

Prevalence of Musculoskeletal Problems Due to Heavy Backpacks in School Going Children

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ABSTRACT

Objective: To find out the prevalence of musculoskeletal discomfort due to heavy backpacks in school going children.

Materials and Methods: This observational study recruited **200** students from different schools of Sargodha, Pakistan. Data was collected based on inclusive and exclusive criteria. The inclusive criteria were the students of **7th** and **8th** grades from different schools. The survey was done through self-validated questionnaire that included closed ended questions and weight machines were used to measure the weight of students and their backpacks. The data was analyzed and assembled through **SPSS 23.0**

Result: According to current study, **61.5%** students had discomfort due to carrying backpacks while **38.5%** students didn't complain any discomfort. Moreover, **51.5%** students had pain in shoulder, **6%** in neck, **4.5%** in back and **38%** students didn't feel any discomfort while carrying backpacks.

Conclusion: The study concluded that students suffer from shoulder, neck and back discomfort due to carrying heavy backpacks that are beyond the **recommended safe load limit of 10% to 15%**. Shoulder discomfort was the most commonly reported.

Keywords: Backpacks, Discomfort, Students.

INTRODUCTION

The weight of school backpacks carried by children exceeding the recommended safe load limit, which is usually between 10% to 15% of their body weight, has raised concerns among parents, educators, and healthcare professionals worldwide (1). The safety of schoolchildren has become a global issue due to the weight of their backpacks (2). Research has shown that there is a significant correlation between the weight of the backpack and the individual's body posture. Carrying a backpack that weighs more than the recommended limit can cause a forward head posture, which compensates for the weight. Experts recommend carrying the backpack on both shoulders and limiting its weight to 10% of the individual's weight (3). While some studies suggest that the weight of the school backpacks causes discomfort in the neck, shoulders, and back, other studies claim that factors such as obesity, poor posture, and psychological issues are the main contributors (4). The weight shouldn't be greater than 10%, according to the **American Occupation Therapy**

Association, American Academy of Orthopedic Surgeons, and International Chiropractic Pediatric Association. The incorrect use of a backpack can cause muscular imbalance, which over time may result in chronic back and neck issues. In the UK, adults carry backpacks that burden 15 to 20% of their body weight on average, while children can carry backpacks that weigh 30 to 40% of their weight (5). MSD refers to a progressive injury to a part of the musculoskeletal system over time, affecting the tendons, muscles, nerves, and joints in various areas, including the hands, arms, shoulders, back, and torso. According to a research study, discomfort in the thoracic region is more common in younger children, suggesting that the spine and MSD should be treated as distinct entities, with separate consideration given to neck, upper back, and low back discomfort. Research indicates that musculoskeletal discomfort is frequently reported by schoolchildren as young as seven years old (6). In population surveys and primary care, neck discomfort ranks second only to low back discomfort as the most prevalent musculoskeletal discomfort. Like low back discomfort, neck discomfort is a major health and financial burden as well as a regular cause of disability. According to research, a child's participation in everyday activities while in school is significantly impacted by their backpack. Among them, MSD is a result of the unsafe atmosphere at school (7). The appendicular skeletal system reaches its peak rate of development during childhood puberty and stops growing around 16 years of age for females and 18 years of age for males. However, secondary vertebral ossification does not finish until the middle of the thirties. Skeletal tissue undergoes a multi-stage ossification process in these years that turns it from cartilage to bone, making this the most vulnerable period for them. Due to the spine's ongoing development, children need special consideration. In order to minimize postural changes when carrying a school bag, current suggestions focus primarily on reducing bag weight and optimizing bag designs. However, other elements, such as the amount of time that school backpacks are carried and how they are perceived to weigh may also be significant (8). It is believed that children's physiological and biomechanical factors, such as energy cost or spending, posture, fatigue, contact pressure, gait, spinal curvature and compression, and pulmonary capacity, are affected by the excessive weight of the backpack (9, 10). According to some researchers, the frequent complaints of back pain in children may be caused by their use of heavy backpacks. According to a recent survey, both male and female secondary school students should wear a backpack that weighs no more than 5.18% and 4.91% of total body weight, correspondingly (11). The main purpose for selecting this topic for our research was "To find out the prevalence of musculoskeletal problems due to heavy backpacks in school going children."

