

# Postural Discomforts in Children due to Heavy Backpack

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## ABSTRACT

**OBJECTIVE:** To find the postural discomforts in school-going children due to heavy backpacks.

**METHODOLOGY:** The study was designed as a cross-sectional descriptive study. This study was conducted in private schools in Lahore. Data was collected using a purposive sampling technique from September 2021 to February 2022. A sample size of 196 students was selected for this study. A nordotic musculoskeletal questionnaire was used. The children were chosen using the purposive sampling method. Students in grades 5 through 10 are included, carrying bags with one or both shoulders. Students of all genders were included with independent standing on the weighing scale. The study excluded students with metabolic abnormalities or musculoskeletal complaints caused by pathological, orthopedic, or hereditary factors. SPSS 21.0 was used for analysis.

**RESULTS:** The result shows that about 107(54.6%) students have neck pain due to wearing backpacks. About 160(81%) students have pain in both shoulders. Only 3(1.5%) students had pain in hand/wrist. 109 (55.6%) students had pain in the upper back. 121(61.7%) students had pain in lower back, 107(54.6%) students experienced pain in upper back, 69(35.2%) students had pain in the hip/thighs, 54(27.6%) students had pain in their knees. 78(39.8%) students had pain in ankle/feet.

**CONCLUSION:** Children's shoulders, necks and backs can get chronically strained from carrying a hefty backpack, resulting in pain. The backpack's weight, how it is worn, and other factors all impact how stable a student's posture is, which leads to the conclusion that a child wearing a backpack has postural impacts on their body posture.

**KEYWORDS:** Musculoskeletal Disorders, Spinal Anomalies, Nordic Musculoskeletal, Quality of Life, Body Mass Index, Physical Discomfort, Fatigue, Strain.

## INTRODUCTION

Because of malnutrition and an inadequate diet among school-aged children, the prevalence of musculoskeletal problems is exceptionally high in developing countries. For the past few years, the issue of large backpacks in school-aged children and its link to various forms of improper posture and pain in specific areas of the back has been a major concern<sup>1</sup>. Because of the load of their backpacks, they had to walk to school; school-aged children are acquiring irreversible back abnormalities. By the age of 14, all schoolchildren suffer from back discomfort. As per doctors, there is an increase in cases of spinal anomalies in children, having scoliosis, permanent disfiguring curve of the spine<sup>2</sup>.

Overburdened schoolbags up to twice the weight of

those used ten years ago are leading to the increase; it is believed that this will lead to a rise in violence. Because the skeletons of youngsters are still growing, carrying big luggage might cause long-term spine damage. Many school-aged children have their backpacks on 1 of their shoulders or, increasingly, in their elbows in the crook, putting a lot of pressure on their spine. Many of the bags utilized are large sports packs that are more than double the size of backpacks used ten years ago; there is also no reliance on adolescent health or the effects of high burdens on the backs of children in developing nations like Pakistan<sup>3</sup>. All of these elements add to the weight of the backpack, postural compensations and subjective complaints in school-going children due to heavy backpack loads have been reported in the literature, indicating that average loads in a backpack can cause worsening postural abnormalities due to the backpack's weight<sup>4</sup>. Backpacks increase the likelihood of back pain and back pathology. The number of students carrying large backpacks to school is unusually high, and preventive and academic activities should be implemented for this age group.

Other factors, such as bag weight and wearing duration, appear to contribute even more to the distress of school-aged children. Backache, poor

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structural alterations, and the risk of damage connected with the transfer of too-heavy backpacks are becoming increasingly common. These issues may play a role in establishing mobility impairments in children as they grow older<sup>5</sup>. Carrying backpacks causes the child's gravitational centre to shift like the weight is moving. To compensate, the child shifts his weight in the opposite direction. Back pain is linked to a bag weighing more than 15-20% of a kid's weight, and poor use of backpacks can result in abnormalities in posture and gait. All of the above is becoming a concern for parents, schools, and, more recently, the media, as well as institutions that might be able to help solve the situation.

