

## MUSCULOSKELETAL PROBLEMS RELATED TO HEAVY BACKPACKS AMONG SCHOOL GOING CHILDREN

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### ABSTRACT

**Introduction:** Backpacks are used by most school children across the world to transport books and other material to school. The daily physical stresses associated with carrying backpacks cause significant forward lean of the head and trunk. The combined effects of heavy backpack, duration carrying the backpack, manipulating and handling of backpack, method of carrying, position of the load on the body of students are determinant factors for musculoskeletal complaints associated with backpack carriage. They can affect different parts of the body including upper and lower back, neck, shoulders and extremities such as arms, legs, feet, and hands. **Methods:** The present aimed to assess the musculoskeletal problems related to heavy back packs among school going children. A Descriptive Survey Design was adopted for the study which was conducted among 100 school children selected by simple random sampling technique. Data collection tool included a demographic variable performa, a performa to assess the weight of the backpack in relation to body weight and physical examination performa for assessing the musculoskeletal problems. Musculoskeletal discomfort questionnaire and numerical pain scale was used to identify the severity of musculoskeletal problems. **Result:** The findings of the present study showed that all (100%) of the school children had musculoskeletal problems. Majority (60%) of the school children carried bag pack more than 15% of their body weight. Most of the musculoskeletal problems were in shoulder (91%), neck (75%), arms (70%). Almost three fourth of the children had moderate pain. There was a significant correlation between weight of backpack with body weight and severity of musculoskeletal pain as well as musculoskeletal problem among the school children. **Conclusion:** The overall findings of the study clearly showed that there was a significant correlation between the weight of the bag pack and the musculoskeletal problems among the school going children.

**KEYWORDS:** Musculoskeletal problems, MSP, school children, heavy bag pack.

### INTRODUCTION

Students and backpacks are a common site today. Backpacks come in all sizes, colors, fabrics, and shapes and help children of all ages express their own personal sense of style. Many backpack's feature multiple compartments that help students to stay organized while they carry their book and papers from home to school and back again.<sup>[1]</sup> Students of all levels, carry a schoolbag packed with textbook, notebooks, library books, geometrical and mathematic instruments, snacks boxes, lunch packs and water bottles and so on.

Many students carry school backpacks that exceed 10 % to 15 % of their body weight, which puts them at risk for back pain and related disorders. Improper backpack use can also lead to poor posture. Girls and younger kids

may be especially at risk for backpack-related injuries because they're smaller and may carry loads that are heavier in proportion to their body weight. Carrying backpacks increases the risk of back pain and possibly the risk of back pathology. The prevalence of school children carrying heavy backpacks is extremely high. The daily physical stresses associated with carrying backpacks cause significant forward lean of the head and trunk. It is assumed that daily intermittent abnormal postural adaptations could result in pain and disability in school going children.<sup>[2]</sup>

Across the globe, millions of school going children race out to the school bus or carrying to their classes with overstuffed backpacks hanging over their shoulders. It is assumed that daily continuous postural adaptations could result in pain and disability in school going children.

Children carrying backpacks for school with too much weight are also at risk for short term and possible long term health issues. Recent worldwide attention has focused on the role of backpacks in the development of MSP in school children.<sup>[2]</sup>

The backpack is an appropriate way to load the spine closely and symmetrically, while maintaining stability. The improper use of backpacks can lead to muscle imbalance that could turn into chronic back and neck problems later in life. Many children carry bags over one shoulder or the bags hang very low on their backs. This greatly increases the risk of pain and injury.<sup>[3]</sup>

Carrying Heavy bag pack for prolonged periods can result in bad postures. Bad posture is most commonly used to describe the human position in which the head and shoulders are placed forward of the spine with the spine curved into an excessive S-shape, or a C-shape, also called as slouched, or hunchback posture. Bad posture is associated with backaches of all types, poor health, poor breathing, tiredness, and ready fatigability.<sup>[4]</sup>

This excessive weight of the schoolbags will create an imbalanced stance and will cause the students to lean forward which in time will disrupt both coordination and posture of the students and worst, it may distort the back's natural curves. Furthermore, heavy backpacks create a forward trunk lean which causes a forward head posture with an extended neck, creating neck and shoulder pain and making it difficult for muscles and ligaments to hold up the body. This could eventually lead to chronic muscle imbalance.<sup>[5]</sup>

Due to growing concerns among parents, educators and health care professionals related to the subject of children and backpacks and its effect on the musculoskeletal system the additional research in this area would only strengthen the understanding of the problem. Hence the present study was undertaken with the aim to explore the problems of school children related to heavy bag packs.

