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Assess the Relationship Between School Bag Weight on Back Pain and Postural Issues in School Children at Selected Urban Areas of Belagavi City

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ABSTRACT
School-aged children are at a crucial stage of growth and development and are vulnerable to musculoskeletal problems caused by improper ergonomic practices and heavy school bags. This study aimed to assess the correlation between school bag weight, back pain, and postural issues among school children and to identify their association with selected socio-demographic variables. A quantitative, non-experimental descriptive correlational design was adopted among 100 school children aged 11–13 years from selected urban schools in Belagavi using probability random sampling. Data were collected through a semi-structured questionnaire, weighing scale, Numeric Rating Scale, and observational checklist. The findings revealed that 76% of students perceived their bags as heavy, with most carrying bags weighing 3–4 kg. Common postural problems included rounded shoulders (75%), uneven shoulders (69%), and forward head posture (65%). Back pain was reported by 76% of students, mainly in the upper back and neck regions, with moderate pain intensity. Pearson correlation showed weak and non-significant relationships between school bag weight and pain or posture. However, chi-square analysis indicated significant associations between school bag-related factors and postural issues. The study highlights the importance of ergonomic education, awareness programs, and preventive strategies for promoting healthy posture and reducing musculoskeletal problems among school children.
KEYWORDS: School bag weight, back pain, postural issues, school children

INTRODUCTION
Children are the future of every nation, and their health and well-being are essential for social and national development. School-aged children are in a critical stage of growth and musculoskeletal development, making them more vulnerable to physical stress and ergonomic problems. One of the major concerns among school children today is the increasing prevalence of back pain and postural problems caused by carrying heavy school bags. Many children carry bags exceeding the recommended limit of 10% of their body weight, which may result in back pain, shoulder strain, muscle fatigue, and postural abnormalities such as rounded shoulders and forward head posture. If not identified early, these problems may progress into chronic musculoskeletal disorders affecting physical efficiency and academic performance[1,2,3]

In urban areas such as Belagavi, academic pressure, extensive curricula, and lack of locker facilities contribute to heavier school bags. Reduced physical activity and poor ergonomic awareness among parents, teachers, and students further worsen the problem. Nurses and school health professionals play an important role in prevention through posture screening, ergonomic guidance, and awareness programs. This study reviews literature related to school bag weight and postural alterations, explains the research methodology, presents the study findings, and discusses implications and recommendations for future research.[4,5,6]

Review of Litrature

Author(s) & Year	Study Title	Findings	Significance of the Study
Negrini and Carabalona (2002)	Relationship between School Bag Weight and Back Pain among Children	Children carrying school bags exceeding 10% of body weight experienced significantly higher prevalence of back pain and discomfort.	Supports the association between heavy school bags and musculoskeletal pain among school children.
Dockrell et al. (2006)	Impact of School Bag Weight on Musculoskeletal Health	Nearly 50% of students reported back pain, especially those carrying heavier school bags.	Demonstrates the direct relationship between school bag weight and back discomfort.
Moore et al. (2007)	Backpack Weight, Pain, and Absenteeism	Heavy backpacks were associated with increased pain and school absenteeism.	Indicates that excessive school bag weight affects both health and academic performance.
Dianat et al. (2011)	School Bag Weight and Musculoskeletal Symptoms among Primary School Children	More than 60% of children carried bags above recommended limits and reported back and shoulder pain.	Highlights the importance of ergonomic interventions and proper carrying methods.
Korovessis et al. (2004)	Backpack Weight and Spinal Curvature	Heavy backpacks were significantly associated with altered spinal curvature and postural deviations.	Supports the relationship between heavy school bags and postural changes.
Ramprasad et al. (2010)	Postural Changes due to Heavy School Bags	Students carrying heavy backpacks showed forward head posture and rounded shoulders.	Indicates prolonged heavy load contributes to postural abnormalities.

