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Impact Of An Educational Package On Knowledge Regarding Body Mechanics Among School Children

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Abstract: *Prolonged sitting, improper lifting, and unergonomic school environments contribute to postural abnormalities, spinal misalignments, and musculoskeletal pain among children. Studies worldwide have reported a high prevalence of back, neck, and shoulder pain in this age group, leading to decreased physical performance, poor academic focus, and potential long-term health issues. Prevention of such disorders through early education about proper body mechanics is essential. Body mechanics involve the correct use of muscles and posture to minimize strain and injury during daily physical activities such as sitting, standing, lifting, and carrying. Educating school children on correct body mechanics can significantly reduce the risk of MSDs, improve comfort during school hours, and promote healthier lifelong habits. This was a pre-experimental study (one-group pre-test post-test design). The sample included 60 school children from G.K. Public School, Moradabad, U.P. Data were gathered through a self-structured knowledge questionnaire. In the pre-test, 86.7% of students had poor knowledge. Post-intervention, 75% of students achieved good knowledge. A significant improvement was observed in both knowledge (mean pre-test: 7.78, post-test: 15.98) at $p<0.05$. Significant associations were found between pre-test knowledge scores and demographic variables such as age, class, gender, religion, area of residency, and mode of transportation.*

Keywords: *Body mechanics, musculoskeletal disorders, school children, educational package, postural habits, ergonomics, knowledge, physical health promotion, lifestyle, health issues, future health.*

1. INTRODUCTION

Schoolchildren's body mechanics have a significant impact on their musculoskeletal health since they must navigate a range of tasks and circumstances throughout the day. Musculoskeletal diseases (MSDs) are a large category of illnesses that affect the bones, muscles, tendons, ligaments, and other soft tissues. Children who have poor body mechanics are more susceptible to develop these conditions. Understanding how MSDs and body mechanics are related is crucial to promoting the general welfare of schoolchildren.[1] According to the WHO Global Burden of Disease research, neck, shoulder, and back pain, as well as other musculoskeletal disorders, were prevalent in school-age children and adolescents, with an incidence ranging from 7% to 74%. It becomes crucial to teach kids how to properly use body mechanics concepts in order to mitigate the effects of the factors that lead to kids having trouble with body mechanics.[2]

Understanding body mechanics (MSDs) is primarily motivated by the desire to prevent musculoskeletal issues in school-age children. Poor posture, excessive strain, or insufficient movement patterns can all

lead to MSDs. Back pain, scoliosis, and repetitive strain injuries are a few examples of these ailments. Children who frequently employ poor body mechanics are particularly vulnerable to these disorders since their bones, muscles, and joints are still developing. [3]

Additionally, there is a direct correlation between academic success and proper body mechanics. Proper posture can lead to discomfort, fatigue, and difficulty concentrating, all of which can negatively impact a child's academic performance and learning. To stay attentive and focused in class, one must sit up straight and maintain normal blood flow and respiration. Children who learn the importance of good posture and movement will be better able to concentrate, retain knowledge, and engage in their education. A more enthusiastic approach to learning and improved academic performance could come from this. In addition to keeping them safe, this approach promotes physical activity, which is essential for children's physical and mental well-being. [4]

1. Research Statement

Effectiveness of an educational package on knowledge regarding body mechanics among school children.

2. Objectives

1) To assess the pre-test level of knowledge regarding body mechanics among school children.
2) To evaluate the effectiveness of educational package through pre-test post-test on knowledge regarding body mechanics among school children.
3) To find out the association between pre-test level of knowledge regarding body mechanics among school children with their selected socio demographic variables.

3. Hypothesis

Hypothesis is tested at 0.05 level of significance.

H_1: There is a significant difference between pre-test and post-test level of knowledge regarding Body Mechanics among school children.

H_2: There is a significant association between pre-test level of knowledge regarding body mechanics among school children with their selected socio demographic variables.

