AJAB

Asian J Agri & Biol. 2018;Special Issue:6-12.

Original Research Article

Association between schoolbag weight with back pain and perceived load among primary schoolchildren in Selangor

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Received:
November 09, 2017

Accepted:
February 28, 2018

Published:
May 30, 2018

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Abstract

Heavy schoolbag weight has been identified as one of the risk factors that influenced the health of young children. Considering the increased and improved syllabus in the primary schools in Malaysia, the risk of heavy schoolbag weight and its impact on the musculoskeletal health of children needs to be identified. This study was performed to determine the association between schoolbag weight and perceived load with back pain among schoolchildren. This was a cross-sectional study performed among 114 primary schoolchildren in two schools at Selangor, Malaysia in 2015. Background information and perceived load was obtained via self-administered questionnaires from both parents and schoolchildren. Data on height, body weight and schoolbag weight were objectively measured. Data obtained were entered into statistical software for analysis. The average schoolbag weight and relative schoolbag weight were 5.98 kg and 19.7% respectively. The prevalence of back pain was 36.8% and more than one-third of the respondent perceived load as heavy and cause fatigue. Significant associations were found between relative weight and perceived load (heaviness and fatigue) with back pain. Findings of this study suggest that schoolbag weight pose musculoskeletal health risk to schoolchildren. Therefore, there is a need for implementation of policy and guideline as well as intervention in minimising schoolbag weight.

Keywords: Musculoskeletal Disease, Ergonomic Risk, Adolescents, Knapsack, Heavy Lifting

Introduction

Schoolbag weight poses various risks to the children health including back pain, neck pain, and musculoskeletal disorder. Moreover, the heavy load from schoolbag puts the schoolchildren at an increased risk of injuries (Mackie et al., 2003). Findings of Neushwander et al. (2008) showed that heavy schoolbag can increase loads on lumbar intervertebral disc which increases the chances of getting back pain. According Lai and Jones (2001), spinal ligaments and muscles of growing children are not fully developed until after 16th year of life. Thus, heavy loading of spine can induce vertebral stress and could significantly compress lumbar disc height. Schoolbag as a form of load can decrease muscle activity of erector spine which plays a vital role in maintaining posture (Neuschwander et al., 2010). Other studies of risk factor indicated that there is a positive association between carrying heavy schoolbag and reported musculoskeletal pain and discomfort (Negrini and Carabalona, 2002; Sheir-Neiss et al., 2003; Syazwan

et al., 2011; Nurul et al., 2011) and back pain (Azuan et al., 2010; Al-Saleem et al., 2016). Improper use of schoolbag can cause muscle imbalance and result in chronic pain and neck problems later in life. Schoolbag load was also found to be associated with lost school time, lost school sport time and greater chiropractic utilization (Moore et al., 2007). It has been reported that improper use of schoolbag can be reduced through educating schoolchildren on proper carriage of the schoolbag (Feingold and Jacobs, 2002). To assist in encouraging the proper carriage of schoolbag among schoolchildren, there is a need to identify the personal perception of the schoolchildren towards schoolbag load. Personal perception of the schoolbag load may take account of personal characteristic such as body fitness, strength and also endurance. A study reported that schoolbag which is felt to be heavy or cause fatigue to carry it may indicate poor trunk muscle endurance which is known as one of the risk factors for back pain (Negrini and Carabalone, 2002). Hence, a study which explores the link between schoolbag weight, perceived load and back pain is needed. Considering the increased and improved syllabus in the primary schools in Malaysia, the risk of heavy schoolbag weight may be more pronounced. This study was performed to determine the association between schoolbag weight and perceived load with back pain among schoolchildren. Findings of this study will provide input on schoolbag-related issue to improve understanding and help in providing evidence for policy making.

Materials and Method

Study location and study population

This was a cross-sectional study conducted among primary children in two selected schools (one Malay-National Primary school and one Chinese-medium National School) in a district of Selangor, Malaysia. This study included schoolchildren within the age of 9 to 11 years old (Primary Year 3 to 5 in the National Primary School system). The sampling method of this study was purposive sampling. A total of 165 schoolchildren were invited to participate in this study. This study obtained ethical approval from the institutional ethical review board of Universiti Putra Malaysia.