Author(s) & Year	Study Title	Findings	Significance of the Study
Haselgrove et al. (2008)	Backpack Weight and Back Pain among Adolescents	Approximately 50% of students reported back pain, especially with heavy loads and long carrying duration.	Highlights the influence of both bag weight and duration of carrying on back pain.
Perry et al. (2010)	Backpack Weight and Musculoskeletal Health in Children	Carrying loads above 10–15% of body weight increased the risk of back pain and postural changes.	Supports international guidelines regarding safe school bag weight limits.

Research Objectives:

1) To assess the correlation between school bag weight on back pain and postural issues among school aged children.
2) To find out the association between school bag weight on back pain and postural issues with their selected socio-demographic data among school aged children
3) To prepare and distribute info graph to prevent back pain and postural issues among school aged children.

HYPOTHESES:

H1: There is a significant correlation between back Pain at school and the weight of school bags children in selected urban areas of Belagavi.
H2: There is a significant relationship between school bag weight and postural issues in school children in selected urban areas of Belagavi.

Research Methodology:

The present study adopted a quantitative, non-experimental descriptive correlational research design to assess the effect of school bag weight on back pain and postural problems among school-aged children. School bag weight was considered as the independent variable, while back pain and postural issues were dependent variables. The study was conducted among 100 school children aged 11–13 years studying in selected schools of Belagavi using a probability random sampling technique. Data were collected using a structured interview schedule including socio-demographic details, school bag-related factors, postural assessment, and back pain assessment. School bag weight was measured using a weighing scale, back pain was assessed using the Numeric Rating Scale, and postural issues were evaluated using an observational checklist. Ethical approval was obtained from the Institutional Ethical Clearance Committee of KAHER Institute of Nursing Sciences, and permission was taken from the Headmaster of Government School No. 24, Mahantesh Nagar, Belagavi.

RESULT

This descriptive correlational study carried out among 100 school children aged 11-13 years in urban Belagavi city. Data analysis systematically addresses all three study objectives using Descriptive statistics, correlation, chi-square, and multiple regression. Results are organized by demographic characteristics, school bag usage patterns, back pain prevalence, postural assessment, statistical relationships, and preventive intervention.

SECTION : 1 Socio-Demographic Variable of Study among school aged children.

Table 1: Distribution of Study among school aged children by Socio-demographic Variables (n=100)

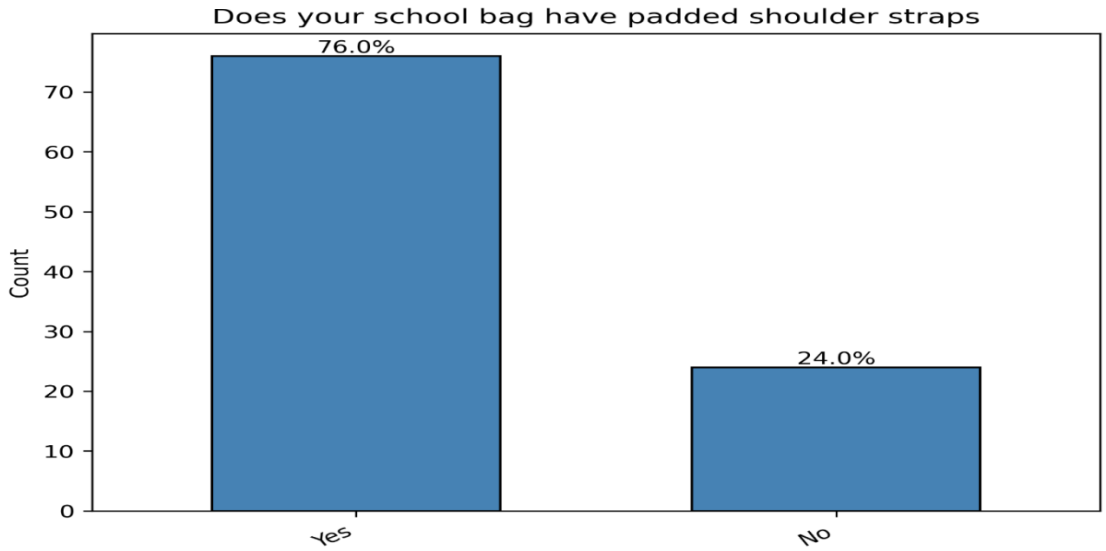
Variable	Frequency (n)	Percentage (%)
Age		
12	57	57
13	25	25
11	18	18
Gender		
Male	58	58
Female	42	42
Religion		
Hindu	69	69
Muslim	31	31
Monthly Income of the family		
<10,000/-	76	76
10,001-20,000/-	24	24
Area of residence		
Urban	100	100
Educational status of the father		
High school	67	67
Graduate and above	25	25
No formal education	6	6
Primary	2	2
Educational status of the mother		
High school	47	47
Graduate and above	24	24
Primary	23	23
No formal education	4	4
Primary	2	2
Type of family		
Nuclear family	83	83
Joint family	17	17

