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Schoolbag weight and musculoskeletal symptoms in New Zealand secondary schools

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Abstract

The weight of schoolbags and the prevalence of musculoskeletal symptoms amongst 140 students (70 third form students comprising 35 females and 35 males, and 70 sixth form students comprising 35 females and 35 males) from five New Zealand secondary schools was investigated. Schoolbag weight for third form students (mean age 13.6 years) was 13.2% of their body weight, while for sixth form students (mean age 17.1 years) it was 10.3% of their body weight. These weights may exceed the recommended guideline load limits for adult industrial workers. Musculoskeletal symptoms were reported by 77.1% of the students. Symptoms were most prevalent in the neck, shoulders, upper back and lower back. Although musculoskeletal symptoms are believed to be multifactorial in origin, the carriage of heavy schoolbags is a suspected contributory factor and may represent an overlooked daily physical stress for New Zealand secondary school students.

Keywords: Load carriage; Back pain; Children

1. Introduction

Only a handful of studies have investigated the weight of schoolbags, and the impact of schoolbag carriage on the musculoskeletal systems of school students. Voll and Klimt (1977) found the relative weight of schoolbags of first graders to be 11.1% of body weight, 12.5% for the second graders, and for the third and fourth graders between 12.5% and 14.3%. The National Back Pain Association (1997) recorded schoolbag weights for British children and found that 13-year olds carried 10.4% of their body weight, and 16-year olds 10.2%. Malhotra and Sen Gupta (1965) assessed the impact of schoolbag carriage using schoolbags weighing 6 lb, which represented approximately 10–12% of the body weight of the students investigated. Pascoe et al. (1977) investigated the effect of backpacks and athletic bags which were loaded with 17% of students body weight. They concluded that the carriage of schoolbags significantly altered the posture and gait of students and suggested that it may lead to a variety of musculoskeletal complaints such as muscle soreness, back pain, numbness and shoulder pain. More recently, Negrini et al. (1999) found the average load carried by year 6 (mean age 11.6 years) Italian schoolchildren was 9.3 kg (22.0% of body weight), and suggested that a decrease in the load carried is advisable as rates of low back pain in children are approaching those seen in adults. However, no assessment of pain or discomfort was undertaken in this study. Whittfield et al. (2001) also investigated the weight and use of schoolbags, this time in New Zealand schools, but the impact of schoolbag carriage on the musculoskeletal systems of school students was not outlined.

There have been many attempts to establish safe load carriage limits (Snook, 1978; Jiang and Ayoub, 1987;

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Snook and Ciriello, 1991; Waters et al., 1993). However, the concept of a maximum safe weight implies that there is an identifiable cut-off point beyond which the levels of risk become unacceptable (Pheasant, 1991). The New Zealand Department of Labour Guidelines (1991) indicated that weight should not be used to prescribe absolute limits, but should instead be considered as just one of the important factors to be taken into account when assessing risk in load carriage. While this seems logical, guideline load limits may be useful in providing a base from which to begin to assess a load carriage task. However, while there are often regulations in place designed to protect adults from injury, it is rare to find equivalent regulations in place to protect children or adolescents.

The New Zealand Department of Labour Guidelines (1991) specify a relatively high weight limit of 16 kg for workers under 18 years of age, but do not offer guidelines for school students. The Manual Handling Operations Regulations of Great Britain (Health and Safety Executive, 1992) contains numerical guidelines which are designed to identify those tasks requiring more detailed examination, but these do not take age into account. Recognising that there were no maximum weight regulations relating specifically to load carriage in school students, the National Back Pain Association created some guidelines. They suggest that ideally a schoolbag should weigh no more than 10% of a student's body weight (National Back Pain Association, 1997), and this weight should be supported on both shoulders in a backpack style schoolbag.

Although musculoskeletal symptoms in school students are believed to be multifactorial in origin (Balague et al., 1988), the carriage of heavy schoolbags is a suspected factor in the aetiology of musculoskeletal pain in this age group (Burton et al., 1996; Troussier et al., 1994). Certainly the transportation of schoolbags is a task which repeatedly loads the musculoskeletal system, and this load bearing could contribute to the production of pain in this population. As the potential for injury resulting from schoolbag carriage may be considerable, the present study investigated the weights of schoolbags and the prevalence of musculoskeletal symptoms amongst secondary students from five New Zealand schools.

2. Methods

One hundred and forty secondary school students (70 third form students comprising 35 females and 35 males, and 70 sixth form students comprising 35 females and 35 males) were randomly selected from five Auckland schools to participate in this study. These schools were randomly selected from a list of co-educational secondary schools from the Auckland region in order to obtain a representative cross section of Auckland secondary schools. An explanation of the procedures of the study was given and all subjects signed a consent form which indicated their voluntary participation. Data were collected on an unscheduled day so that students could not alter their schoolbag weight. The height and body weight of each student was measured, as were the weight of their schoolbags and the weight of any additional items that they carried. Height was measured using a portable stadiometer (manufactured by 'Medizintechnik'). Body weight was measured with electronic scales ('Thinner' Model MS-7), as were the weight of the students' schoolbags and the weight of any additional items carried. The electronic scales were calibrated using known weights prior to data collection. The students then answered a questionnaire that enquired about musculoskeletal symptoms experienced in the week immediately preceding data collection. The questionnaire was a modification of the standardised Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987). A picture of the human body with nine body regions (neck, shoulders, upper arms, lower arms, upper back, lower back, hips/thighs, knees, lower legs) (adapted from Corlett and Bishop, 1976) was provided. The students were asked to answer 'yes' or 'no' to the question, "Have you, at any time in the last 7 days had any ache, pain, discomfort or numbness that may be as a result of your schoolbag(s)?" for each of the nine body regions. The prevalence of musculoskeletal symptoms overall, as well as for all nine body regions, was recorded. Some of these body areas were combined to determine the prevalence of symptoms in the upper body (combination of 'neck', 'shoulders' and 'upper back').

Statistical analysis of the data was performed with SPSS (1998) and SAS (1996). Calculations were made for the whole sample and for the subgroups of third form students, sixth form students, females, males, third form females, third form males, sixth form females and sixth form males. Heights and weights were compared using analysis of variance. The incidence of symptoms in particular locations was compared between four of the subgroups (third form boys, third form girls, sixth form boys and sixth form girls) using logistic regression. Further logistic regressions were used to test whether carrying heavier bags increased the risk of musculoskeletal pain. Third and sixth formers were analysed separately. No further statistical tests were performed. Statistically significant differences were accepted at the 5% level of probability ($p < 0.05$).

3. Results

The mean (SD) age, height and body weight (BW) of the third form students (13.6(1.3) years, 162.7(7.8) cm and 54.7(11.7) kg, respectively) was significantly lower