2. REVIEW OF LITERATURE

A group investigation was undertaken in the North West Province by Grobler and Kramer to assess how carrying heavy schoolbags influences children's posture and walking patterns. Many of the participants were found to be carrying bags exceeding 15% of their body mass, which is considered excessive. The study, one of the few in South Africa to explore early impacts of schoolbag loads on gait and posture, involved 60 children aged between 10 and 13 years. Significant variations were observed in gait speed (Mdiff = -0.18 km/hr, $p = 0.016$), force ratios (Mdiff = 0.02, $p = 0.029$), and forefoot and heel forces (Mdiff = 17.05–34.86 N, $p < 0.001$), while postural angles showed no significant differences ($p > 0.052$). Children carrying loads above 15% of their body mass were about nine times more likely to report pain than those below this threshold. When compared with similar age groups internationally, participants carried relatively heavier loads ($p < 0.001$). Although immediate postural or gait alterations were minimal, the high load was strongly linked to increased pain levels among children in the 10–13 age group.[5]

Li and colleagues carried out a cross-sectional study in Tianjin, China, examining how poor sitting habits relate to sagittal spinal imbalance among primary and secondary school students. The sample comprised 1,138 participants (570 primary and 568 secondary students; 604 boys and 534 girls) aged 6–18 years from three schools. Using the PA200 Station Posture Assessment System, spinal sagittal curvature was measured in three positions—relaxed standing, desk-based reading/writing, and upright seated posture. Results showed that, during reading/writing, lumbar lordosis angles significantly reduced ($p < 0.05$) and thoracic kyphosis angles significantly increased ($p < 0.05$) compared to standing. Improper TKA and LLA angles were seen in 33% and 52% of students, respectively, when reading/writing. Height was positively associated with both standing and sitting spinal angles. The shift from standing to seated reading/writing was marked by a rise in thoracic kyphosis and a reduction, or loss, of lumbar lordosis. Poor sitting posture with abnormal sagittal angles contributed to spinal imbalance, even when students were in their natural standing posture.[6]

In Famagusta and nearby villages, Karasel and colleagues conducted a cross-sectional survey to assess musculoskeletal pain (MSP) and its associated factors among children aged 8–12 years. The study evaluated 313 primary school students (52.4% boys, 47.6% girls; mean age 9.53±0.82 years). Measurements included schoolbag weight, body mass index, height, quality of life, and musculoskeletal discomfort during physical activity. MSP prevalence was reported at 39%. No significant association was

found between MSP and variables such as age, sex, BMI, gym lesson hours, sports participation, weekly sports duration, schoolbag type, or schoolbag weight. Pain location also showed no link with these factors. However, prolonged walking and sitting were linked to higher MSP occurrence. Contrary to common belief, neither the weight nor type of schoolbag was a significant contributor. Reducing MSP may help improve children's overall quality of life.[7] Podrekar Loredan and colleagues assessed the ergonomic suitability of school furniture for students in Slovenia, covering the span from primary school to university. The study involved 442 students from different educational levels. Measurements included five furniture dimensions and nine anthropometric parameters, with mismatch criteria applied for analysis. Results indicated that body dimension differences between genders became more pronounced in secondary and tertiary education, whereas differences across ages were most evident in primary school. In primary schools, desk height mismatches were universal (100%), while universities had a 48% mismatch. Seat height mismatches were highest in primary schools (89.7–94.6%), followed by universities (52%) and secondary schools (18%). Seat depth mismatches were found in all groups, ranging from 23.1% to 40.4%, more common in males. Secondary school students showed the greatest mismatch in desk and seat clearance. Many primary school students reported that desks and seats were too high. The findings underscore the need for adjustable school furniture that can accommodate at least two different size categories to enhance comfort and promote healthy posture.[8]

Abdel-aziem, A.A., et al conducted an observational study, and explored how smartphone viewing duration and body posture affect head and neck positioning in elementary school children. Thirty-four boys aged 5–12 were grouped by smartphone usage: Group A (n=18) used devices for over four hours daily, while Group B (n=16) used them for less than four hours. Postural measurements were taken while standing and sitting during smartphone use, as well as 30 minutes afterward, using the Kenova software to calculate cranio-cervical, head, neck, and gaze angles. Findings showed increased flexion in the head and neck, as well as altered gaze angles during and after use, particularly in seated posture. Group A exhibited significantly smaller cranio-cervical angles and greater head, neck, and gaze flexion than Group B ($p<0.05$). Extended screen viewing time appears to promote forward head and neck posture, especially when sitting.[9]

Pirns and Kallio investigated the relationship between objectively measured physical activity, sedentary behaviour, and screen time with neck and shoulder pain over a two-year follow-up in school-aged children. The study included 970 children aged 10–15 years at baseline in 2013, with follow-ups in 2014 and 2015. Screen use and pain frequency were self-reported via online questionnaires, while accelerometers measured moderate-to-vigorous activity and sedentary time. Logistic regression analyses, adjusted for demographic and lifestyle factors, revealed no baseline association between accelerometer data and later neck/shoulder pain. However, at the first follow-up, significant links were found between pain and time spent on social media ($p=0.023$) as well as passive gaming ($p=0.036$), but not with total screen time. These findings suggest that specific screen activities, rather than total duration, may contribute to neck and shoulder discomfort, highlighting the need for targeted interventions to reduce such strain.[10]