METHODOLOGY

Study design:

The study design was observational, and the sample size was calculated to be 200 school children using Gateway Software. The study was conducted for six months from August 2019 to February 2020. Data was collected through carefully designed questionnaire, and the study population was the students of four different schools in Sargodha.

Sample selection and sampling technique:

The sampling technique used was purposive sampling due to a small period and a low budget for research purposes. The assortment criteria for inclusion were students of grade 7 and 8, aged between 11-14 years, both boys and girls who were able to wear backpacks on one or both shoulders, and healthy students with no known history of MSK problems. Exclusion criteria included students with physical disability and major health problems, those with any recent health issues, and students who were not willing to participate.

Data collection procedure:

Data collection was done using a self-structured questionnaire, and weight machines were used to measure the weight of students and their backpacks. Questions regarding type of Backpack, way of carrying backpack, any discomfort while carrying backpacks and regarding any past medical history were asked from students.

Data analysis:

Data was analyzed and compiled through SPSS (statistical packages for social sciences) **23.0** and presented in graphical and tabular form for better understanding. Study was conducted in four different schools of Sargodha.

RESULTS

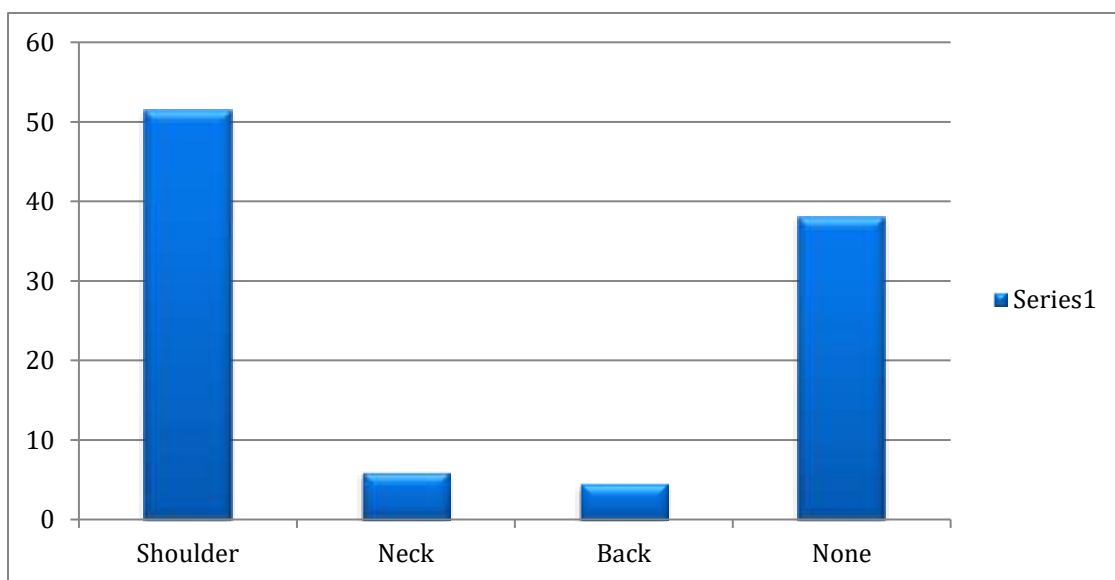
A total of 200 students were participated in the study. Mean age of the students were 12.5 ± 0.9 with a range of 11 to 14 years. There were 63% males and 37% females. Mostly students (97.5%) carry backpack on both shoulders. Mean weight of the bags were 7.7 ± 1.6 with range of 3-12 kgs. Mean weight of the students were 62.4 ± 12.44 with range of 27-98 kgs as described in **Table 1**. Prevalence of MSK disorders in different parts of the body were found to be 61.5%. Most of the students complain pain in shoulders while carrying backpack. According to current study, Shoulder Pain was found to be 51.5%, Neck Pain (6%), Back Pain (4.5%) and with No Discomfort (38%) summarized in **Table 2**.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	200	11	14	12.5	0.93508
WEIGHT OF BAG	200	3	12	7.7	1.63686
WEIGHT OF CHILD	200	27	98	62.4	12.44413

Table2: % Types of backpacks, Area wise distribution of pain, Prevalence of discomfort and Duration of discomfort.

