SCHOOL BAGS EFFECTS ON STUDENTS' HEALTH IN CHANDRAPUR CITY, CENTRAL INDIA

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Abstract

To ascertain the health impact due to school bags a cross-sectional study on government and private school children (n=190, n=99 girls, n=91 boys) from the Chandrapur city, central India was carried out. These impacts were identified based on a specially designed and developed questionnaire. The results revealed that both shoulders exert pressure due to school bags (45.18% in government schools and 36.36% in private schools). The body pain according to their pain level is shoulder > neck > hand > back > foot. Back pain has been identified as a major effect of school bags on these students' health. Fatigue due to lifting the bag is another issue reported by both government and private school students. The shoulder pain has been the major (~35%) reason for not carrying the school bag followed by neck pain (~25%). The severity of these impacts varies as per the affiliation of the school viz. government and private school. The students have visited the physician and took medicine to get relief from health ailments due to school bags. In addition to school bag, hours per day for doing homework, watching television or/and computer and position of homework at home may also be the factors responsible for health issues. To reduce the impact of school bags an inclusive policy taking into account different affiliated school types and their effective implementation is the need of the hour.

Key Words: Chandrapur, School bag, Student health

Introduction

Children are the future of the nation and education is the backbone of our society. For the holistic development of the children school education plays a vital role. Children's stress-free minds and good health will be an asset to nationbuilding. The children's education starts at an early age of 3-4 years and progresses onwards. At this age, children have to carry school bags which may vary depending upon the age, grade and school affiliation viz. Central Board of Secondary Education, State Board, National Council of Education Research and Training, Kendriya Vidyalaya Sangathan, etc. As per Collins Dictionary, "A school bag is a bag that children use to carry books and other things too and from school". Maximum students carry the school bag on their back along with tiffin and water bottle in a separate small bag in their hand.

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The government and private school setting may aggravate the problems due to school bags as lack of transportation facilities in rural areas force these students to carry the school bag on their back and walk to and fro the school every day throughout their early academic life.

The combined weight of all things carried out by these students is a growing concern among parents, academicians, and policymakers. Increased school bags weight's effects on students need to be understood as their bodies are in the developing stage (Singh and Koh, 2009). Carrying heavy school bags every day is the most stressful experience for a schoolgoing child. The adverse effects of heavy school bags on children's shoulders, back and neck can be noticed. In urban setting children has to carry heavy school bags on their back and they have to climb up and down the stairs of the school building and many of the times in a heavy rush. It has been further observed that children's classrooms are mostly on the top floor (3^{rd}) or 4th floor) of the school building which will augment the problem due to school bags.

Mackenzie *et al.*, (2003) reported school-going children to carry school bags loads 30-40% of their body weight. "The school bag is a common cause of backache in school-going children. A heavy bag may cause a child to compensate by leaning his body forward and this can strain muscles in his neck, shoulder and back. The child may also find it difficult to put the bag on and take off, or he falls frequently in school while carrying his school bag" (Rai *et al.*, 2013).

The print and online literature review revealed that no study was carried out on the government and private regulated

school bags' effects on students' health in India. Thus, this is the identified gap in this subject domain. This study was aimed to assess the effects of government and private school bags on students' health from the Chandrapur city of Maharashtra state of central India. The study outcome will add a new understanding of health problems in school-going students due to school bags. Furthermore, the initiatives to be taken at national/state-level policy formulation and mechanism for the implementation of the same can be taken to minimize the health effects due to heavy school bags thus ensuring an enjoyable school life.

Study Area

Chandrapur city (19.57° North latitude and 78.18° East longitude) is the district headquarters of the Chandrapur district and has a geographical area of 70.02 sq km (Figure 1). The city is situated at an altitude of 189.9 m above mean sea level. According to the Census of India 2011 the population of the city was 3,20,379. The demographic profile of the city includes males and females as 1.64.085 and 1,56,294 respectively. The average literacy rate of Chandrapur city is 89.42% of which male and female literacy was 93.45% and 85.21% respectively (Census of India, 2011). The climate of the city can be classified as hot and dry with warm summer and cold winter. The city is the education centre of the district and catering to the needs of playschool to research studies of the students. Primary school education is offered by government and private-run educational institutions. Number of schools from the city are multistory 93-4 floors) with common stairs for girls and boys and without lift facility.