Kumari S, Singh S et al conducted a study on assessment of musculoskeletal discomfort due to back pack among school children. Objectives of the study were to assess the musculoskeletal discomforts due to backpack in school going children, To find out the correlation between the backpack and musculoskeletal discomforts in school going children and To determine the association between the demographic variables and musculoskeletal discomfort among the school going children. The Methodology used for study was Non-experimental survey approach, the target population for the study was the school going children of class 7th to 10th. Total 100 samples were selected using the convenient sampling technique. The tool used for the data collection was NDMQ. The results of the study shows that 86% have mild musculoskeletal discomforts, 12% have moderate and 2% have severe. The Correlation between backpack weight and musculoskeletal discomforts among school going children through Pearson's correlation which gave r value 0.050 which was statistically non-significant with level of significance fixed at $p<0.05$. [11]

3. MATERIALS AND METHODS

A quantitative research approach was adopted as it is considered suitable for the investigation. The study's research design is pre-experimental (one group pre-test post-test design). This study aimed to evaluate the effectiveness of an educational package on knowledge regarding body mechanics among school children at G.K. Public School, Moradabad, U.P. The population under study was school children of 7^{th} and 8^{th}

class. The present study comprised 60 samples. They were selected by purposive sampling technique. The tool used in this study was organized into two sections. Section A includes the Demographic profile. Section B includes the Self-structured knowledge questionnaire. A multiple-choice questionnaire was used to assess knowledge of school children body mechanics. These were 20 questions in total. Each question was prepared with one correct option. A Score of 1 was fixed for the correct answer and a 0 score for the wrong one. The Cronbach alpha method was applied to examine the tool's reliability, and the reliability value was r =0.74, which revealed that the tool was reliable. Data analysis based on study objectives and hypothesis states was prepared using descriptive and inferential statistics.

4. RESULT AND INTERPRETATION

Section A: Description of the socio-demographic variables of school children

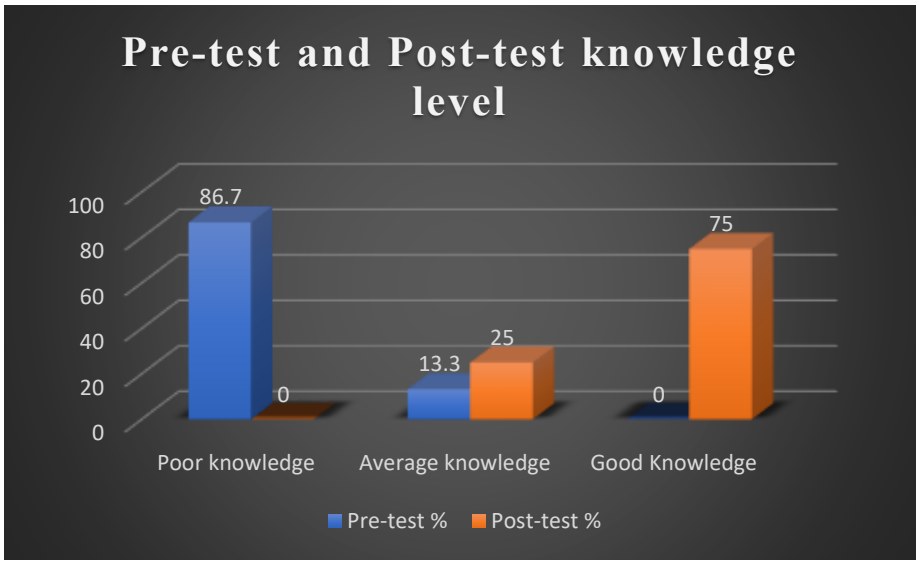
It deals with demographical data which consists of 9 items to collect sample characteristics, which comprises of age in years, class, gender, family, religion, area of residence, mode of transport, type of school bag, weight of school bag.