#### Objectives of the Study

1. To assess the musculoskeletal problems among school going children related to heavy backpacks.
2. To find out the correlation between heavy backpacks and musculoskeletal problems among school going children.
3. To find out the association between the musculoskeletal problems among school going children with the selected demographic variables.

#### METHODOLOGY

**Research Approach/Design:** A descriptive approach and survey design was adopted for the study

**Setting:** The study was done at selected schools in Bengaluru, Karnataka, India.

**Sample and Sampling criteria:** The accessible population of the study comprised of school children (8-12years) studying at a selected school in Bengaluru. The sample size consisted of 100 school children. Simple random sampling technique using odd and even number was adopted for selecting the students.

**Inclusion criteria:** Children willing to participate, in the age group of 8-12 years and who could read and write English were included.

**Exclusion criteria:** Children who were not available at the time of data collection and those who were not carrying school bag by their own.

#### Data Collection Tools

1. Demographic variables performa: A structured self-administered questionnaire developed by researcher to gather data regarding school children demographic variables
2. Performa to assess the weight of the bag pack in relation to body weight.
3. The weighing machine was used to assess the weight of school children with and without the bag pack. Scoring key: The difference between the two items was recorded as the weight of the bag pack. And the percentage of the weight of the bag pack in relation to body weight of the school children is measured as  $\text{Weight of bag pack} / \text{weight of school children with bag pack} \times 100$ . The obtained score was categorized as per American Academy of Pediatrics<sup>[6]</sup> (< 15% of the Body weight- Out of risk, 5-20% of the body weight- at risk, >20% of the body Weight-High risk).
4. Physical examination performa: for assessing musculoskeletal problems: It consisted of 7 areas such as gait, neck, knees, arms, spine, extremities and shoulder.
5. Musculoskeletal pain/discomfort questionnaire: There were 11 areas with 18 items in the question form with Yes/No option. For 'Yes' response numerical pain scale was used to assessed the severity of musculoskeletal pain/discomfort.

**Validity and Reliability of tools:** Validity of tools was established by group of subject experts and Reliability coefficient obtained was 0.87.

**Ethical clearance:** Ethical clearance was taken from Institutional Ethical Committee Board of Institution.

#### RESULTS AND DISCUSSION

##### I. Demographic characteristic of school children

Table 1 reveals that 38% of school children were 12 years of age, 30% were 11 years, 62% of school children were male, 42% school children belonged to Grade VII, majority (83%) of school children went to school by walking, 96% carried bag pack with double strap.

**Table 1: Frequency and percentage distribution of school children as per the demographic variables (n=100).**

Variable	Categories	Frequency	Percentage (%)
Age in Years	8	8	8
	9	10	10
	10	14	14
	11	30	30
	12	38	38
Gender	Male	62	62
	female	38	38
Grade	III	7	7
	IV	16	16
	V	7	7
	VI	28	28
	VII	42	42
Mode of transportation	Walking	83	83
	Cycle	17	17
Type of bag	Double Strap	96	96
	Single Strap	04	04

**II. Musculoskeletal Problems:** 60% of the students were at the risk of developing musculoskeletal disorders carried backpack more than 15% of body weight and (Table 2)

**Table 2: Frequency and percentage distribution of school children according to bag pack and body weight (n=100).**

Category	Frequency	Percentage (%)
Less Than 15 % of Body weight	40	40
15 – 20% of BW	53	53
More than 20% of Body weight	07	07

**III. Type of Musculoskeletal Problem**

Table 3 reveals that majority (85%) of the school children had shoulder pain, 53% children had abnormal movement of the shoulder, 75% had neck pain, 7% had

limited neck movement, 70% had pain in the arm, 20% had rigid movement of the arm, 21% had poor posture, 6% had hip abduction and 21% had poor posture with hip abduction.