Fig. 1: Chandrapur district with administrative blocks (Satapathy et al., 2009)

Material and Methods

To ascertain the school bag's effects on the students' health from the Chandrapur city sample population was drawn from the government and private school children. The sample population of n=135 from three government schools was identified; whereas, from private schools n=55. The sample population comprises 99 girls and 91 boys. The stratified random sampling methodology was adopted to carry out this study. These identified sample population children were of class 5th, 6th and 7th (age group 9-16 years). The inclusion criteria for this study were generally healthy students who are agreed to participate in the study. The prior consent of the Principal and the students were taken at the beginning of the study.

To elicit the information from the students a specially designed and

developed and field-tested tool (questionnaire) was used. While preparing this tool the NORDIC questionnaire was referred. This questionnaire consists of sections about student's profile, homework, television/sports profile, and health-related problems due to school bags. The health-related problem section was further divided into musculoskeletal, back, neck, and other physiological problems. The questions were designed to get quantitative output. The Likert scale was adopted while framing the options for the questions.

In addition, children's body weight, body weight with/without bag was measured with the help of a digital weighing scale. The readings were recorded to the first decimal point. To receive the correct response from the students regarding health issues due to school bags on various body parts an enlarged human posture figure was shown to the students and asked them to confirm the body part which is getting affected. The generated data was analyzed with the help of Microsoft Excel and SPSS.

Results and Discussion

The age, gender and class distribution of the sample population is presented in Table 1. The age distribution is carried out in two categories of 9-12 years and 13-16 years. The emphasis was laid on the inclusion of the young age group (of 9-12 years) students. The female students outnumber males in the sample population.

		Government school	Private school
Age group	9-12 years	72 (53.30%)	35 (63.60%)
	13-16 years	63 (46.70%)	20 (36.40%)
Gender	Male	65 (48.10%)	26 (47.20%)
	Female	70 (51.90%)	29 (52.80%)
Class	5 th	43 (31.80%)	25 (45.50%)
	6 th	53 (39.30%)	30 (54.50%)
	7^{th}	39 (28.90%)	Nil

Table 1: Age, gender and class distribution of sample population

The characteristics of school bags regarding the type, way of carrying, rate the weight of the bag, lean forward while carrying a school bag and separately carrying tiffin/water bottle is presented in Table 2. From the table, it is observed that double strap school bag is common as compared with single strap in both types of school students. The way of carrying school bags has interesting observations from private school students. The maximum (51%) students carry the school bag on both shoulders while $\sim 22\%$ carry it on the front of the body. However, in government school students the tendency of carrying the school bag on the front of

the body is negligible (0.70%). The students' response regarding 'rate the weight of school bag' in three responses of light, medium and heavy is in the order of light > heavy > medium. In the case of private schools, light and heavy responses were comparable. While carrying school bags maximum (63.6%) students from private school lean forward. This may be assigned to heavy school bags and the way of carrying the school bag (on front of the body, 21.8%). To carry a tiffin and water bottle separately was a normal tendency in the students and this was dominated by private school students as compared with government schools.

Particular	Type of bag	Government school	Private school
Type of bag	Single strap	47 (34.80%)	24 (43.60%)
	Double strap	88 (65.20%)	31 (56.40%)
Way of carrying school bag	On one shoulder	66 (48.90%)	15 (27.20%)
	On both shoulder	68 (50.40%)	28 (51.00%)
	Front of the body	1 (0.70%)	12 (21.80%)
Rate the weight of school bag	Light	61 (45.20%)	21(38.10%)
	Medium	36 (26.70%)	15 (27.27%)
	Heavy	38 (28.10%)	19 (34.54%)
Lean forward while carrying	Yes	56 (41.50%)	35 (63.60%)
school bag	No	79 (58.50%)	20 (36.40%)
Seperately carry tiffin/water	Yes	64 (47.50%)	37 (67.20%)
bottle in a bag	No	71 (52.50%)	18 (32.80%)