SN	Variables	Categories	Frequency (f)	Percentage (%)
1.	AGE	10 years	1	1.7
		11 years	5	8.3
		12 years	23	38.3
		13 years	20	33.3
		14 years	11	18.3
2.	CLASS	7^{th} Class	33	55.0
		8^{th} Class	27	45.0
3.	GENDER	Female	31	51.7
		Male	29	48.3
4.	FAMILY	Extended family	1	1.7
		Joint family	28	46.7
		Nuclear family	29	48.3
		Single parent	2	3.3
5.	RELIGION	Christian	1	1.7
		Hindu	57	95.0
		Muslim	1	1.7
		Sikh	1	1.7
6.	AREA OF RESIDENCE	Rural	10	16.7
		Semi-urban or semi-rural	2	3.3
		Urban	48	80.0
7.	MODE OF TRANSPORT	Bicycle	24	40.0
		Public transport	15	25.0
		Walking	21	35.0
8.	TYPE OF SCHOOL BAG	Backpack with two straps	60	100.0
9.	WEIGHT OF SCHOOL BAG	1-2kgs	1	1.7
		2-3kgs	17	28.3
		More than 3 kgs	42	70.0

Section B: Findings related to Knowledge Regarding Body Mechanics among School Children

Sl. No.	Knowledge level	Range of score	Pre-test		Post-test	
			f	%	f	%
1	Poor knowledge	0-10	52	86.7	0	0
2	Average knowledge	11-15	8	13.3	15	25

3	**Good Knowledge**	16-20	0	0	45	75
Total			**60**	**100%**	**60**	**100%**



The data shows that pre-test and post-test knowledge score of participants. It depicts that major portion of the pre-test is 86.7% (52) have poor knowledge, 13.3% (8) have average knowledge and 0% (0) have good knowledge, and here by the post-test depicts that 0% (0) has poor knowledge, 25% (15) have average knowledge and 75% (45) have good knowledge regarding Body Mechanics.

Section C: Findings related to effectiveness of educational package on knowledge regarding body mechanics among school children.

(N=60)

S.NO.	TEST	MEAN	SD	MEAN DIFFERENCE	T VALUE	P VALUE
1.	**Pre-test**	7.78	2.26	8.2	22.04	0.000*
2.	**Post-test**	15.98	1.88			0.000*

The data displays that, the mean post-test score (15.98) is more than mean pre-test score (7.78), which shows the adequate level of knowledge in the post-test and inadequate level of knowledge in the pre-test, with the mean difference of (8.2) . Hence, it displays the effectiveness of an educational package on knowledge regarding Body Mechanics among school children.

So, the stated hypothesis H1- There is a significant difference pre-test and post-level of knowledge regarding Body Mechanics among school children is accepted. **(N=60)**

Section D: Findings related to association between pre-test knowledge scores with their selected demographic variables.

S. NO.	DEMOGRAPHIC VARIABLES	POOR KNOWLEDGE (0-6)	AVERAGE KNOWLEDGE (7-13)	GOOD KNOWLEDGE (14-20)	TOTAL	X^2 CALCULATED VALUES/ Df	INFERENCE
1	**AGE IN YEAR** 10 11 12 13 14	 1 5 23 17 6	 0 0 0 3 5	 0 0 0 0 0	 1 5 23 20 11	 Chi-square= 14.331 Df=4	 P=.006 P< 0.05 S*
2	**CLASS** 7th	 33	 0	 0	 33	 	 P= 0.001

	8th	19	8	0	27	Chi-square= 11.282 Df=1	P < 0.05 S*
3	**GENDER** MALE FEMALE	 24 28	 7 1	 0 0	 37 29	Chi-square= 4.736 Df= 1	P= 0.029 P<0.05 S*
4	**TYPE OF FAMILY** EXTENDED FAMILY JOINT FAMILY NUCLEAR FAMILY SINGLE PARENT	 1 22 27 2	 0 6 2 0	 0 0 0 0	 1 22 27 2	Chi-square= 3.089 Df= 3	P=0.378 P>0.05 NS
5	**RELIGION** CHRISTIAN HINDI MUSLIM SIKH	 1 51 0 0	 0 6 1 1	 0 0 0 0	 1 57 1 1	Chi-square= 13.543 Df= 3	P=0.004 P<0.05 S*
6. 7.	**AREA OF RESIDENCY** RURAL SEMI-URBAN OR SEMI-RURAL URBAN **METHOD OF TRANSPORTATION** BICYCLE PUBLIC TRANSPORT WALKING	 10 0 42 24 9 19	 0 2 6 0 6 2	 0 0 0 0 0 0	 10 2 48 24 15 21	Chi-square= 14.567 Df= 2 Chi-square= 13.187 Df=2	P= 0.001 P<0.05 S* P=0.001 P<0.05 S*

8	**TYPE OF SCHOOL BAG** BACKPACK WITH TWO STRIPS	52	8	0	60	N.A	N.A
9	**WEIGHT OF SCHOOL BAG** 2-3 KGS 2-3 KGS MORE THAN 3 KGS	1 13 38	0 4 4	0 0 0	1 17 42	Chi-square= 2.211 Df=2	P=0.331 P>0.05 NS

***S- Significant, Ns- Non-Significant**

The obtained chi-square value for age in years (chi-square=14.331, p<0.05), class (chi-square=11.282, p<0.05), gender (chi-square=4.746, p<0.05), religion (chi-square=13.543, p<0.05), area of residency (chi-square=14.567,p<0.05), and method of transportation (chi-square=13.187,p<0.05) was less than 0.05 which indicates there was a significant association between pre-test knowledge score regarding Body Mechanics with their selected demographic variables.