Questionnaire

Two sets of questionnaires were used in this study. The questionnaires were provided in English and Malay language. The first questionnaire was to be answered by the parents and was given to the schoolchildren together with the parental permission form. This self-administered questionnaire was used to obtain information regarding socio-demography, background information and the medical history of the schoolchildren.

The second set of questionnaire was answered by the schoolchildren who had their parental permission to participate in the study. This self-administered questionnaire was used to access the usage of schoolbag, prevalence of back pain and perception load of the schoolchildren. Explanation was given to the schoolchildren who did not understand the question to ensure accurate reporting of the information. The response for load perception was rated according to Likert scale.

Physical measurements and schoolbag weight measurement

Physical data including height, body weight, and lung function as well as schoolbag weight of schoolchildren were measured after the schoolchildren answered their questionnaire. SECA 206 body meter scale (Seca GmbH & Co. KG, Germany) was used to measure the height of the schoolchildren, while Tanita HD314 digital weight scale (Tanita Corporation, Japan) with detection limit of 150 kg and KERN-ECB20K10 digital weighing scale (Kern Engineering and Manufacturing Corporation, United States) with detection limit of 20 kg were used to measure the schoolchildren body weight and schoolbag weight respectively. The schoolbag was measured thrice to ensure accuracy.

Data were entered into SPSS version 22 for statistical analysis according to the objective. The relative weight of the schoolbag and body weight of each schoolchild were calculated and presented in average values (mean and standard deviation). For further analysis, relative weight was re-categorised into categories of 10-15%, 15-20% and 20% above (Brackley and Stevenson, 2004).

Results

From the 165 returned forms, only 114 of the schoolchildren were given permission to participate in this study. In total, the response rate for this study was 69%. In terms of socio-demographic distributions, the results in Table 1 showed that most of the schoolchildren were from year 10 (40.4%) and there

were higher percentages of female (57.9%). For the distribution of ethnicity, majority of the schoolchildren were Malay. Approximately 49% of schoolchildren were from Malay-medium National Primary School (MNPS) while the rest were from Chinese-medium National Primary School (CNPS). A larger percentage of the schoolchildren had families with average income level of RM 4,000 (equivalent to US Dollar 930). Average height and weight of the respondents were 134 cm and 30 kg, respectively. The average schoolbag weight was 5.98 kg. In terms of relative weight, children from the CNPS had relative schoolbag weight of 21% while children from the MNPS had relative schoolbag weight of 17%.

Schoolbag weight, back pain and perceived load

Approximately 37% schoolchildren reported ever-experiencing back pain. For perceived weight, 11.4% and 26.3% of the schoolchildren reported never or almost never felt the schoolbag to be heavy to them while 23.7% and 8.8% reported that they often or always felt that the schoolbag was heavy respectively. For perceived fatigue, 16.7% and 21.1% of the schoolchildren reported never or almost never felt fatigue when carrying the schoolbag while 14.0% reported often or always felt that the schoolbag made them feel fatigue. Table 2 presents the cross-tabulations of relative weight and perceived load. There were no associations between relative weight with perceived load and fatigue.

The analyses to determine the association between back pain with the use of schoolbag and load perception is shown in Table 3. Perception of load in both weight and fatigue and relative weight of schoolbag were associated with back pain. However, no link was found for the type of bag, method of carriage, duration of carriage and type of transport with back pain.

Table 1. Background information and distribution of back pain of the respondents (N=114)

Variable	Frequency	Average (mean± standard deviation)
Age (years)		10.0±2.0[a]
Gender		
Male	48 (42.1%)	
Female	66 (57.9%)	
Ethnicity		
Malay	67 (58.8%)	
Chinese	39 (34.2%)	
Others	8 (7%)	
Family Income (RM)		4,000±4,325[a]
Height (cm)		134.4±12.0[a]
Weight (kg)		30.1±11.2[a]
Schoolbag weight (kg)		5.98±1.36[b]
MNPS		5.20±0.87[b]
CNPS		6.49±1.40[b]
Relative schoolbag weight (%)		19.70±8.97[b]
MNPK		16.88±7.78[a]
CNPK		21.33±8.73[a]
Bag type		
Double strap	90 (78.9%)	
Beg with wheel	24 (21.2%)	
Method of carriage		
Both shoulder	93 (81.6%)	
Pull with wheel	21 (18.4%)	
Duration of carriage (minutes)		
< 10	54 (47.4%)	
10-15	32 (28.1%)	
15-30	20 (17.5%)	
>30	8 (7.0%)	