Table 2: Characstics of school bag

The school bag's weight, body weight without a bag, body weight with a bag and the time (min.) required to reach the school by walking is presented in Table 3. From the table it can be seen that in government school maximum (47%) students schoolbag weight was 3-4 kg whereas; in private schools, it was 5-6 kg (51%). This indicates private schools may ask to carry more things in their school bag as compared to government schools. The body weight with school bag is divided into five groups and found to be maximum (43%) in 41-50 kg in government schools. In the case of private schools, it has been observed that the maximum (38.1%) students' body weight with school bags was in the range of 31-40 kg followed by 21-30 kg (25.4%). The time required to reach the school by walking is reported to be a maximum (39.2%) of 10-15 minutes by government school students.

Table 3: School bag, body weight and time required to reach school

Particular	Particular	Government school	Private school
Bag weight	1-2 kg	44 (33.0%)	10 (18.0%)
	3-4 kg	64 (47.0%)	17 (31.0%)
	5-6 kg	27 (20.0%)	28 (51.0%)
Body weight without bag	21-30 kg	10 (7.40%)	20 (36.3%)
	31-40 kg	61 (45.20%)	10 (18.0%)
	41-50 kg	44 (32.6%)	18 (32.7%)
	51-60 kg	13 (9.6%)	7 (12.0%)
	61-70 kg	7 (5.20%)	Nil
Body weight with bag	21-30 kg	3 (0.70%)	14 (25.40%)
	31-40 kg	36 (26.1%)	21 (38.10%)
	41-50 kg	58 (43.0%)	11 (20.0%)
	51-60 kg	30 (22.2%)	9 (16.50%)
	61-70 kg	8 (5.9%)	Nil
Time required to reach the	10-15 min	53 (39.2%)	34 (61.80%)
school (walking/vehicle)	15-30 min	34 (25.0%)	18 (32.70%)
-	30-60 min	43 (31.8%)	3 (5.50%)

Table 4 presents the characteristics of homework and sports activities at home. Maximum (56.36%) students from private school devote 1-2 hours/day for doing homework; whereas, in government school students it was 2-4 hours/day (43%). The time spent for watching television/computer is maximum (65.3%) in the private school students (2-4 hours/day). In the case of government school students, it was 1-2 hours/day (57.77%). The position while carrying out homework is in the order of on the desk > on the floor > any other in government school students while in private school it is on the desk > on the floor. The body pain while playing sports at home is reported by both government and private school students. The body pain due to school bags may get aggravated while playing sports results in this observation.

Table 4: Ccharacteristics of homework and sports at home

Particular	Response	Government school	Private school
Hours/day doing	1-2 hrs	50 (37.0%)	31 (56.36%)
home work	2-4 hrs	58 (43.0%)	18 (32.72%)
	>4 hrs	27 (20.0%)	6 (10.90%)
Hours/day watching	1-2 hrs	78 (57.7%)	19 (34.5%)
TV/Computer	2-4 hrs	42 (31.11%)	36 (65.30%)
	>4 hrs	15 (11.1%)	Nil
Position of homework	On the floor	42 (31.1%)	15 (27.20%)
at home	On the desk	58 (42.96%)	40 (72.8%)
	Any other	35 (25.92%)	Nil
		chair, stool	
Pain while playing	Yes	45 (33.0%)	31 (56.3%)
sports	No	27 (20.0%)	15 (27.20%)
	Sometimes	63 (47.0%)	9 (16.50%)

The school bag rests against the lower back response is presented in Figure 2. The private school student's school bag rests against the lower back was found to be maximum (54.54%); whereas, a government school student's school bag doesn't rest against their lower back (40.74%). About 25% of the students from government and private schools don't know if their school bag rests against the lower back or not.

The responses of stay upright while walking with the school bag (Figure 3) revealed private school students stay upright all the time; most of the time and some of the time contributes 72.72%. In the case of government school students, 43.7% stay upright for very little time. The probable reason for this observation can be assigned to as government school students most of the times have to walk (10-15 minutes, 39.2%) from their home to school. In the case of private schools, this is not the case as they use transportation mode as a result of which they have to walk for a shorter distance of time thus they do not show any immediate health effects. A bodily worn school bag can change posture and gait when walking and this compounds the problems. The schoolbags heavy load can result in changes in static and dynamic posture. The heavy school bag can interfere with the children's walking and climbing the stairs. It may also be the cause of injury to other students if it falls or hit them.

