Prevalence of Musculoskeletal Pain in School Going Adolescents Using School Bags: A Co-relational Research

Rina Koshy Panicker & Sandesh T. S.

Rina Koshy Panicker (PT)*, Musculoskeletal & Sports rehabilitation, Alvas college of Physiotherapy, Moodbidri. Karnataka. India. Email id: panicker.rina@gmail.com. Mobile no.: +91 9900449982

Sandesh T. S. (PT), Neurological rehabilitation, Alvas college of Physiotherapy, Moodbidri. Karnataka. India. Email id: sandeshthachappilly@gmail.com. Mobile no.: +91 9880313993

ABSTRACT

Children aged 12 – 18 years undergo rapid musculoskeletal development and an application of external forces (school bags) cause musculoskeletal disorders. The aim of this investigation was to assess the prevalence of neck, shoulder and back pain in the 1st term in school going adolescents using school bags. A co-relational research was conducted in Mangalore which included 580 students aged 13 -15 years. Their bag weight, body weight and height was measured and the subjects having pain either in the neck, shoulder or back were given McGill Melzack pain questionnaire to be filled. Descriptive analysis revealed that the percentage of bag weight on body weight ratio is more in females (mean ± SD 9.18 ± 3.71) compared to males (mean ± SD 8.88 ± 3.65). 6.03% of subjects carried bag weight weighing more than 15%, out of which 8.57% subjects complained of pain either in the neck, shoulder or back. The correlation between bag weight and pain was analysed using Karl Pearson’s correlation which is perfect positive (0.78). Analysis of correlation between BMI with percentage of bag weight in males (0.413) is more compared to females (0.086). The prevalence of adolescents having pain in the 1st term of school was 2.93% due to school bags. Hence, it is important to investigate further and take appropriate measures for adolescent problems with the use of school bags as it is a predictor for musculoskeletal disorder in adulthood.

Keywords: school bag weight, musculoskeletal pain in children, posture, ergonomics
INTRODUCTION

One of the several forms of manual load carriage and the most popular means of carrying books and supplies among school children today, are by school bags and backpacks is often used by hikers, backpackers and soldiers as it provides versatility and is an appropriate way of loading the spine closely and symmetrically while maintaining stability. One of the reason people mostly visits a medical practitioner or a physiotherapist is for musculoskeletal pain. Hence, it is important to investigate the aetiology of adolescent spinal pain as studies suggest that back pain experienced in youth is a predictor for pain in adulthood. Pain associated with musculoskeletal disorder is a condition where a part of the musculoskeletal system is injured overtime. It not only affects the tendons and the muscles but also the nerves and joints in the neck, upper back, chest, shoulders, arms and hands. Musculoskeletal disorder should be considered as 3 distinct entities that are the neck, upper back and lower back pain and thoracic pain being more prominent in younger children. Hence, carrying heavy school bags by school children could cause a wide spectrum of pain related to musculoskeletal disorders and postural dysfunctions.

Concern has been expressed by parents, researchers and educators regarding the long term impact of children carrying excessive loads in their school bags on a daily basis and musculoskeletal problems have become an increasing concern with school children.

There are lot of evidence in the literature which shows that musculoskeletal complaints such as neck, shoulder and back pain among school age students are believed to be from multiple and casual factors which are related to static and faulty postures, obesity, psychosomatic factors, due to classroom furniture and excessive load on the spine due to school bags. School bags load exceeding 10% of the body weight increases energy consumptions, increases neck and trunk forward lean and result in decreasing lung volumes and increased cardio-respiratory parameters. Some studies state the neck, shoulder and back pain are due to the load on the spine by school bags whereas few studies state that it is due to obesity, static and faulty postures and psychosomatic factors. When using school bags, the neck and trunk moves in forward position placing abnormal forces on the body. The risk factors associated are varied and sometimes are contradictory between the studies done. Studies on risk factors for back pain in children and adolescents showed that there is a slight association with anthropometric factors, radiological abnormalities, smoking and a stronger association with time spent watching television and with intensive participation in sports. Musculoskeletal symptoms in school children are multi-factorial in origin; but the carriage of heavy school bag is the suspected factor. A number of studies have demonstrated that there was a mismatch between the design of school bag, furniture and the anthropometric dimensions of school children. An important association was found with age that is more back pain at an older age and in gender as there was a higher prevalence in females.