Occupational status of mother		
Housewife	72	72
Private sector	28	28
Occupational status of father		
Private sector	65	65
Self-employed	35	35

SECTION: 2 Assessment of School Bag-Related Variables among School-Aged Children.

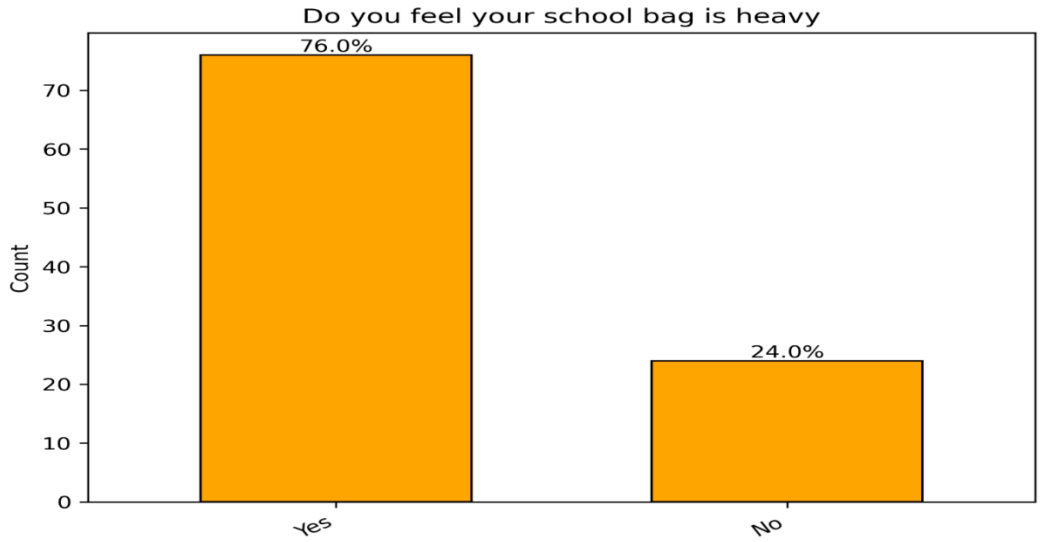
Table 2: School Bag Characteristics among Study Participants (n=100)

Diagram Showing school bag has padded shoulder steps.



