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Schoolbag carriage and schoolbag-related musculoskeletal discomfort among primary school children

Sara Dockrell [a, *], Ciaran Simms [b], Catherine Blake [c]

[a] Discipline of Physiotherapy, Trinity Centre for Health Sciences, St. James's Hospital, James's St., Dublin 8, Ireland
[b] Mechanical and Manufacturing Engineering, Parsons Building, Trinity College, Dublin, Ireland
[c] School of Public Health, Physiotherapy and Population Science, Health Sciences Centre, University College Dublin, Bellfield, Dublin 4, Ireland

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ABSTRACT

Schoolbag carriage is a common occurrence and has been associated with musculoskeletal discomfort in children. The current study investigated the relationship between schoolbag-related musculoskeletal discomfort and individual, physical and psychosocial risk factors in primary school children in Ireland. A cross-sectional survey and pretest–posttest quasi-experimental design was used. The site and intensity of musculoskeletal discomfort was assessed before and after schoolbag carriage to provide a dose-response assessment of schoolbag-related discomfort for the first time. Objective measurements of the children, schoolbags and other additional items were made, and a researcher assisted questionnaire was completed on arrival at school. A total of 529 children (male 55.8%: female 44.2%) with a mean age of 10.6 years ± 7.14 months were included. The majority had backpacks (93.8%) and 89.7% (n = 445) carried the backpack over 2 shoulders. The mean schoolbag weight (4.8 ± 1.47 kgs) represented a mean % body weight (%BW) of 12.6 ± 4.29%. Only 29.9% carried schoolbags that were ≤10%BW. A significantly greater proportion of normal weight children carried schoolbags that were >10%BW compared to overweight/obese children ($p < 0.001$). The mean %BW carried was 18.3 ± 5.03 for those who had an additional item. The majority (77.5%) carried schoolbags to school for ≤10 min. The prevalence of baseline musculoskeletal discomfort was high (63.4%). Schoolbag-related discomfort was reported more frequently in the shoulders (27.3%) than in the back (15%). The dose–response assessment indicated that both statistically and meaningfully significant increases in discomfort were observed following schoolbag carriage. Multiple logistic regression models indicated that psychosocial factors and a history of discomfort were predictors of schoolbag-related back discomfort, while gender (being female) and a history of discomfort were predictors of schoolbag-related shoulder discomfort. None of the physical factors (absolute/relative schoolbag weight, carrying an additional item, duration of carriage, method of travel to school) were associated with schoolbag-related discomfort. This study highlights the need to consider the multifactorial nature of schoolbag-related discomfort in children, and also the need to identify background pain as its presence can inadvertently influence the reporting of 'schoolbag-related' discomfort if it is not accounted for.

1. Introduction

Carrying a schoolbag is a common occurrence for children, and the activity and its effects have been of interest to researchers for some time. The first study of schoolbag carriage was carried out by Malhotra and Sen Gupta in 1965. Since then, many systematic reviews of the literature about schoolbag weight have been undertaken and the majority have concluded that evidence-based recommendations for load carriage, expressed as a percentage of the child's bodyweight, could not be made. Lindstrom-Hazel (2009) and Dockrell et al. (2013) concluded that schoolbag weight recommendations were not supported by the literature. Similar statements have been made by others who stated that there was 'no scientific rationale' for the 10% bodyweight limit guideline (Mackie et al., 2004). A systematic review by Cardon and Balague (2004) concluded that there was little scientific evidence to

* Corresponding author.
E-mail address: sara.dockrell@tcd.ie (S. Dockrell).

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support a causative relationship between schoolbag weight and low back pain. Steele et al. (2003) made similar conclusions with regards to posture, and emphasised the lack of a standardised approach to investigating load-induced postural changes. In contrast, Brackley and Stevenson (2004) concluded that a guideline weight limit of 10–15%BW was justified based on physiological (oxygen consumption (VO_2 max), ventilation (VE) and blood pressure) and biomechanical effects (trunk forward lean, craniovertebral angle and gait).

The association between schoolbag weight and musculoskeletal pain has been investigated. A small number of studies have focussed on schoolbag-related pain in primary school children, that is the participants were asked specifically about back pain (Negrini and Carabalona, 2002; Korovessis et al., 2004; Skaggs et al., 2006) or any musculoskeletal pain (Moore et al., 2007; Talbott et al., 2009; Kistner et al., 2013) or ache, pain, discomfort or numbness (Dianat et al., 2013) that was due to carrying a schoolbag. The terminology used in studies is varied and the terms 'ache', 'pain' and 'discomfort' are used interchangably in the literature (Rateau, 2004; Dianat et al., 2013). The choice of term that is used is frequently based on the language in the measurement tool e.g. the Nordic Musculoskeletal Questionnaire includes ache, pain, and discomfort (Whittfield et al., 2005; Dianat et al., 2013, 2014). The term 'musculoskeletal symptoms' has also been used (Whittfield et al., 2001; Dianat et al., 2013), and the term 'soreness' has been selected for a paediatric population following a pilot study (Coleman et al., 2009).