Figure 4 depicts pressure on the shoulders due to the school bag. Of the two shoulders, the right shoulder has more pressure and the responses from government and private school students were comparable. About 40% students from both types of schools have reported pressure on both shoulders. The school bag's straps can apply pressure on the blood vessels and nerves in children's shoulders and neck.

The feeling of pain while carrying a school bag (Figure 5) revealed about 50% and 75% of students from government and private schools respectively have it at regular or some times. The pain due to school bags is bearable (Figure 6) is reported by ~72% government school

students whereas; private school students reported ($\sim 78\%$) the pain is not bearable. The body parts according to their pain level (Figure 7) revealed shoulders have the maximum pain level in government (37.03%) and private (32.72%) school students followed by neck (~29% in government and 25% in private). The pain level in hands was reported higher (25.45%) in private school students than the government (15.07%). The strain or damage to back and stomach muscles is the result due to improperly worn school bags. Of the surveyed students, 33.5% reported they were currently experiencing pain that they attributed to schoolbag use with 54% of the respondents reporting at least one symptom that they attributed to the school bag.







Fig. 3: Stay upright while walking with school bag





Fig. 4: Pressure on shoulder due to school bag



Fig. 6: Pain due to school bag is bearable Fig. 7: Body parts according to their pain level

Figure 8 depicts health impacts on students due to the school bag. From the figure, it can be seen that muscular soreness is predominant (29.47%) in government school students. The neck, leg, and arm pain results were comparable in both government and private school students. The private school students' heavier school bags that rest on their lower back (54.54%, Figure 2) results in lower back pain (51.33%).

The school bag's effects on students' health are presented in Table 5. From the table, it can be seen that musculoskeletal pain by heavy school bags is a common

health issue in both government (40.7%)and private (63.7%) school students. The long back pain problem is the other identified health issue in these students with both government and private school students suffering equally (29%). Another health issue identified was headache and predominant (70.4%) this was in government school students as compared with private school (30.9%). In addition to the school bag weight, there may be other problems viz. poor health, inadequate food, walking in intense heat etc. which may result in adverse health effects on students. The health issue (pain) resulting

due to school bags has forced the students to stay at home. The results are comparable for both government (22.2%) and private (25.4%) school students. As students are staying at home and missing their classes this will have adverse effects on their results and promotion in the next class. The students have reported 'tiredness without any reason' and private school students have reported a maximum (61.8%) response.

Health effect	Response	Government school	Private school
Musculosketal pain by	Yes	55 (40.7%)	35 (63.7%)
heavy school bag	No	80 (59.3%)	20 (36.3%)
Long back pain	Yes	45 (29%)	16 (29.0%)
	No	90 (71.1%)	39 (71.0%)
Headache	Yes	95 (70.4%)	17 (30.9%)
	No	40 (29.6%)	38 (69.1%)
Stay at home because	Yes	30 (22.2%)	14 (25.4%)
of pain	No	105 (71.8%)	41 (74.6%)
Tired without reason	Yes	77 (57.0%)	34 (61.8%)
	No	58 (43.0%)	21 (38.2%)

Table 5: Effects of school bag on student health



Fig. 8: Health impacts on chlidren due to school bag Fig. 9: Body pain remains





Fig. 10: Backpain and application of pain balm



Fig. 12: Fell numness in any body part after lifting and walking with school bag



Fig. 11: Tingling felling in arms, hands, legs, and neck





40

30

20

10

Ð

15.07

G

14.54

P

Yes

G

No

Fig. 14: Reasons for not carrying school bag Fig. 15: Reported backpain problem to school authorities

The body pain due to school bags is reported to remain for 1-2 days by both government and private school students and the results are comparable (Figure 9). The back pain problem is reported by both government (35.29%) and private (21.81%) school students. The repetitive loading and unloading of school bags on the spine is known to be a risk factor for lower back pain. To get relief from the back pain application of pain balm (Laal balm, Zandu balm and Iodex) was reported (Figure 10). About 42% students both from government and private schools do not apply any pain balm. Figure 11 depicts a tingling feeling in the arms, hands, legs and neck. A distinct difference in results was observed for this and government school students are at receiving end. The government school students have reported (~80%) numbress in the body after lifting and walking with a school bag (Figure 12). In the case of private school students, this observation was reported by $\sim 21\%$ only. The tingling feeling in arms, hands, legs and neck along with numbress in body parts was