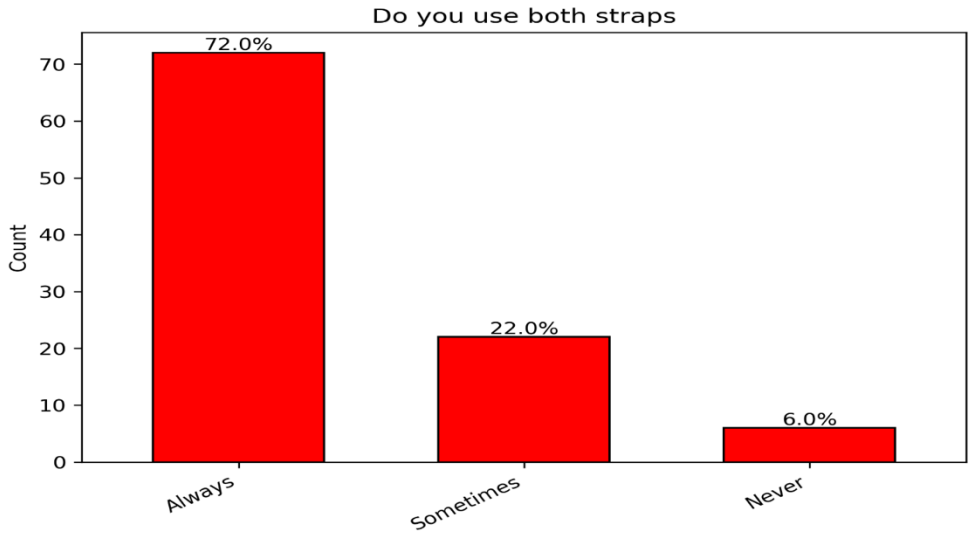
Graph shows that 76% of students used school bags with padded shoulder straps, while 24% used bags without padding.

Diagram showing school bag heavy among school children.



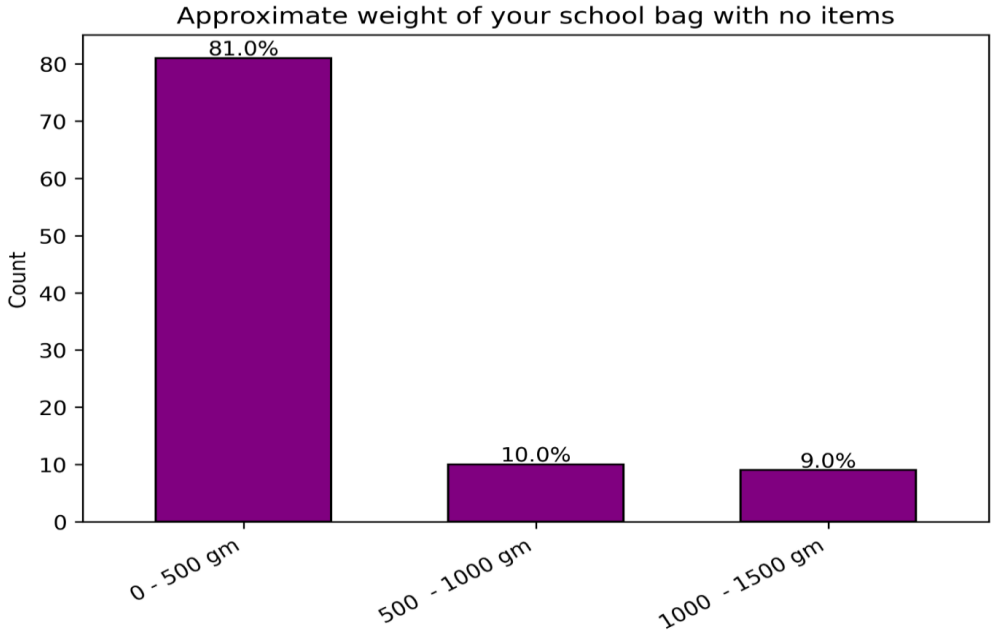
Graph indicates that 76% of children felt their school bags were heavy, whereas 24% did not feel so.

Diagram showing used both shoulder strapsamong school children.



