carrying schoolbags; and the majority of guidelines for safe loads are within 10%-15% of child's body weight.^{1,10} For example, the American Academy of Pediatrics has published recommendations for parents to choose the 'correct' backpack or schoolbag to "decrease back strain and

pain".¹⁰ These recommendations are summarized in Table 2; and include the maximum schoolbag weight, the correct bag size and type, correct handling, proper wear and weight distribution; and tips such as the use of lockers and reduced number of books, as well as certain 'contraindications' when the schoolbag should not be used or 'red flags' when the back pain should not be ignored by the parents, teachers and clinicians.

Discussion

Paediatric back pain, and especially non-specific back pain is multifactorial;⁹ and it seems to be associated with various physical and psychosocial factors. Carrying a schoolbag is part of the daily routine for students and it is understandable to be a topic of parental concern raising questions for potential association with back pain and to represent a school health issue. There are various recommendations/guidelines on the schoolbag use, and particularly the 'ideal' weight of a schoolbag; but it is important to acknowledge that there is a lack of convincing evidence in the current literature. On the contrary, many recent studies found no association between schoolbag characteristics such as weight, design and carriage method and increased risk of developing back pain in children and adolescents.^{1,3,7,8} Overall, current evidence is inconclusive and not helpful to determine any choice of limit or recommendations regarding schoolbags; however, there seems to be an association between the perception of heaviness or difficulty in carrying the schoolbag and paediatric back pain.^{1,8}

As the prevalence of back pain in children and adolescents is increasing,¹⁻³ further research is needed to try and elucidate its aetiology and potential risk factors, in an effort to minimize and ideally prevent back pain at a young age and help decrease the burden in adulthood. A greater understanding of schoolbag-related risk factors for back pain is important to guide future recommendations and determine appropriate preventative and proactive actions for children and their support network. In general, it is suggested that a more generic guidance may be more appropriate than a single weight limit guideline regarding schoolbags.

Conclusion

The prevalence of non-specific back pain in children

and, especially, in adolescents is increasing. Despite the multifactorial nature of paediatric back pain and the lack of convincing evidence that excessive schoolbag weight is associated with back pain, parental concerns regarding a 'safe' maximum bag weight and characteristics for an 'ideal' schoolbag are rising. Current recommendations regarding schoolbags do exist, providing safe guidelines for clinicians, parents and teachers and reinforcing healthy 'back habits' for children and adolescents to reduce the risk of back pain/

strain. Furthermore, they often help identifying back pain that may need further evaluation to exclude any underlying pathology. More research is needed to clarify any possible association between schoolbags and paediatric back pain and elucidate potential risk factors. The aim would be to produce more generic guidance regarding schoolbags than a single weight limit guideline, for all associated professional bodies and clinicians, based on firm evidence and free of financial conflict.

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