Hence, the stated hypothesis H2- There is a significant association between pre-test level of knowledge regarding Body Mechanics among school children with their selected demographic variables is accepted.

5. DISCUSSION

The study findings were presented in separate sections, with the analysis aligned to the stated objectives and hypotheses. A significance level of $p < 0.05$ was used to test the hypotheses. As per the age in years of school children,1.7% (1) comes under 10 years of age, 8.3% (5) comes under 11 years of age, 38.3% (23) comes under 12 years of age, 33.3% (20) comes under 13 years of age, 18.3% (11) comes under 14 years of age, as per the class of school children 55% (33) studying in class 7^{th} and 45% (27) studying in class 8^{th}. as per the gender 51.7%(31) are female and 28.3% (29) are male, as per the type of family, 1.7% (1) are from extended family, 46.7% (28) are from joint family, 48.3% (29) are from nuclear family and 3.3%(2) are from single parent family, as per the religion 1.7% (1) are Christian, 95% (57) are Hindu, 1.7% (1) is Muslim and 1.7%(1) is Sikh, as per the area of residency 16.7%(10) are from rural area , 3.3% (2) are from semi urban or semi-rural area and 80%(48) are from urban area, as per the method of transportation 40%(24) come by bicycle, 25%(15) come by public transport, 35% (21) come by walking, as per the types of school bag, 100%(60) carry backpack with both the straps, as per the weight of school bag, 1.7% (1) comes under the category of 1-2kgs, 28.3%(17) comes under the category of 2-3kgs and 70% (42) comes under the category of more than 3kgs.

The results showed that, before the intervention, the majority of school children 86.7% (52) had poor knowledge about body mechanics, while 13.3% (8) had only an average level of knowledge. After the educational program was delivered, there was a remarkable improvement: 75% (45) of students achieved good knowledge levels, and the remaining 25% (15) reached an average level. The mean post-test score (15.98) was notably higher than the mean pre-test score (7.78), indicating a mean difference of 8.2 points. This clear improvement demonstrates that the educational package was effective in enhancing students' understanding of body mechanics.

Further analysis revealed that the improvement in knowledge was significantly associated with certain socio-demographic factors. A p-value below the 0.05 threshold was observed for variables such as age, class, gender, religion, area of residence, and mode of transportation, suggesting these factors influenced pre-test knowledge scores. However, no significant relationship was found between knowledge levels and the type of family or the weight of the school bag.

With the support of my study, Poovizhi and Satchi reported that the Ergonomic Health Promotion Programme (EHPP) significantly improved postural health among school children in Chennai. Using a quasi-experimental design, they found that 65% of children initially had musculoskeletal problems, but post-intervention, most demonstrated good posture, fewer musculoskeletal complaints, and improved ergonomic knowledge. The study concluded that EHPP effectively enhances postural health, ergonomic awareness, exercise frequency, and academic performance.[12]

6. CONCLUSION

The study concludes that school children had inadequate knowledge and poor practices regarding proper body mechanics. Children are particularly vulnerable to developing musculoskeletal issues due to lack of awareness, improper posture, and unhealthy daily habits such as carrying heavy backpacks or sitting incorrectly. These issues are often overlooked in early years due to limited health education and lack of emphasis on preventive care. The results of this study clearly demonstrate that the educational package was highly effective in improving both knowledge and practice among school children, empowering them to adopt correct body mechanics and prevent future health complications.

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Data Availability Statement: The present study sample consists of school children of 7th and 8th class in G.K. Public School, Moradabad U.P.

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Conflicts of Interest Statement: The authors declare no conflicts of interest related to this study.

Ethics and Consent Statement: To secure credibility, the tools besides the research statement, objectives, and criteria checklist were submitted to 7 validators. Content Validity- the overall tools was appropriate regarding language, content, and organization. Language- in the context of language tools, it was appropriate and easily understood by experts. The content of the tools was adequate, accurate, and organized, as per the instructions of the validators.

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