Overall, there were diverse findings on schoolbag-related pain. Moore et al. (2007) reported that the percentage bodyweight carried was associated with pain. Negrini and Carabalona (2002) found that carrying a backpack was associated with back pain, but the weight of the backpack was not. No correlation was found between backpack weight and back pain by Korovessis et al. (2004) and Dianat et al. (2013). Demographic risk factors for schoolbag-related pain, such as gender and BMI, have also been investigated. It has been reported consistently that girls were more likely to report schoolbag-related pain than boys (Talbott et al., 2009; Dianat et al., 2013; Korovessis et al., 2004), however a recent study reported that back pain was not associated with gender (Adeyemi et al., 2014). Dianat et al. (2013) found BMI to be negatively associated with schoolbag-related shoulder pain.

Children's perception of schoolbag weight has been explored as a psychosocial aspect of schoolbag-related pain (Pascoe et al., 1997; Gunzburg et al., 1999; Goodgold et al., 2002; van Gent et al., 2003; Talbott et al., 2009). Children have been shown to be poor judges of schoolbag weight (Pascoe et al., 1997; Goodgold et al., 2002; van Gent et al., 2003) and van Gent et al. (2003) found an association between perceived weight and musculoskeletal complaints. Children who perceived their bag to be heavy were more likely to report pain. The relationship between psychosocial factors, such as emotional wellbeing, and low back pain (LBP) in children was also reported by Watson et al. (2003). Children who reported conduct or emotional problems had a threefold increase in the reporting of pain. This had previously been found by Gunzburg et al. (1999) who stated that the lifetime prevalence of LBP was significantly higher ($p < 0.05$) in children who reported to be less happy, worse sleepers, and more tired without reason. There was also a strong correlation between self-reported LBP and the reporting by the children of one or both parents having LBP.

Musculoskeletal pain and discomfort in children is complex and needs to be considered in a multi-factorial manner. Furthermore, the investigation of schoolbag-related pain and discomfort is complicated by a high level of nonspecific background pain in children that has been reported (Mikkelsson et al., 1997; Roth-Isigkeit et al., 2005). Previous cross-sectional studies of schoolbag-related pain (Negrini and Carabalona, 2002; Korovessis et al., 2004; Skaggs et al., 2006; Moore et al., 2007; Talbott et al., 2009; Kistner et al., 2013) have not identified this and consequently pain may have been inappropriately attributed to schoolbag carriage. The current study therefore aimed to investigate the characteristics of schoolbag carriage and the prevalence of schoolbag-related discomfort. The level of discomfort that existed before and after schoolbag carriage was investigated, and the differential between the two was considered as schoolbag-related discomfort. The dose–response relationship between schoolbag carriage and schoolbag-related discomfort could then be determined for the first time. The study also aimed to establish the association of individual, physical and psychosocial factors with schoolbag-related discomfort.

2. Method

2.1. Research design

A cross-sectional survey and quasi-experimental pretest-posttest design was used. Children and their bags were weighed on one day only, and the prevalence, site and intensity of discomfort was recorded before and after the children carried their schoolbags.

2.2. Participants

A convenience sample of primary schools with different size, type (mixed/single-sex), geographical and socio-economic backgrounds was included. All children in 4th or 5th class (9–11 year olds) in the participating primary schools were eligible for inclusion. Children who were unable to stand or who were unable to carry a schoolbag were excluded.

2.3. Procedure

School principals were approached by email or telephone to enquire if they would allow the research to be conducted in their school. If the principal agreed, an information pack, the parent and child information leaflets and the consent and assent forms were sent to the principal for distribution to the potential participants. Written consent was sought from a parent/guardian, and written assent was sought from each child. Ethics approval for the study was given by the Faculty of Health Sciences Ethics Committee, Trinity College Dublin.

On the day before data collection, a brief information session was held to instruct the participating children on how to complete a Body Discomfort Chart (BDC) and Visual Analogue Scale (VAS) (Merkel and Malviya, 2000). The children were asked to complete the BDC and VAS before leaving for school the following morning. The children were given a Strengths and Difficulties Questionnaire (SDQ) to be completed by their parent/guardian. The children were asked to bring the completed BDC, VAS and SDQ to school the following morning to give to the researcher. On arrival at school, the children completed another BDC and VAS (after). The children's height was measured and they were weighed under three conditions in a designated measuring zone: firstly without any bags, secondly while carrying their schoolbag, and finally while carrying their schoolbag and all additional items, such as sports gear and musical instruments. The children were measured in stocking feet and light indoor clothing. Following objective testing, a researcher-assisted questionnaire was completed.