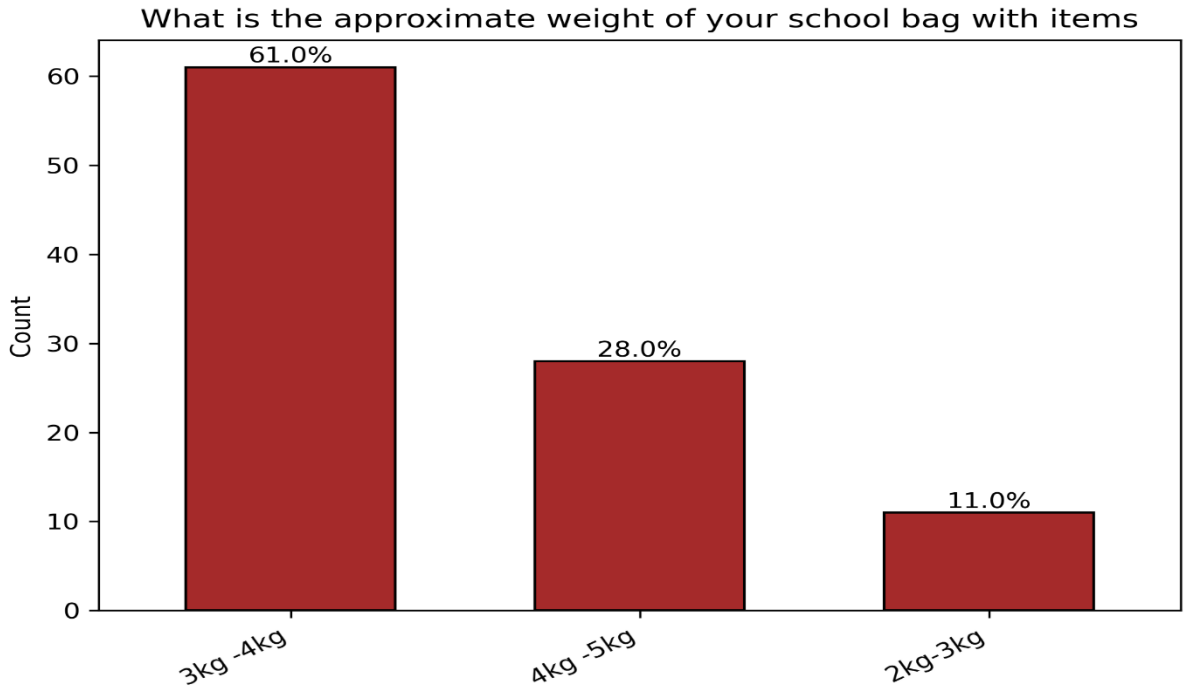
The graph shows that 72% (n = 72) of students always used both shoulder straps, 22% (n = 22) used them sometimes, and 6% (n = 6) never used both straps.

Diagram Showing approximate weight of school bag with no items.