Backpack weight of 10-15% has been recommended as an acceptable limit for school children. The bag weight should not be more than 15% of their body weight in the backpack but often their bags weigh 50% of their body weight as they have to carry the bag for much longer period of time, full day class schedule of school books in addition to other items and supplies throughout the day. In spite of several concerns being raised and attempts being made to reduce the schoolbags load, school children are still found with overweight school bags. Ultimately such heavy loads induce physiological strain and alter movement kinematics. However, when reviewing the literatures, worldwide the evidences is widely dispersed but when looking into the Indian setup, evidences are scattered. Hence, this study aimed at finding the prevalence of musculoskeletal pain in the neck, shoulder and back in adolescents using school bags and also to find the correlation between presence of pain and bag weight carried.

MATERIAL & METHODS

This co relational study was conducted on June 2013 in the beginning of the new academic year (1st term). 19 schools were targeted out of which 6 schools were included as permission was not obtained from all. The participants to be included in the study were students (boys and girls) studying in class 8th, 9th and 10th with an age group of 13-15
years using school bags. Participants were included if both pain was present or absent in regions of neck, shoulder or back but meeting with the inclusion criteria. A prior informed consent was obtained from the school authorities as well as from all the participants. Clearance was obtained from the institutional ethics committee. The nature and purpose of the study was explained to them while taking due care to avoid any bias. They were ensured that confidentiality of the data would be maintained.

The subjects were screened first based on the inclusion and exclusion criteria using a data collection form and were excluded if they had any recent or chronic illness or recent injuries or previous surgeries over the neck, shoulder, back or abdomen or musculoskeletal pain for more than 6 months. Subjects who met with the inclusion criteria and who were having pain over the neck shoulder or back region were given McGill - Melzack pain questionnaire to be filled. As the school authorities granted permission, students were assessed but not all the students were present on the day of the survey as few students were on leave.

Height of the student, weight of the student and the weight of the school bag was taken of all the students who met with the inclusion criteria. The weight of the student and the bag weight were taken using WC 150 weighing machine. This measurement was then used to find out the ratio of bag weight on body weight in percentage. The height of the students was measured using an inch tape and the body mass index of the students were calculated.

The data thus obtained was then subjected to statistical analysis using SPSS 17.0 in order to determine the prevalence of musculoskeletal pain in school going adolescents due to the weight of the school bags and to find out the correlation between presence of pain and bag weight carried.

Results:
2.93% of subjects reported of pain in the neck, shoulder or back. Correlation of pain rate with respect to bag weight was analysed using Pearsons product moment correlation is \( r = 0.784 \). The BMI of males are lesser when compared to females. The percentage of bag weight on body weight ratio is more in females (mean ± SD is 9.18 ± 3.71) when compared to males (mean ± SD is 8.88 ± 3.65). 30% of subjects carried bag weight between 10 - 15% and 6.03% of students carried bag weight weighing more than 15%. 8.57% of subjects complaining of pain carried bag weight of more than 15%.

**DISCUSSION**

This study was conducted with the purpose of finding the prevalence of musculoskeletal pain in the neck, shoulder and back in adolescents using school bags and also the correlation between presence of pain and bag weight carried.

The random sample in this study included 727 adolescents of 6 high schools according to their admissions in 8th to 10th. Out of this 580 students were included as they met with the inclusion criteria (Table 1). During the time of survey not all students were present. 147 students were excluded as they either underwent surgery in the region of neck, shoulder, back or abdomen, there was injury present at the time of assessment, they were ill during the time of assessment or had any chronic illness, had musculoskeletal pain for more than 6 months or not in 13 – 15 yrs of age group.

Out of 580 students the total number of students who complained about pain in the neck, shoulder or back region was 19 males and 7 females. But the students who complained of pain due to bag weight were 12 males (3.80%) out of 316 males and 5 females (1.89%) out of 264 females. Hence, out of 580 students, 17 subjects (2.93%) reported of having pain in the neck, shoulder and back region due to bag weight. The correlation of pain rate with respect to bag weight was analysed using Pearsons product moment co relation, revealed that, there is moderate correlation present (\( r = 0.784 \)) (Table 2).

