

Ergonomics Evaluation of Various Risk Factors Associated With Carrying School Bags



Home Science

KEYWORDS :

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ABSTRACT

The present study was conducted on "Ergonomics evaluation of various risk factors associated with carrying school bags" with objectives to observe various risk factors associated with carrying school bags, to analyse its impact in different body parts of respondents and to find out correlation between observed risk factors and various variables. The study was conducted on a sample of 120 school children from middle class (i.e. from vi to viii) and their mothers. Respondents were randomly selected from five government and five private schools of Ludhiana city from the age group of 11-14 years. A pre structured interview schedule was used to achieve all the objectives. Risk factors scores were calculated on four variables i.e. pain, stiffness, numbness and swelling which were further ranked on three point scales for frequency, duration and severity. It was observed that respondents had maximum overall risk score in upper/lower back and neck followed by shoulder. Different variables like B.M.I, total bag weight, total distance travelled, total time to carry school bags and number of steps had correlation with risk factors i.e. pain, stiffness, swelling, numbness scores and feeling of fatigue, difficulty in picking up of things, in stepping up and down stairs.

Introduction

The school bag is one of the several forms of manual load carriage that provides flexibility and is often used by hikers, and soldiers, as well as by the school children (Knapik *et al* 1996). In today's life there is a growing concern among the teachers, medical professionals and parents over the increasing incidents of school bags related injury in school children (Iyer 2000). School bag load carriage increases ground reaction forces and increases the stiffness in the upper extremity that can cause transmission of higher amount of forces from the lower extremity to the head (Singh and Koh 2009). Studies have shown that the school children across the world suffer from musculoskeletal pain or discomfort in the shoulder and back (Iyer 2001). Musculoskeletal symptoms in school children are multi-factorial in origin; the carriage of heavy school bag is clearly a suspected factor (Whitfield *et al* 2001).

Negrini and Carabalona (2002) investigated the weight of school bags and the prevalence of musculoskeletal symptoms amongst respondents found that musculoskeletal symptoms were reported by 77.1 per cent of the respondents in neck, shoulder, upper and lower back. A study has shown a significant association between spinal pain or postural habits and heavy school bag weight by Grimmer *et al* (1999) and (Koley and Kaur 2010). They also found a strong association between low back pain and both school bag weight and the length of time carried. Rageswariharan *et al* (2009) observed that kids who walk to and from school are also more likely to suffer back pain from heavy packs because duration of use increases the risk of injury. Musculoskeletal problems associated with school bag use have become increasing concern with school children (Negrini and Carabalona 2002). Therefore, the present study entitled "Ergonomics evaluation of various risk factors associated with carrying school bags" was undertaken with three objective:

1. To observe various risk factors associated with carrying school bags
2. To analyse its impact in different body parts of respondents
3. To find out correlation between observed risk factors and various variables

Materials and Methods

The study was conducted in Ludhiana city. Two zones were randomly selected out of four zones; further five governments and five private schools were selected randomly from these

two zones. A sample of 120 students and their mothers were taken from these selected schools from class (i.e. vith to viiith). The age group was 11- 14 years. Three parametric scale was used to assess various risk factors in different body parts on the basis of frequency, duration and severity. Mean ranks were given on the basis of mean scores Spearman's rank correlation coefficient was used in the present study to measure the degree of relationship between two variables. It is a two way statistical technique aims to examine the relationship of variables like B.M.I, total bag weight, distance travelled by respondents, total time to carry school bags, no of steps of stairs, type of school bag (shoulder bag) etc. with various risk factors like pain scores, stiffness scores, numbness scores, swelling scores gained by respondents while carrying school bags.

Results and Discussions

Observation various risk factors associated with carrying school bags and analysis of its impact in different body parts of respondents

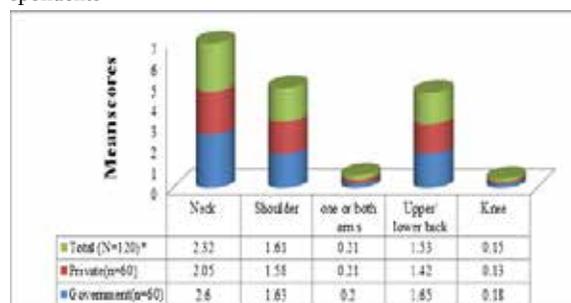


Fig 1: Risk factor (pain score) associated with carrying school bags and analysis of its impact in different body parts

Fig 1 highlights that pain score was found high in neck followed by shoulder and upper/lower back and low score was observed in arms and Knee. Grimmer *et al* 1999 also found a significant association between spinal pain and heavy school bag weight.

Very less number of respondents were had stiffness in their body while carrying school bags. Fig 2 shows that the respondents those who felt stiffness, had high scores for neck followed by shoulder and upper/lower back.