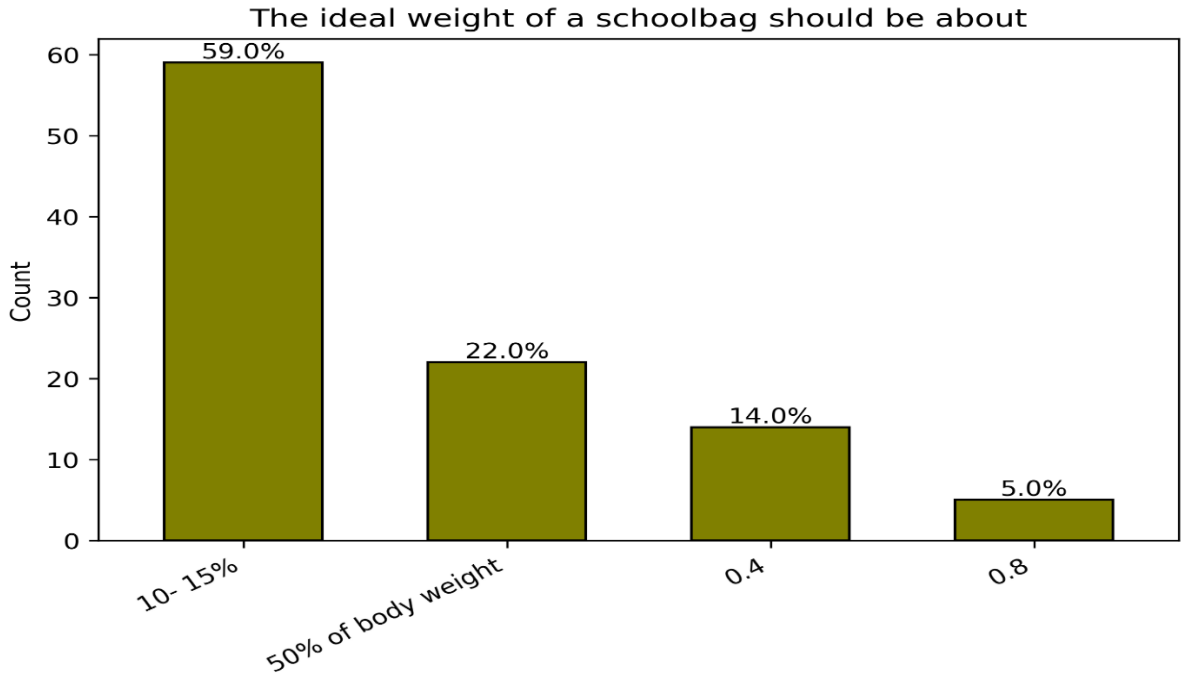
The graph shows that 81% (n = 81) of students had school bags weighing 0–500 gm, 10% (n = 10) had bags weighing 500–1000 gm, and 9% (n = 9) had bags weighing 1000–1500 gm, indicating that most bags are lightweight when empty.

Diagram showing approximate weight of school bag with items



The graph shows that 61% (n = 61) of students carried bags weighing 3–4 kg, 28% (n = 28) carried 4–5 kg, and 11% (n = 11) carried 2–3 kg.

Diagram Showing ideal weight of school bag carrying among school children's



The graph shows that 59% (n = 59) of students identified the ideal school bag weight as 10–15% of body weight, while 22% (n = 22) chose 50%, 14% (n = 14) chose 40%, and 5% (n = 5) chose 80%, indicating some misconceptions among students.

SECTION: 3 Postural Assessment and the Impact of School Bag Variables on School-Aged Children.

Table 3: Postural Assessment of School Bag Variables among School-Aged Children (n=100)

Characteristics	Frequency (n)	Percentage (%)
Uneven shoulders observed		
yes	69	69
no	31	31
Rounded shoulders posture		
yes	75	75
no	25	25
Head tilted forward		
yes	65	65
no	35	35
How do you carry your school bag?		
on both shoulders	58	58
on one shoulder	24	24
by hand	18	18
How long do you carry your school bag daily?		
15-30 minutes	41	41
less than 15 minutes	39	39
more than 30 minutes	20	20
Do you experience back pain		
yes	76	76
no	24	24
Duration of pain		
less than 5 days	46	46
5-10 days	25	25
10-15 days	16	16
more than 15 days	13	13
Frequency of pain		
daily	67	67
occasionally	33	33
Pain intensity (Numeric Rating Scale 0–10)		
5	39	39
6	36	36
7	8	8
4	7	7
8	4	4
3	3	3
2	2	2

1	1	1
Location of pain		
upper back	51	51
neck	34	34
mid back	10	10
lower back	5	5

Table 3 presents postural and pain-related findings among school children. Uneven shoulders were observed in 69%, rounded shoulders in 75%, and forward head tilt in 65% of children. Most students (58%) carried school bags on both shoulders, while 24% carried them on one shoulder. Back pain was reported by 76% of children, with 67% experiencing pain daily. Pain intensity was mainly moderate, with scores of 5 (39%) and 6 (36%). The upper back was the most common site of pain (51%), followed by the neck (34%).