Parameters(n=200)	%
Gender	
Male	63%
Female	37%
Type of Backpacks	
Single Strap Bags	2.5%
Double Strap Bags	97.5%
Prevalence of discomfort	
Students with Discomfort	61.5%
Students with no Discomfort	38.5%
Duration of Discomfort	
Discomfort for <5 minutes	52%
Discomfort for >5 minutes	12%
No Discomfort	38%
Type of Pain	
Shoulder Pain	51.5%
Neck Pain	6%
Back Pain	4.5%
No Discomfort	38%



DISCUSSION

Anecdotal and scientific data suggests that school bag carriages cause musculoskeletal discomfort. Students, parents, and educators and health experts are all concerned about school bag weight and their way of carrying because these things matters a lot in developing MSK disorders in school going children (12). This includes health barriers and facilitators, as well as suggested content delivery strategies to promote health among school-aged children. According to studies, musculoskeletal discomforts encountered by growing children are significantly related to backpack loads, and heavy backpack loads can actually result in changes in posture (13). Schoolchildren typically transport their school materials in a backpack. Carrying heavier school bags than suggested may have negative health consequences (14). A total of 200 participants were recruited for this study, out of which 63% students were male and 37% were female. The participant profiles differed greatly providing a diversified set of ideas and experiences. Participant's ages ranged from 11-14 years. According to current study, 97.5% students had double strap bags while 2.5% students had single strap bags. 61.5% students had discomfort due to carrying backpacks while 38.5% students didn't complain any discomfort. The pressure exerted on the spine of teenagers due to their weight has been recognized as a significant factor that increases the risk of developing different musculoskeletal issues in children (15). The American Occupational Therapy Association states that strain on backpack straps can compress blood vessels and nerves in the neck and shoulder area, resulting in discomfort and tingling sensations in the arms, hands, legs, and neck. To prevent excessive pressure, it is essential to use properly padded straps. At 10, 20, and 30% of body weight, the contact pressure under the shoulder strap was significantly higher on the right shoulder than on the left (16). According to our studies, 51.5% students had discomfort in shoulder region, 6% students complained discomfort in neck region and 4.5% students complained discomfort in back region while carrying backpacks. In 93.5% students, there were no limitations of ADLs due to pain while in 6.5% students, ADLs were affected by pain. Research suggests that carrying a backpack for a prolonged period of time (18) and the weight of the backpack (17) can affect both cervical and shoulder posture (19). School children who carry heavy backpacks often experience pain in their shoulders, upper back, neck, and lower back. The excessive weight of the backpack causes forward bending of the trunk and neck, leading to biomechanical strain and musculoskeletal pain. This forward flexion restricts trunk movement, which can impede thorax movement and decrease abdominal size as muscles contract to enhance stability and prevent abdominal breathing (20). The standard value of school bag carriage should be 10-15% of BW. From our survey, we concluded that 109 students (54.5%) were not following the standard value while 91 students (45.5%) were having backpack weight according to standard value. According to a systematic study, it was determined that backpacks weighing no more than 10% of a child's body weight would be safer for their spinal health. To promote a pain-free and healthy society in the future, it is important to reduce the strain on schoolchildren's spines (21). Based on current research, it is recommended that parents be educated about the high incidence of shoulder, neck, and lower back pain associated with carrying

heavy school bags. Such pain among children has become a public health concern, and taking steps to prevent it from an early age can alleviate the burden on older age groups (22). Physiotherapists, who specialise in movement and exercise in schools, will lend their support to this effort.

CONCLUSION

From the result of study, it is concluded that students suffered from musculoskeletal discomfort due to carrying heavy backpacks. The prevalence of shoulder discomfort was highest among students. Most of the articles recommended that backpack load limit for students should be 10-15% of BW. From our observation, we found that 54.5% students were not following the standard load limit. So, we can say that this might be one of the causes of MSD in those students. There is a need to concentrate on the issue of heavy backpacks for children in underdeveloped countries.

Recommendations:

It is crucial for our general population, especially parents, to have knowledge about the safe and recommended weight limits for school children's bags, which should range from 10% to 15% of their body weight. A study ought to be conducted to compare the outcomes of children who adhere to the recommended guidelines with those who do not, to determine if following these guidelines can potentially alleviate discomfort in the shoulders, neck, and back regions. It is recommended for students to adhere to a structured timetable for their daily activities, while schools should also offer lockers to ensure that the weight of their school bags remains within a safe range.