Method of transport		
Bus	40 (35.1%)	
Private car	73 (64.0%)	
Walking	1 (0.9%)	
Back pain		
No	72 (63.2%)	
Yes	42 (36.8%)	
Perceived schoolbag is heavy		
Never	13 (11.4%)	
Almost never	30 (26.3%)	
Sometimes	34 (29.8%)	
Often and always	37 (32.5%)	
Perceived fatigue		
Never	19 (16.7%)	
Almost never	24 (21.1%)	
Sometimes	39 (34.2%)	
Often and always	32 (28.1%)	

[a] Median and interquartile range [b] Mean and standard deviation Malay-medium National Primary School (MNPS) Chinese-medium National Primary School (CNPS) Ringgit Malaysia, RM 4,000~US$ 930

Table 2. Cross-tabulations of relative schoolbag weight with perceived load as reported by schoolchildren

	Relative schoolbag weight (N(%))				
Perceived load[a]	**< 15%**	**15-20%**	**> 30%**	**X^2**	***p-value***
Feel schoolbag is heavy **(N=71)**	18 (25.4%)	17 (23.9%)	36 (50.7%)	1.52	0.469
Perceived fatigue[a]	**< 15%**	**15-20%**	**> 30%**	**X^2**	***p-value***
Feel fatigue when schoolbag is carried **(N=71)**	16 (22.5%)	21 (29.6%)	34 (47.9%)	1.50	0.474

*significant when $p < 0.05$ **[a] Answered sometimes, often and always to the question in Table 1**

Table 3. Cross-tabulations of use and perceived load of schoolbag with back pain (N=114)

	Back pain (N (%))		
Variable	**No**	**Yes**	***X^2* (*p-value*)**
Bag type			
Double strap	60 (66.7%)	30 (33.3%)	2.2 (0.13)
Beg with wheel	12 (50.0%)	12 (50.0%)	
Method of carriage			
Both shoulder	61 (65.6%)	32 (34.4%)	1.2 (0.25)
Pull with wheel	11 (52.4%)	10 (47.6%)	
Duration of carriage (minutes)			
< 5	13 (68.4%)	6 (31.6%)	3.0 (0.55)
5-10	22 (62.9%)	13 (37.1%)	
10-15	19 (59.4%)	13 (40.6%)	
15-30	11 (55.0%)	9 (45.0%)	
>30	7 (87.5%)	1 (12.5%)	
Method of transport			
Bus	26 (65.0%)	14 (35.0%)	0.1 (0.72)
Private car	45 (61.6%)	28 (38.4%)	

Load Perception			
Feel schoolbag is heavy			12.5 (<0.001*)
No	36 (83.7%)	7 (16.3%)	
Yes	36 (50.7%)	35 (49.3%)	
Fatigue when schoolbag is carried			5.4 (0.01*)
No	33 (76.7%)	10 (23.3%)	
Yes	39 (54.9%)	32 (45.1%)	
Relative weight (%)			11.1 (0.004*)
< 15	24 (80%)	6 (20%)	
15-20	23 (74.2%)	8 (25.8%)	
> 30	25 (47.2%)	28 (52.8%)	

*p<0.05 Relative weight is percentage of bag weight in comparison with body weight

Discussion

This study has provided useful baseline data that linked relative schoolbag weight with back pain among schoolchildren in two types of national schools in Malaysia. Previous studies which determined relationship between schoolbag weight with back pain and load perception has been done in China (Lai and Jones, 2001), Arab Saudi (Al-Katheri and Abeer, 2013; Al-Saleem et al., 2016) and Malaysia (Syazwan et al., 2011) among schoolchildren of age 9 to 12.

Schoolbag weight of respondents

In the current study, only 2.6% of the respondents carried schoolbag weight less than 10% relative weight while 7.9% of them carried more than 30%. It was reported in literature that the suitable load for children to carry is between 10-15% of their body weight (Marzuki et al. 2009; Brackley and Stevenson, 2004). This means that majority of the schoolchildren have schoolbags that is heavier than the recommended relative weight.