SECTION : 4 Back Pain Associated with School Bag Use among School-Aged Children (n=100)

Characteristics	Frequency (n)	Percentage (%)
Do you feel neck pain while sitting in classroom?		
0	45	45
1	3	3
2	20	20
3	2	2
4	11	11
5	13	13
6	4	4
7	1	1
8	1	1
Do you feel upper back pain while sitting in classroom		
0	49	49.49
1	7	7.07
2	19	19.19
3	5	5.05
4	8	8.08
5	7	7.07
6	4	4.04
Do you feel low back pain while sitting in classroom		
0	66	66
1	8	8

2	15	15
3	3	3
4	2	2
5	6	6
Do you feel upper limb pain while sitting in classroom		
0	82	82
1	7	7
2	8	8
3	3	3
Do you feel lower limb pain while sitting in classroom		
0	77	77
1	5	5
2	12	12
3	3	3
4	1	1
5	2	2

The table shows the distribution of pain levels among students while sitting in the classroom. Most students reported no or mild pain in different body regions. No pain was reported by 45% for neck pain, 49.49% for upper back pain, 66% for low back pain, 82% for upper limb pain, and 77% for lower limb pain. Mild to moderate pain was mainly observed at level 2 for neck pain (20%), upper back pain (19.19%), low back pain (15%), upper limb pain (8%), and lower limb pain (12%). Overall, moderate pain was present in some students, particularly in the neck and upper back regions.

THE IMPACT OF SCHOOL BAG WEIGHT ON BACK PAIN AND POSTURE

Objective 1: To assess correlation between school bag weight on back pain and postural issues.

Table 5: Pearson Correlation Coefficients between School Bag Weight and Outcome Variables

Variables	r-value	p-value	Strength of Correlation
Bag Weight vs uneven shoulders observed	0.05	0.6217	Weak
Bag Weight vs Rounded shoulders posture	-0.06	0.5685	Weak
Bag Weight vs Head tilted forward	0.05	0.6466	Weak
Bag Weight vs Do you experience back pain	-0.12	0.2603	Weak

Bag Weight vs painintensity	0	0.9676	Weak
Bag Weight vs duration	0.12	0.2862	Weak
Bag Weight vs frequency	0.16	0.1418	Weak
Bag Weight vs carrymethod	0	0.9927	Weak
Bag Weight vs location	0.07	0.4929	Weak

The table presents Pearson correlation results between bag weight and posture- and pain-related variables. The correlation coefficients were very low and p-values were above 0.05, indicating weak and non-significant relationships. The findings suggest that bag weight alone did not show a meaningful association with postural problems or pain outcomes among students.

ASSOCIATION WITH SOCIO-DEMOGRAPHIC VARIABLES

Objective 2: Association between school bag weight/back pain/postural issues with socio-demographic data.

Table 6: Chi-square test association between school bag weight and postural issues

Variable	Chi-square (χ^2)	p-value	Significance
Uneven shoulders observed:	19.688	0.0006	**Significant**
Rounded shoulders posture:	10.21	0.037	**Significant**
Head tilted forward:Type of bag used	2.474	0.6493	Not Significant
Do you experience back pain	3.674	0.4519	Not Significant
How do you carry your school bag	0.697	0.9517	Not Significant
Duration of pain:	6.728	0.3467	Not Significant
Frequency of pain:	4.071	0.1306	Not Significant
Location of pain:	7.048	0.3164	Not Significant

The table presents the association between school bag-related variables and postural/pain variables using chi-square analysis. A significant association was found for uneven shoulders ($p = 0.0006$) and rounded shoulders posture ($p = 0.037$). However, head tilt, type of bag used, back pain, carrying method, duration, frequency, and location of pain were not statistically significant ($p > 0.05$), indicating no strong association with the studied variables.

Table 7: Chi-square test association between school bag weightwith socio-demographic data

Variable	Chi-square (χ^2)	p-value	Significance
Do you experience back pain	8.044	0.09	Not Significant
Duration of pain:	9.333	0.1557	Not Significant
Frequency of pain:	3.315	0.1906	Not Significant
Pain intensity (Numeric Rating Scale 0 – 10):	20.948	0.103	Not Significant
Location of pain:	4.356	0.6286	Not Significant

The table shows the association between school bag factors and pain-related variables. Back pain experience, duration, frequency, pain intensity, and location of pain were not statistically significant ($p > 0.05$), indicating no strong association with the studied variables.