**Table 3: Frequency and percentage distribution of school children by type musculoskeletal problems (n=100).**

Area of Body	Abnormality	Frequency (f)	Percentage (%)
Gait	Poor Posture	21	21
	Hip Abduction	06	06
Neck	Pain	75	75
	Limited Movement	07	07
Arm	Arm	70	70
	Rigid Movement	20	20
Knees	Abnormal Movement	22	22
	Pain and Swelling	55	55
Spine	Pain	44	44
Legs	Limited strength	15	15
	Pain and Swelling	30	30
Shoulder	Abnormal Movement	53	53
	Pain	85	85

**IV. Areas of Pain/ discomfort due to heavy Backpack**

Figure 1 depicts that almost all (99%) of the school children had shoulder pain followed by 86% of the school children had lower back pain. (Figure1).

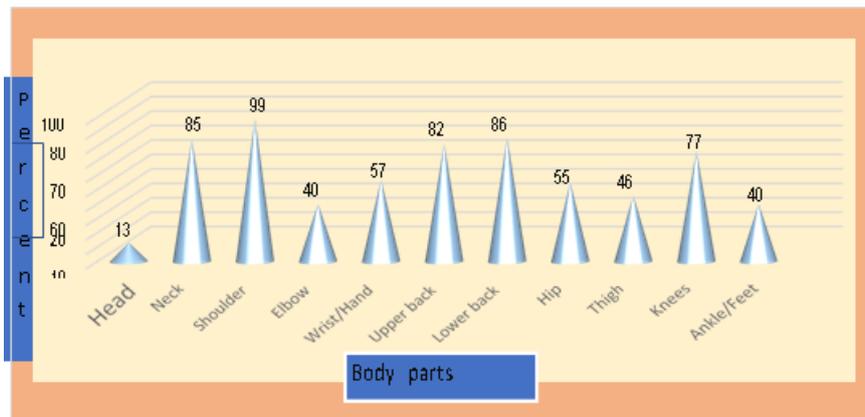


Figure 1: Frequency and Percentage of children according to musculoskeletal pain in different body areas.

**V. Severity of Pain/ Discomfort:** Almost three fourth of the children (73%) had moderate pain, 26% of children had mild pain. (Table 4).

Table 4: Frequency and percentage distribution of children as per severity of musculoskeletal pain/discomfort (n=100).

Severity of pain and discomfort	Frequency (f)	Percentage (%)
Mild	26	26
Moderate	73	73
Severe	01	01

**VI. Correlation between heavy backpack and musculoskeletal problems and musculoskeletal pain of school children**

There was a moderate positive correlation between weight of body with backpack and severity of musculoskeletal problems (r=0.532, p<0.001), which

was significant at 0.001 level. The correlation between weight of body with backpack and musculoskeletal pain was found to be low positive (r=0.316, p<0.001) which was also highly significant at 0.001. (Table 5)

Table 5: Correlation between heavy back packs and severity of musculoskeletal pain and musculoskeletal problem (n=100).

Variable	Mean	SD	r	p value
Weight of body with bag pack	5.39	1.32	0.532	p<0.001**
Severity of musculoskeletal pain /Discomfort	62.16	19.01		
Weight of body with bag pack	5.39	1.32	0.316	p<0.001**
Musculoskeletal problem	3.97	1.0		

\*\* Highly significant at the 0.0001 level.

**VII. Association between the musculoskeletal problems among school going children with the selected demographic variables.**

There was association between the demographic variables such as age ( $\chi^2=11.952$ , p=0.018), mode of transportation ( $\chi^2=5.74$ , p=0.016) and type of bag ( $\chi^2=4.17$ , p=0.041) which is found to be significant at 0.05 level.

problems related to carrying heavy backpacks among school children. A total of 100 school children were included in the study. Findings showed that 60% students carried >15% ratio of bag to body weight. Whereas Fahim FM.<sup>[7]</sup> reported 93% students carried >15% ratio of body to bag weight. This puts the children at risk for various musculoskeletal disorders.