When analysed for students’ bag weight on body weight percentage, it was found that the mean ± standard deviation was 9.18 ± 3.71 for females and 8.88 ± 3.65 for males. This is in agreement with the studies which state that females carry heavier school bags compared to males. Students (n=9) who complained of pain in the neck shoulder and back stated the reason to be prolonged sitting in the McGill Melzack pain questionnaire. As seen in the study conducted by Mohd Azuan et al (2010) who concluded that not only bag weight but age and class room furniture could also be the
Table No.1: Demographic data

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Male</td>
<td>316</td>
<td>157.84 ± 10.5</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>264</td>
<td>155.36 ± 6.88</td>
</tr>
<tr>
<td>Weight</td>
<td>Male</td>
<td>316</td>
<td>43.94 ± 10.78</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>264</td>
<td>44.99 ± 9.98</td>
</tr>
<tr>
<td>Bag weight</td>
<td>Male</td>
<td>316</td>
<td>3.7 ± 1.21</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>264</td>
<td>3.93 ± 1.26</td>
</tr>
<tr>
<td>Bag weight/body weight</td>
<td>Male</td>
<td>316</td>
<td>8.88 ± 3.64</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>264</td>
<td>9.18 ± 3.7</td>
</tr>
<tr>
<td>BMI</td>
<td>Male</td>
<td>316</td>
<td>17.46 ± 3.11</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>264</td>
<td>18.55 ± 3.51</td>
</tr>
</tbody>
</table>

Table No. 2: Correlation of pain present with respect to bag weight

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD (n=17)</th>
<th>r value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag Weight</td>
<td>4.38 ± 1.31</td>
<td>0.784</td>
<td>Moderate correlation</td>
</tr>
<tr>
<td>Pain Rate</td>
<td>3.23 ± 0.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table no. 3: Correlation of BMI with respect to percentage of bag weight on body weight

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>BMI &amp; Percentage of bag weight/body weight</th>
<th>Mean ± SD (n=17)</th>
<th>r value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>12</td>
<td>BMI</td>
<td>4.87 ± 2.81</td>
<td>0.413</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of BW/BoW</td>
<td>10.09 ± 2.53</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>BMI</td>
<td>17.38 ± 1.47</td>
<td>0.086</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of BW/BoW</td>
<td>13.33 ± 4.87</td>
<td></td>
</tr>
</tbody>
</table>
factors associated with pain which causes musculoskeletal disorder\textsuperscript{2}.

This study shows that there is less correlation between BMI and bag weight on body weight in subjects complaining of musculoskeletal pain as in females (n=5) $r = 0.086$ and in males (n=12) $r = 0.413$ This could be due to the reason as the survey was conducted in the $1^{st}$ term of school as the students carried minimum number of books than what is used in the complete academic schedule (Table 3).

Studies show that the recommended school bag weight is $10 – 15\%$ to the body weight\textsuperscript{8, 16, 17}. When analysed for the percentage of bag weight on body weight carried by the students, it shows that $8.57\%$ of the population who complained of pain carried more than $15\%$ of bag weight. Therefore, by midterm or last term of the school the bag weight can increase even more. $63\%$ of the
population included in this study carried less than 10% of bag weight, but this can also increase to more than 10% by the end of the year subjecting to future pain and causing musculoskeletal disorders 4, 22, 23. Ramprasad M et al (2009) concluded that the craniovertebral angle significantly changed after 15% of backpack load. The head on neck and head and neck on trunk angles changed after 15% of backpack load. Hence, carrying a backpack weighing 15% of body weight will change the postural angles in preadolescent children 4. In the study conducted by Connolly B H et al (2008) states that a little change in temporal – spatial gait parameters was noted during backpack use with loads limited to 15% body weight 24. Therefore, school schedules should be looked in for the increase of weight of school bags 25 or other alternative should be made such as keeping lockers in the school.

The result of this study shows the prevalence to be low for pain associated with school bag weight. This could be the limitation of this study as it was done in 6 schools in Mangalore with the population of 580 and also during the 1st term of academics and all aspects were not evaluated. Concern has been shown by many, but still students complained of pain due to heavy bags. Hence, for future research the population can be increased targeting more number of schools. The effect of school bag on musculoskeletal system throughout the academic year should be analysed periodically conducting it by the midterm or the last term where more number of books will be carried in their school bags so that the effects of heavy bags on the musculoskeletal system can be minimised. There was no prior screening done for posture in this study. Therefore postural analysis and environmental analysis can be done in the future with students carry heavy school bags.

CONCLUSION
The prevalence of neck, shoulder and back pain in school-going adolescents in Mangalore – secondary to school bags is 2.93%. The prevalence in this study is low but when analysed for bag weight it shows that the students carry more weight in bags than the recommended acceptable limit for school children being 10 – 15%.

REFERENCES
7. Pack that school bag, lighten that load!. The Hindu. July 10 2003
Available in URL: http://adc.bmj/content/88/1/12.full.html
25. Samo F, Irena D. Physical overburdening of pupils with the weigh of school bags during the period of passing from eight tear primary school to nine year primary school. Informatologia 2007;40(3):207-210
Available in URL: http://www.biocentral.com/1471-2474/3/10