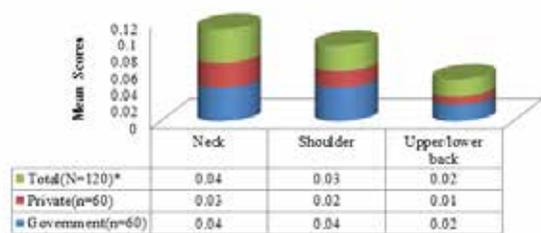


Fig 2: Risk factor (stiffness score) associated with carrying school bags and analysis of its impact in different body parts

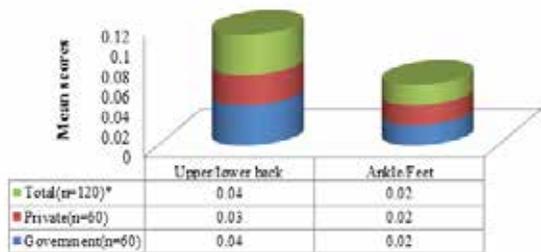


Fig 3: Risk factor (numbness score) associated with carrying school bags and analysis of its impact in different body parts

Fig 3 reveal that numbness was mainly found in upper / lower back and ankle/feet. It was also observed that maximum respondents had numbness in upper/lower back followed by ankle /feet.

Swelling was also one of the risk factor associated with carrying school bags. Maximum respondents felt it in upper lower back followed by ankle/ feet (Fig 4).

Correlation between observed risk factors and various variables

It was observed from Table 1 that variables which were significantly correlated with risk factors include B.M.I, total bag weight, distance travelled, total time to carry school bags and number of steps of stairs.

Table 1 : Correlation between observed risk factors and various variables

Risk factors	Feeling of fatigue	Difficulty in picking up of things	In stepping up and down stairs	Pain scores	Stiffness scores	Numbness scores	Swelling scores	Imbalance while turning
B.M.I	-0.192*	-0.183*	-0.187*	-0.169*	-0.062NS	-0.061NS	-0.091NS	-0.002NS
Total bag weight	0.302*	0.205*	0.176*	0.171*	0.072 NS	0.030NS	0.037NS	0.010NS
Distance travelled by respondents	0.203*	0.185*	0.182*	0.167*	0.065NS	0.011NS	0.003NS	0.003NS
Total time to carry school bags	0.305*	0.170*	0.181*	0.193*	0.070NS	0.065NS	0.130NS	0.005NS
No of steps	0.205*	0.225*	0.171*	0.170*	0.038NS	0.038NS	0.114NS	0.015NS
Type of school bag(shoulder bag)	0.209*	0.208*	0.208*	0.191*	0.035NS	0.027NS	0.110NS	0.025NS
Food habits	0.130NS	0.113NS	0.110NS	0.113NS	0.053NS	0.013NS	0.102NS	0.007NS
Supplements	0.100NS	0.052NS	0.092NS	0.095NS	0.057NS	0.02NS	0.105NS	0.009NS
Education level of parents	0.090NS	0.119NS	0.125NS	0.027NS	0.047NS	0.018NS	0.122NS	0.010NS
Awareness level of parents regarding heavy school bags	0.110NS	0.103NS	0.107NS	0.092NS	0.025NS	0.005NS	0.119NS	0.025NS

NS- Non significant *significant at 0.5% level

Conclusion

Retaining a fixed posture over long periods of times cause muscle fatigue and if this practice is consistent can eventually lead to muscle pain and injury (Smith *et al* 1981). More often, school children carry bags with only one straps slung loosely over the shoulder. American Academy of Pediatrics (AAP) revealed a wide range of symptoms and complaints associated with school bags. Children reported

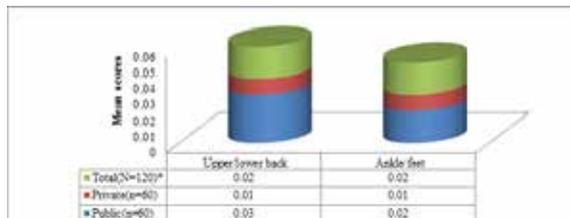


Fig 4: Risk factor (swelling score) associated with carrying school bags and analysis of its impact in different body parts

Fig 5 shows that highest scores were given to neck, shoulder, upper and lower back. It indicates that respondents were having higher risk in these body parts than other body parts. Very less risk was observed in arm, knee and ankle/foot. This is supported by Iyer (2001), whose studies have shown that the school children across the world suffer from musculoskeletal pain or discomfort in the shoulder and back. Singh and Koh (2009) also found that Schoolbag load carriage increases ground reaction forces and increases the stiffness in the upper extremity that can cause transmission of higher amount of forces from the lower extremity to the head.

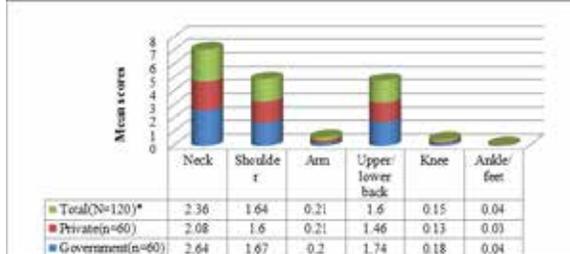


Fig 5: Total risk factors scores associated with carrying school bags and analysis of its impact in different body parts

discomfort, aches and pain in their necks; shoulders and back associated with a heavy school bag. Muscle weakness, tingling in the arms, stooped posture, and headaches have also been reported as associated with carrying a heavy school bag. In the above study it was concluded that children felt pain in their neck, shoulder, upper and lower back and it had positive correlation with total bag weight total distance travelled, total time to carry school bags and number of steps. Only B.M.I showed a negative correlation with these risk factors. Identification of risk factors may be helpful in the ergonomic recommendations of control measures for the school authorities and governing bodies to manage the incident of school bags related injuries among school children.

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