20

P

Shoulder pain | Neck pain | Body pain |

G

P

11.85

G

Any other

9.09

P

25

20

15

10

5

0

P

G

G

higher in government school students. The school bag's straps can apply pressure on the blood vessels and nerves in children's shoulders and neck. This pressure results in pain and tingling in the neck, arms, hands, and legs.

P

16.36

Р

10.14

G

Supportive

The fatigue due to lifting of school bag was higher in private school students (~65% both yes and sometimes together) (Figure 13). The higher prevalence of fatigue in private school students may be assigned to heavier school bags and in addition, carrying sports and musical instruments. Figure 14 presents reasons for not carrying school bags by students. From the figure, it can arrive that shoulder pain is the major (32.59% and 41.81% in government and private school students respectively) reason for not carrying school bags followed by neck pain in government (29.62%) and body pain (29.02%) in private school students.

The reporting of back pain problems to school authorities was not observed in both government and private school students (Figure 15). In the case of reporting the problem to the school

authorities, their nature was supportive in private schools (16.36%) as compared to government schools (10.14%).

To reduce the health issues emerged due to heavy school bag students have visited clinician and took medication for the same (Table 6). From the table, it can be seen that maximum students have consulted clinicians for neck pain in both government (11.9%) and private (81.8%) schools followed by shoulder pain. Neck and shoulder pain has predominantly emerged as a major region of pain in private school children. The medication took to reduce the pain due to school bags

revealed a clear difference between government and private school students. school The private students took medication for upper back (94.5%) and lower back (85.5%) pain; whereas, government school for neck (14.8%) and shoulder (14.1%). To reduce the pain due to heavy school bags, a reduction in their weight according to the age and grade of the student will be immensely beneficial. Table 7 provides details about the classwise range for ratio for school bags as 10% of the bodyweight (Policy on School Bag, 2020).

Health impact	Gover	nment school	Priv	ate school
-	Yes	No	Yes	No
		Visite	d physician	
Neck	16 (11.9%)	119 (88.1%)	45 (81.8%)	10 (18.2%)
Shoulder	14 (10.4%)	121 (89.6%)	41 (74.6%)	14 (25.4%)
Upper back	2 (1.5%)	133 (98.5%)	33 (60%)	22 (40%)
Lower back	9 (6.7%)	126 (93.3%)	27 (49%)	28 (51%)
		Took	medication	
Neck	20 (14.8%)	115 (85.2%)	14 (25.5%)	41 (74.5%)
Shoulder	19 (14.1%)	116 (85.9%)	24 (43.7%)	31 (56.3%)
Upper back	2 (1.5%)	133 (98.5%)	52 (94.5%)	3 (5.5%)
Lower back	14 (10.4%)	121 (89.6%)	47 (85.5%)	8 (14.5%)

Table 6: Visit to physician and medication

Table 7: Class wise range of average body weight of children (Policy on School Bag, 2020)

Class	Average body weight range (in kg)	Bag weight range (Recommended)
Pre-primary	10-16	1.0-1.6
Class 1	16-22	1.6-2.2
Class 2	16-22	1.6-2.2
Class 3	17-25	1.7-2.5
Class 4	17-25	1.7-2.5
Class 5	17-25	1.7-2.5
Class 6	20-30	2.0-3.0
Class 7	20-30	2.0-3.0
Class 8	25-40	2.5-4.0
Class 9	25-45	2.5-4.5
Class 10	25-45	2.5-4.5
Class 11	35-50	3.5-5.0
Class 12	35-50	3.5-5.0

Al-Hazzaa (2006) reported >65% of the sample carried their bags over one or two shoulders, 20% used single strap bags carried by one hand and 14.5% had bags with wheel and approximately 29% of the students walk to and fro the school. Dockrell *et al.*, (2015) reported the mean percentage body weight carried was 18.3 ± 5.03 kg for those who had an additional item. The majority (77.5%) carried school bags to school for ≤ 10 minutes.