Schoolbag weight was found to be heavier among schoolchildren in CNPS when compared to schoolchildren in MNPS and majority of the schoolchildren that used schoolbag with wheels were from CNPS. It is likely that parents are aware of the heavy schoolbag load faced by their children and opt to provide schoolbag with wheels to decrease the burden of the schoolbag load. The possible reason for the heavy schoolbag weight of the schoolchildren was the large number of subjects studied by the primary schoolchildren. According to the Ministry of Education Malaysia, Year 1 to 3 schoolchildren have 5 core subjects with at least 3 additional compulsory subjects, meanwhile Year 4-6 schoolchildren have 7 core and at least 4 additional compulsory subject (Ministry of Education, 2014). For CNPS, there are additional core Chinese subjects that need to be taken by the schoolchildren. This explains the heavy schoolbag weight in primary schoolchildren and why it is heavier in CNPS.

Schoolbag weight and perceived load

Results of the present study showed that more than half of the respondents perceived schoolbag to be heavy and causes fatigue. However, both perceived heaviness and fatigue were not associated with relative weight. As proposed by Haselgrove et al. (2008) perception on schoolbag load might influenced by other factors such as time taken to arrive in school and method of transport to school.

On the other hand, perception of load in both heaviness and fatigue were found to have significant association with reported back pain. This finding was similar to a previous study by Haselgrove et al. (2008). It is suggested that existing back pain may influence the schoolchildren' perception in heaviness and energy while carrying schoolbags. According to Proffitt et al. (2003), college students carrying schoolbags weighing between 16 to 20% of their body weight perceived walks as farther compared to those who did not carry schoolbag. Other studies also show that heavy schoolbag causes a decreased in walking speed (Wang et al., 2001; Chow et al., 2005). The possible reason was that heavy load of schoolbag caused the schoolchildren to become tired faster and thus influenced the perception on walking distance and ability to walk fast.

Schoolbag weight and back pain

The study shows that of the lifetime prevalence of back pain was 36.8%. This figure was higher than the findings found by Azuan et al. (2010) that showed that the lifetime prevalence of upper back pain was 22.7% among 100 Malaysian schoolchildren in Pengkalan Hulu, Perak. This study only involved one type of national school. However, this prevalence was considered lower than the findings of other studies. For example, the prevalence of back pain were found more than 40% in the studies of Siambanes et al. (2004) and Moore et al, (2007) among schoolchildren in California, United States. Similar to the findings of this study, there were evidence between back pain and higher relative schoolbag weight (Moore et al, 2007; Talbott et al., 2009).

By comparison, some studies show that there was no significant association between back pain and schoolbag weight (Negrini and Carabalona, 2002; Korovessis et al., 2004; Whitfield et al., 2005). Negrini and Carabalona (2002) conducted a study among year 6 schoolchildren (n=237) in Milan, Italy and found that carrying schoolbag was associated with back pain but the weight itself did not cause back pain. This evidence was supported by Korovessis et al. (2004) who did a study among Greek schoolchildren between the ages of 9 and 15 years and Whitfield et al. (2005). It was further suggested that these findings generally represent short duration discomfort rather than long term consequences (Dockrell et al., 2013). However, studies about the long-term effect of schoolbag on back pain are limited.

Limitation of study

This study has a few limitations. Due to the design of the study, recall bias may occur. Moreover, information bias might also appear due to misinterpretation of the parents or guardians when answering the questionnaire. Also, this study did not assess the time table or schedule for the subjects taught each day for each class. It might be that there were days when subjects taught require fewer books. It may also be likely that books required for each subject daily is evenly distributed to reduce the issue of heavy schoolbag weight, but it may be that some schoolchildren themselves were not able to correctly identify the books required for school. In the end, the schoolchildren bring books in excess of what is required in school.

Conclusion

Findings of this study suggest that schoolbag weight pose musculoskeletal health risk to schoolchildren. This study indicates the needs for minimising relative schoolbag weight of primary schoolchildren. In addition, providing lockers or similar facilities in schools may be useful to help solve such problem. A guideline related to schoolbag weight should also be provided by the ministry of education or related agency in Malaysia. It is worth for future research to focus on the long term effects of schoolbag load.

Acknowledgment

We would like to express our utmost gratitude and highest appreciation to all of the participants involved in this study, their parents and especially their teachers for their time, support and understanding given without which, this study will not be successfully completed. We would also like to thank Ms. Siti Khatijah Ahmad Ramli, from the Occupational Safety and Health Laboratory at the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia for the technical assistance rendered.

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