Previous research examined the link between heavy backpacks and low back pain in schoolchildren. Through this study, we examined the postural discomforts in students due to heavy bag weights. The results of this study aided in raising awareness about the adverse effects of heavy backpacks on posture and, as a result, may help develop preventative techniques for carrying school bags.

## METHODOLOGY

The design of the study was cross-sectional descriptive. This study was conducted in private schools in Lahore. Data was collected using a purposive sampling technique from September 2021 to February 2022. A sample size of 196 students was selected. The school administration was initially asked for permission by explaining the study's aims and objectives. The children were chosen using the purposive sampling method. Students in grades 5 through 10 are included, carrying bags with one or both shoulders. Students of all genders were included with independent standing on the weighing scale. The study excluded students with metabolic abnormalities or musculoskeletal complaints caused by pathological, orthopaedic, or hereditary factors. First, demographic data was collected on the questionnaire, including age, gender, class, weight, height, and bag weight. The Nordic Musculoskeletal Questionnaire was used. It included a human picture where the respondent pointed out the areas of discomfort. The reliability of NMQ ranges from 0-23%. Sensitivity of this tool is 66-92%, while specificity is between 71-88%. Data was entered into the SPSS to analyze the questionnaire on Nordic Musculoskeletal Disorders in school-going children. Data was entered and analyzed with the help of the SPSS 21 version. A frequency distribution test was used.

## RESULTS

The total sample consisted of 196 students. As shown in (Table I) 56(28.6%) children were in the age range of 9-11 years, 96(49%) children were in the age range of 12-14 years, and 44(22.4%) children were in the age range of 15-17 years. 105(53.6%) were male and 91(46.4%) were female. 78(39.8%) students were

underweight, 110(56.1%) students were normal weight and 8(4.1%) students were overweight. 60 (30.6%) students were from 5th class, 21(10.7) students were from 6th class, 15(7.7) students were from 7th class, 35(17.9) students were from 8th class, 32(16.3) students were from 9th class and 33(16.8) students were from 10th class. According to results maximum students have pain in shoulders 168(85%), upper-back 109(55.6%), lower-back 121(61.7%) and neck 107(45.6%). Minimum of students have pain in elbows 2(1%), wrist/hand 3(1.5%), hip/thigh 69 (35.2%), knees 54(27.6%), ankle/feet 78(39.8%) as given in Table II.

**Table I: Demographics of the child**

	Frequency(n)	Percent (%)	
Age of child	9-11	56	28.6
	12-14	96	49.0
	15-17	44	22.4
Gender	Boy	105	53.6
	Girl	91	46.4
Body Mass Index	Underweight	78	39.8
	Normal weight	110	56.1
	Overweight	8	4.1
Class of child	5th class	60	30.6
	6th class	21	10.7
	7th class	15	7.7
	8th class	35	17.9
	9th class	32	16.3
	10th class	33	16.8

**Table II: Nordic Musculoskeletal Questionnaire**

Have you at any time during the last 12 months had trouble		
Variables	Yes n(%)	No n(%)
Neck	107(45.6)	89(45.4)
Shoulder (one or both)	168(85)	28(14.3)
Elbows	2(1)	194(99)
Wrist\Hands	3(1.5)	193(98.5)
Upper back	109(55.6)	87(44)
Lower back	121(61.7)	75(38.3)
Hip\Thighs	69(35.2)	127(64.8)
Knees	54(27.6)	142(72.2)
Ankle\Feet	78(39.8)	118(60.2)
During the last 12 months, have you been prevented from carrying out everyday activities of this trouble?		
Neck	96(49.6)	99(50.5)
Shoulder (one or both)	158(80)	38(19)
Elbows	2(1)	194(99)
Wrist\Hands	1(0.5)	195(99.5)