Oka *et al.* (2019) reported significant association was found between back pain and the number of hours spent watching television. Al-Hazzaa (2006) reported over one-third of the students reported experiencing bodily pain due to bag carriage. According to Rezapur-Shahkolai (2020), 26.6% students (7-12 years old) have reported lower back pain last month. Of the various factors identified for lower back pain watching television for > 3hours/day, carrying a school bag on one shoulder etc. were identified.

About 88.2% of pupils reported having body pain, especially in the neck, shoulder and upper back. About 35.4% of the children reported carrying the school bag was the cause of their musculoskeletal pain. There was a significant association between lower back pain and method of bag carriage, long duration of the walk, and time spent sitting after school (Mwaka et al., 2014). Dianat et al. (2011) reported 86% of the children reported some kind of musculoskeletal symptoms. The occurrence of the shoulder, wrist/hands, and lower back pain was 70%, 18.5%, and 8.7% respectively. Oka et al. (2019) reported the prevalence of back pain over the last month was 53.9%.

According to Dianat *et al.* (2013) the method of carrying the school bag was

significantly associated with hand/wrist and shoulder symptoms, and time spent carrying a school bag was associated with hand/wrist and upper back symptoms. According to Delele et al. (2018), the prevalence of self-reported musculoskeletal pain was 62% with a significant difference between school types (government 68% versus private 51%). Walking to and fro school for ≥ 20 minutes and relative school bag weight were found significantly associated with self-reported musculoskeletal pain. The lifetime, more than 3 months, and last month's history of lower back pain in female high school students was 46.2%, and respectively 11.6% 31.2% (Noormohammadpour et al., 2019). An overall prevalence of back pain was 39.4%, upper back pain, middle back pain and lower back pain amounted to 14.5%, 11.5% 13.4%. and respectively. Associated significant factors with middle back pain were carrying the bag on one side compared to on the back (Assiri et al., 2019). The high prevalence of baseline musculoskeletal discomfort was high (63.4%) (Dockrell et al., 2015).

Conclusion

The study was aimed to ascertain the health impacts on government and private school students due to school bags. The conclusions drawn from the results obtained in this study highlights that students' perception of the school bag is of medium and heavyweight. The school bag's weight is >10% of the bodyweight of the student. The various health issues have been identified among this sample population which can be attributed to heavy school bags. The health issues among government and private school students are different and there are number

of factors responsible for them. Back pain has been identified as an important health issue among these students. The hours/day doing homework and watching television/computer and position of homework at home may aggravate the health issue arisen due to school bag. The private school students visit the clinician and took medicine to get relief from the pain arisen due to the school bag. The health issue due to school bags results in academic loss of the students as they stay at home due to pain. The school authorities need to pay special attention to this issue and should initiate measures to resolve the same.

To reduce the health issues due to school bag various measures can be adopted which includes bagless day, vocational courses, vocational crafts, changes in the school time table such that each alternate day children are allowed to not carry the school bag, adequate space for sports and physical education, reading of books available in school other than textbooks, arts and crafts etc., introducing block periods so that students don't need to bring more subjects, encouraging sharing of one textbook in a subject with the peer sitting nearby, separate textbook for each semesters, use of tabs instead of complete textbooks, scope to the homework in school after school hours, providing good quality of drinking water in school premises, facility for notebooks and class work copies to be kept in school, one notebook for all subjects class work only, no reference textbook to be carried to the school, use of files instead of notebooks, only one textbook to be prescribed for the subject, weight of the school bag to be limited to 10% of the body weight, school bags needs to be light-weighted with proper compartments

and contain two padded and adjustable straps that can be squarely fit on both the shoulders, good quality of mid-day meal should be provided, weight of each textbook may be printed on the textbook by the publishers, two set of textbooks one for school and other for home, locker/cupboard facility in school, ensure a fair distribution of textbook weight per day, school diary or almanac to be avoided or made thinner, stationary items/music instruments/sports equipments can be provided by school authorities and use of smart classrooms and digital books (Policy on School Bag, 2020).

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