Table 8: Multiple Linear Regression Analysis Showing the Association between school bag weight and Socio-demographic Variables Among School Children

Variable	Coefficient (β)	Std Error	t-value	p-value	Lower CI	Upper CI	Significance
Constant	7.6183	2.8104	2.7107	0.0082	2.0243	13.2123	**Significant**
Age	-0.0982	0.2089	-0.4703	0.6394	-0.514	0.3175	Not Significant
Gender	0.0703	0.2641	0.266	0.7909	-0.4555	0.596	Not Significant
Bag weight	0.0001	0.0002	0.3498	0.7274	-0.0003	0.0005	Not Significant
Carrying method	-0.2155	0.203	-1.0618	0.2915	-0.6195	0.1885	Not Significant
Duration of pain	-0.0791	0.1681	-0.4707	0.6391	-0.4137	0.2555	Not Significant
Frequency of pain	-0.4148	0.2753	-1.5069	0.1358	-0.9628	0.1331	Not Significant
Carrying duration	-0.3157	0.1792	-1.7612	0.0821	-0.6725	0.0411	**Slightly Significant**

The multiple regression analysis showed that most variables, including age, gender, bag weight, carrying method, duration, and frequency of pain, was not statistically significant ($p > 0.05$). Carrying duration showed slight significance, indicating a possible weak association.

DISCUSSION

The current study showed that most participants were aged 12 years (57%), male students (58%), and belonged to urban low-income families (76%). Most students perceived their school bags as heavy, and 61% carried bags weighing 3–4 kg. Postural deviations such as rounded shoulders (75%), uneven shoulders (69%), and forward head posture (65%) were highly prevalent. Back pain was reported by 76% of students, mainly in the upper back and neck regions. However, Pearson correlation analysis showed weak and non-significant relationships between school bag weight and postural or pain-related variables.

Chi-square analysis revealed a significant association between school bag-related factors and uneven shoulders ($p = 0.0006$) and rounded shoulders ($p = 0.037$). Multiple regression analysis showed that most variables were not significant predictors, although carrying duration showed slight significance. These findings suggest that posture, carrying duration, and usage habits may influence musculoskeletal problems more than bag weight alone.
Based on the findings, an infographic was prepared and distributed to create awareness regarding proper school bag usage, correct posture, use of both shoulder straps, recommended bag weight, and prevention of musculoskeletal problems among school children.

CONCLUSION

The study concluded that school bag-related musculoskeletal problems are highly prevalent among school-aged children aged 11–13 years. Most children perceived their school bags as heavy, and many carried bags weighing 3–4 kg. A high prevalence of postural deviations such as rounded shoulders, uneven shoulders, and forward head posture was observed, along with back pain mainly in the upper back and neck regions. The findings suggest that these problems are multifactorial in nature, where posture, carrying duration, ergonomic practices, and behavioural habits play an important role. Early intervention and ergonomic awareness are essential to prevent long-term health problems and promote children's physical well-being.
Ethical Approval: Ethical approval for the study was obtained from the Institutional Ethical Clearance Committee of KAHER Institute of Nursing Sciences, Belagavi, Karnataka. Permission to conduct the study was obtained from the Headmaster of Government School No. 24, Mahantesh Nagar, Belagavi.
Informed Consent: The study participant permission was obtained from the school authorities. Parents/guardians gave informed permission.Participants were informed about the study objectives and their right to withdraw at any stage. Confidentiality and anonymity were maintained throughout the study.
Conflict of interest: None of the parties have conflicts of interest.
Data availability statement: The utilized data will be shared upon request.
Funding statement: No one funded this study
Authors' contributions: All authors contributed equally to all research elements**.**
All writers reviewed and approved the article.

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