Upper back	96(49)	100(51)
Lower back	107(54.6)	89(45.4)
Hip\Thighs	43(21.9)	153(78)
Knees	26(13.3)	170(86.7)
Ankle\Feet	39(19.9)	157(80)
Have you at any time during the last seven days had trouble		
Neck	96(49.6)	99(50.5)
Shoulder	158(80)	38(19)
Elbows	2(1)	194(99)
Wrist\Hands	1(0.5)	195(99.5)
Upper back	102(52)	94(48)
Lower back	107(54.6)	89(45.4)
Hip\Thighs	49(25)	147(75)
Knees	33(16.8)	163(83.2)
Ankle\Feet	44(22.4)	152(77.6)

## DISCUSSION

This research aimed to assess the effects of heavy backpacks on children's posture; this was assessed by using the Nordic musculoskeletal disorders scale. The total sample consisted of 196 school-going children, in which there were 105 males and 91 females. The children were in the age range of 9-17 years. Of these, 78 students were underweight, 110 were normal weight, and 8 were overweight.

The 2021 study by Karim RA 2021<sup>6</sup> investigated the impact of heavy school bags on primary students' physical health. Average bags weighed 6kg, over half the pupils' body weight, causing lumbosacral shoulder aches and various complaints like muscular pain, headaches, leg pain, height concerns, and psychological stress. Teachers were concerned about bag weight's adverse effects on children's health. Bags were notably heavier than the recommended guidelines. Students in different classes faced discomfort; e.g., class 1 students weighed 18–20 kg, bags 3.5–5.0 kg. Recommendations suggest bags not exceed 1.5 kg for the second primary and 3 kilograms for class III-V, aligning with the Human Resource Development Ministry of Jammu<sup>6</sup>, whereas according to the studies, about 107(54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and 78(39.8%) students have pain in ankle/feet.

The 2019 study by Sundas R 2022<sup>7</sup> in Wah Cant, Pakistan, explored the link between school bag weight, wearing duration, and musculoskeletal disorders in 1104 school children aged 8-15 years. 61.6% experienced discomfort due to heavy bags,

with 40.2% reporting neck pain, 47.4% shoulder pain, and 46.6% lower back pain. 33% had a healthy BMI, but 32.6% were significantly underweight. Wearing heavy bags for over 10 minutes was associated with prevalent musculoskeletal discomfort, mainly upper and lower back pain. A majority carried bags exceeding 16% of their body weight, raising concerns about its impact on children's health<sup>7</sup> whereas according to this study, about 107(54.6%) students have neck pain due to wearing backpacks, about 160 (81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54 (27.6%) students have pain in knees and 78(39.8%) students have pain in ankle/feet.

It was hypothesized by Natasha AA 2018<sup>8</sup> on The association between backpack use and low back pain among pre-university students. According to the Roland–Morris Disability Questionnaire and Body Discomfort Chart, a pack's use and heft were not significantly related to low back pain. This study had 101 participants (42 men and 59 women). The subjects ranged in age from 16 to 18 years old. Most of the students were 18 years of age (86.1%), followed by 17 years of age (12.9%). Only one subject was 16 years old. Most students had a normal BMI (72.9%). More than half of the subjects were physically stable (59.4%). The usage of a backpack was not linked to low back discomfort in Malaysian pre-university students in this study<sup>8</sup> whereas according to this studies that about 107(54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and . 78(39.8%) students have pain in ankle/feet.

In Shahid G 2018<sup>9</sup> study in Karachi on musculoskeletal pain from heavy backpacks in school children aged 9 to 13, with an average age of 10.90 and BMI of 17.8. Of the participants, 58.3% were male. The prevalence of musculoskeletal pain was high, with 96% experiencing discomfort in various body areas, notably 83% in the neck, 93.8% in the shoulders, and 36.5% in the back. Knee pain was reported by 24% of students. Only 20% sought medical help for pain. Carrying bags over 15% of body weight was linked to future pain and posture issues<sup>9</sup> whereas according to this study, about 107(54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and .