**DISCUSSION**

Carrying baggage on the back and shoulder is a common practice among children as well as adults worldwide. Use of heavy backpacks and improper carrying of backpacks are one of the factors contributing to musculoskeletal problems in school going children. This study was done with the aim to investigate the musculoskeletal pain and

With regard to pain in different areas of body our study showed that almost all (99%) of the school children had shoulder pain which is higher than the finding of Afjal N et al,<sup>[8]</sup> Neuschwander TB et al,<sup>[9]</sup> Patil MA.<sup>[10]</sup> Hamzat TK et al.<sup>[11]</sup>

Another common problem reported in literature is back pain. In our study 86% students had lower back pain and

82% upper back pain which is comparatively higher than that reported in other studies of Afjal N. et al,<sup>[8]</sup> Patil MA,<sup>[10]</sup> Sheir-Neiss G et al,<sup>[12]</sup> Dockrell S et al<sup>[13]</sup> Haselgrove C,<sup>[14]</sup> Mwaka ESet al,<sup>[15]</sup> Skaggs D,<sup>[16]</sup> De Paula AJ.<sup>[17]</sup>

Present study found 85% students had symptom of neck pain, which is consistent with the finding noted by Haselgrove C et al.<sup>[14]</sup> and Patil MA.<sup>[10]</sup> Other areas of pain found in more than half the students in our study included wrist/ hand (57%) and hip (55%). Children also reported pain in the knees, spine and extremities. This is attributed to the fact that excessive load on the back leads to forward bending of the trunk and neck and large muscle imbalances in the neck, shoulder and spine thus a biomechanical cause of musculoskeletal problem.

The severity of pain was assessed by numerical scale. Our study indicated that majority (73%) of the school children had moderate pain, 26% mild pain and only 1% had severe pain where as in a study by Faim FM,<sup>[7]</sup> reported 35% had moderate pain, while mild pain was noticed in (21%) students, severe pain was found in (26%).

The present study found a significant positive correlation between weight of bag pack with body weight and severity of musculoskeletal pain ( $r=0.532$ ,  $p=0.001$ ) as well as musculoskeletal problems ( $r=0.316$ ,  $p=0.001$ ) among the school children. Whereas Hamzat TK et al,<sup>[11]</sup> reported a weak relationship between pain intensity, body weight and backpack to body weight ratio ( $r$  range 0.433–0.442;  $p < 0.001$ ), Hence it can be emphasized that heavy backpack has impact on musculoskeletal system.

Findings regarding association between the selected demographic variables such as age ( $\chi^2=11.952$ ,  $p=0.018$ ), mode of transportation ( $\chi^2=5.74$ ,  $p=0.016$ ) and type of bag ( $\chi^2=4.17$ ,  $p=0.041$ ) and severity of musculoskeletal pain or discomfort. was significant. The possible explanation can be that children were in the age group of 8 to 12 years. Majority (83%) of the school children went to school by walking and it makes the children to carry bag pack for a long period of time, hence contributing to the various musculoskeletal symptoms.

These problems if continue for a long period of time can result in condition which may require intense medical treatment. Therefore, school children, parents and the school authorities require an equal involvement in determining the weight of the bag pack and various contribution in reducing it. In view of the above finding it is suggested that preventive measures such as right size of bag pack, wearing strap on both shoulder, choosing bag pack of light material and appropriate guidelines with regard to safe load carriage in school children are therefore needed to protect this age group of school children. To further reduce on the effects of bag weight school, provide students with lockers for storage of their

scholastic materials. Schools should also have fully functional libraries where students can sit, read and borrow text books instead of carrying them daily in their bag. Lunch packs and water bottles as additional contributors to the school bag weight. Parents should be urged to select school bags and items which are made of light-weight materials. When selecting a backpack, look for an ergonomic design the correct size, padded back and shoulder straps, multiple compartments to better distribute the weight, light material. Physical training program focusing on relief of symptoms. Teaching program and demonstrations of exercises for better understanding of preventive measures and musculoskeletal system strengthening is recommended.

## CONCLUSION

This study demonstrates that backpack weight affects the musculoskeletal system adversely. More research is needed to determine safe backpack weights for children. Backpack weight represents a controllable risk; through education and preventive measures long and short term backpack related problems may be reduced. Early back care education can promote healthy behavior and potentially prevent musculoskeletal problems related to heavy backpack

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