REFERENCES

1. Mwaka ES, Munabi IG, Buwembo W, Kukkiriza J, Ochieng J. Musculoskeletal pain and school bag use: a cross-sectional study among Ugandan pupils. *BMC research notes*. 2014;7:1-7.
2. Bauer DH, Freivalds A. Backpack load limit recommendation for middle school students based on physiological and psychophysical measurements. *Work*. 2009;32(3):339-50.
3. Arghavani F, Zamanian Z, Ghanbary A, Hassanzadeh J. Investigation of the relationship between carrying school bags (handbags and backpacks) and the prevalence of musculoskeletal pains among 12-15 year old students in Shiraz. *Pakistan journal of biological sciences: PJBS*. 2014;17(4):550-4.
4. Panicker RK, Sandesh T. Prevalence of musculoskeletal pain in school going adolescents using school bags: A co-relational research. *International journal of therapies and rehabilitation research*. 2014;3(4):1.
5. Rai A, Agarawal S. Back problems due to heavy backpacks in school children. *IOSR J Hum Soc Sci*. 2013;10:1-5.
6. Martin A, Bertha OY, Hosea B, Acheampong B, Edward A, Cynthia OY. Prevalence of Musculoskeletal Pain and Body-Chair Mismatch among Junior High School Students in Ghana: A Risk Factor for the Young. *Journal of advances in medicine and medical research*. 2017;23(12):1-9.
7. Mohd Azuan K, Zailina H, Shamsul B, Nurul Asyiqin M, Mohd Azhar M, Syazwan Aizat I. Neck, upper back and lower back pain and associated risk factors among primary school children. *J Appl Sci*. 2010;10(5):431-5.

8. O'Sullivan P, Smith A, Beales D, Straker L. Understanding Adolescent Low Back Pain From a Multidimensional Perspective: Implications for Management. *J Orthop Sports Phys Ther.* 2017;47(10):741-51.
9. Adeyemi AJ, Rohani JM, Rani MRA. Backpack-back pain complexity and the need for multifactorial safe weight recommendation. *Applied ergonomics.* 2017;58:573-82.
10. Adeyemi AJ, Rohani JM, Rani MA. Back pain arising from schoolbag usage among primary schoolchildren. *International Journal of Industrial Ergonomics.* 2014;44(4):590-600.
11. Ismaila S. Safe backpack weight limit for secondary school students in Ibadan, Southwestern Nigeria. *Alexandria Engineering Journal.* 2018;57(2):547-54.
12. Mackie HW. Schoolbag carriage: design, adjustment, carriage duration and weight: a thesis presented in fulfilment of the requirements for the degree of Doctor of Philosophy in Ergonomics at Massey University, Palmerston North, New Zealand: Massey University; 2006.
13. Kellis E, Emmanouilidou M. The effects of age and gender on the weight and use of schoolbags. *Pediatric Physical Therapy.* 2010;22(1):17-25.
14. Lasota A. Schoolbag weight carriage by primary school pupils. *Work.* 2014;48(1):26-12.
15. Moore MJ, White GL, Moore DL. Association of relative backpack weight with reported pain, pain sites, medical utilization, and lost school time in children and adolescents. *Journal of School Health.* 2007;77(5):232-9.
16. Macias BR, Murthy G, Chambers H, Hargens AR. High contact pressure beneath backpack straps of children contributes to pain. *Archives of pediatrics & adolescent medicine.* 2005;159(12):1186-8.
17. Young IA, Haig AJ, Yamakawa KS. The association between backpack weight and low back pain in children. *Journal of Back and Musculoskeletal Rehabilitation.* 2006;19(1):25-33.
18. Grimmer KA, Williams MT, Gill TK. The associations between adolescent head-on-neck posture, backpack weight, and anthropometric features. *Spine.* 1999;24(21):2262.
19. Chansirinukor W, Wilson D, Grimmer K, Dansie B. Effects of backpacks on students: measurement of cervical and shoulder posture. *Australian Journal of physiotherapy.* 2001;47(2):110-6.
20. Vieira AC, Ribeiro F. Impact of backpack type on respiratory muscle strength and lung function in children. *Ergonomics.* 2015;58(6):1005-11.
21. Hassan D, Kashif M, Bandpei MAM, Ali SQ, Raqib A, Manzoor N, et al. School Bag Packs and Associated Problems among School Going Children. *Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin.* 2020;30(01):10-6.
22. Shahid G, Aziz K, Arif A, Fahim MF. Prevalence of musculoskeletal pain due to heavy backpacks in school going children of Karachi. *Int J Phys Med Rehabil.* 2018;6(3):2.