78(39.8%) students have pain in ankle/feet. In study by Patil AY 2018<sup>10</sup> focused on optimizing school backpack design using FEA tools. The backpack structure significantly impacted load distribution. A dual bag structure was proposed to distribute loads evenly, reducing stress and strain by 85% and 96%, respectively. Additionally, a twist structure was suggested, adjustable from the outside, which decreased stress transfer to the body by a few MPa and lowered total displacements and strain by 34% and 56%, respectively. Both solutions offer to improve whereas according to this study, about 107 (54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3 (1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in the upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and 78(39.8%) students have pain in ankle/feet. In study by Vaghela NP 2019<sup>11</sup> they examined the impact of backpack weight on posture in 160 school children. The average body weight was 34.83 kg, and backpacks weighed 6.42 kg (18% of body weight). Without a bag, cervical vertebral angle (CVA) was 40.62°, and sagittal shoulder posture (SSP) was 39.39°. With the bag, SSP increased to 54.38° while standing and 77.62° during dynamic activities. Carrying an 18% body weight backpack led to significant CVA reduction and SSP increase, implying postural changes and potential strain; this underscores the importance of appropriate backpack weight and design for students' musculoskeletal health<sup>11</sup> whereas according to this study, about 107 (54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3 (1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and . 78(39.8%) students have pain in ankle/feet.

Khan R 2015<sup>12</sup> in their research they studied neck, shoulder, and back pain caused by heavy backpacks among Spirit School children in Lahore. Most participants (53.3%) were aged 9 to 12, followed by 13 to 16 years (46.7%). Female students (52%) outnumbered males (48%). Students from 6th class (39.3%) were predominant. Responses were received from all participants. The heaviest bag range (41-30 kg) had the highest frequency (43%), while the lowest (21-30 kg) had 0.7%. Neck pain led to clinician visits for 12% of students. Shoulder soreness (44.4%), neck pain (29.6%), low back pain (23%), and upper back discomfort (3%) were common symptoms. Bag weight significantly correlated with neck, shoulder, and back pain. Using dual straps and carrying bags on both shoulders was associated with fewer complaints. Whereas according to this study about 107(54.6%)

students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and . 78(39.8%) students have pain in ankle/feet.

A study by George D 2015<sup>13</sup> investigated backpack weight and musculoskeletal discomfort in school children. Shoulder discomfort, alongwith neck, ankle/feet, knee, elbow, upper back, hip/thigh, and lower back pain, was prevalent. Surprisingly, despite widespread discomfort, the study didn't establish a statistically significant link between heavy backpacks and musculoskeletal issues in school children, whereas according to this study, about 107(54.6%) students have neck pain due to wearing backpacks, about 160(81%) students have pain in both shoulders, 2(1%) students have pain in elbows, 3(1.5%) students have pain in hand/wrist, 109(55.6%) students have pain in upper back, 121(61.7%) students have pain in lower back, 69(35.2%) students have pain in hip/thighs, 54(27.6%) students have pain in knees and 78 (39.8%) students have pain in ankle/feet.

## CONCLUSION

Children's shoulders, necks and backs can get chronically strained from carrying a hefty backpack, resulting in pain. The backpack's weight, how it is worn, and other factors all impact how stable a student's posture is, which leads to the conclusion that a child wearing a backpack has postural impacts on their body posture. Detailed interviews and questionnaires with students can provide more information. Safe bag weight limits need further research. Health professionals, teachers, and parents must know how to keep backpacks under 5% of body weight. Students should only carry the necessary items. More studies should explore factors affecting backpack weight and student health.

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## AUTHOR CONTRIBUTION

Shahbaz A: Article writeup, final approval

Sadaf A: Conception and design, final approval

Saleem S: Analysis, interpretation of data, final approval

Robina C: Article drafting, final approval

Ali Y: Critical review, final approval

Khan T: Final review and approval

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