Original Article

Intervention Study for Reducing Schoolbag Weights in Two Rural Schools in Maharashtra

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Abstract

Context: Heavy schoolbags are reported worldwide including India. The prescribed safe upper limit was 10% of student bodyweight. **Aims:** This intervention study explored (a) impact of awareness measures among stakeholders and (b) any systemic constraints for reducing bag loads. **Settings and Design:** This is a two-stage intervention study following a 2016–2017 baseline study of schoolbag weights in two rural schools. **Subjects and Methods:** The study involved 175 students (male: 79 and female: 96) from 8th to 9th standards. The intervention consisted of sharing the baseline findings of schoolbag weight, guidelines, and necessary measures for the same. The first intervention involved creating awareness among teachers regarding the harmful effects and the second intervention involved students. Bag weights were recorded on digital luggage scale in prelunch sessions in the following weeks after the intervention. **Statistical Analysis:** The impact of interventions was tested with (a) Paired *t*-test for mean bag weights and (b) Chi-square test for the proportion of heavy schoolbags. **Results:** The mean baseline bag weight of 3.77 kg declined statistically significantly after successive interventions to 3.4 and 3.2 kg. The baseline proportion of 51% of heavy bags (>10% of body weight) declined to 38% and 29%. Despite interventions, 19% students in 8th carried heavier bags than the 3.4 kg cap set by Government guidelines. Subjects taught in 8th standard were above 6/day. **Conclusions:** Awareness programs for stakeholders only partially succeeded in reducing bag weights. Hence, reducing the daily subject load is necessary.

Keywords: Adolescent, backpack, school schedules, school-bag weight

Introduction

Heavy schoolbags have caused great concern among parents, administration, and media.[1] The problem is common in many countries.[2] The Government of Maharashtra issued a government resolution (GR) to optimize schoolbag weights in 2015.[3] Our recent rural study showed that 47% of students had bag weights heavier than 10% of their bodyweights despite the GR.[4] Although prevalence studies abound, intervention studies are scant. This was possibly the first intervention study in Maharashtra. The main objectives were as follows: (a) assessing the impact of stakeholder awareness measures about schoolbag weights and (b) exploring other constraints in reducing bag loads.

Subjects and Methods

Our baseline cross-sectional study conducted among 261 students (M:F = 128:131) of standards 8th and 9th in three rural schools in the vicinity of Medical College, found that 47% students had schoolbags heavier than 10% individual bodyweight.[4] Two of these schools were now included in this intervention study, while the third school was spared because teachers advised students to keep books in the school-desk after the study.

Sample size calculation

From an earlier study, the proportion of heavy schoolbags was found to be 47% (p1).[4] The interventions in this study were expected to halve this proportion, i.e., to 24% (p2). The desired sample size is given by formula $n = (Z\alpha + Z\beta)^2 (p1q1+p2q2)/(p1-p2)^2$.[5] $Z\alpha$ is 1.96 (95% confidence interval [CI], two-tailed) and $Z\beta$ is 0.84 (80% CI, one-tailed).[5] This yields a sample size of 64, and

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this with design correction of 1.5 and attrition adjustment of 10% suggested a sample of 106 students.

Study site and material

Both the selected schools were grant-in-aid and under Secondary School Certification Examination Board of Maharashtra sharing the same syllabus and books. A total of 175 students were found in common with baseline and were included in this study. The intervention study period was undertaken from November 2016 to academic year ending May 2017.

Interventions

The first intervention after 2 months of the baseline involved meeting and informing the schools and teachers about (a) government guidelines regarding bag weight limits, (b) the list of students whose schoolbag was seen to be heavier than 10% body weight, (c) the short term and long-term harmful effects of schoolbags carried over distances, and (d) the contents of the schoolbags (books, notebooks, the water bottle, and other items if any). Each school was provided a simple portable 50 kg electronic luggage scale, validated by testing for the standard weight of 4–5 kg sandbags previously weighed on a mechanical baby weighing machine used in the baseline study. The digital weighing luggage scales were also tested against each other for the same bag loads before handing over. All the readings correctly matched to the first decimal point. School bags were weighed in the presence of classteacher the same day to demonstrate how to weigh bags and share the results on the spot with students. After the first intervention, checking of schoolbag weights was done in the next week. All visits were done on Thursdays to ensure consistency with baseline visits but without prior intimation to prevent any opportunistic manipulation of schoolbags. Students were asked to repack their bags. Bag weights were recorded on the digital weighing scale with the help of students to make it a participatory learning event.

The second intervention was done after 1 month. First, the schoolbags were weighed, and thereafter the team informed students (n = 175) about (a) harm from carrying heavy bags using anatomy charts, (b) retraining about digital luggage weighing machines for self-testing bag weights, (c) ensure that only relevant books and notebooks should be brought each day, and (d) adjust schoolbag straps so that bags are fitting on backs rather than low back region. Follow-up bag weights were taken next week without prior intimation. Some more students showed up in each follow-up, and some were absent, but these were not included in the analysis.

Classroom schedules were analyzed from the two schools for 8th standard for estimation of weekly allocation for academic subjects that included sciences, InfoTech, mathematical subjects, languages, and social sciences. Teachers were interviewed about any re-scheduling of subjects for lowering schoolbag weights in the current academic year. Again in November 2017, classroom schedules of both schools for 8th standard were studied for a number of subjects also that of 7th standard in one school.

Ethical considerations

The Institutional Ethics Committee approved the study. Teachers and students were informed about the purpose and procedure, with the assurance that school names will be kept confidential to spare any administrative hassles.

Statistical analysis

Excel was used for entry and Epi Info 7.2 for analysis of data. The before and after bag weight differences were tested with a paired t-test. Counts of students having heavy bag weights before and after interventions were tested with Chi-square.

Results

Table 1 shows mean bag weights and proportion of heavy bags among 175 students in baseline and two interventions.

Mean bag weight showed a significant decline through baseline – first – second intervention. When compared with bag weight limit of 3.4 kg given by GR guidelines pertaining to 8th standard (n = 69), proportion of heavy bags recorded in baseline study (42%), declined to 17% after first intervention and rose slightly to 19% after second intervention. The decline in counts of heavy bags between baseline-first and baseline-second interventions were statistically significant (P = 0.0013, P = 0.0033). There was a comparable decline in the counts of heavy bags in boys and girls after first and second interventions. In boys, the baseline count was 29 which declined to 21–18. In girls, the baseline counts of 60 declined to 47–35 after successive interventions (Chi-square = 0.132, P = 0.936).

The weekly classroom schedules in January 2017 for 8th standard from both schools covered 6.5 subjects daily on all weekdays, and this persisted even in November 2017. The weekly schedule for 7th standard in the same school in November 2017 was found to be even heavier, at 6.6 subjects a day. This suggests a pattern of 6+subjects.

Table 1: Mean bag weights and proportion of heavy school-bags: Baseline and after each intervention

	Baseline	Post 1st intervention (teacher awareness)	Post 2nd intervention (student interaction)
Mean bag weight, kg (SD)	3.77 (1.05)	3.40* (1.14)	3.20$ (0.84)
Proportion of heavy bags (weighing >10% of student bodyweight) (%)	89 (51)	67 (38)	51 (29)

*The difference between mean bag weights from baseline and after first intervention was statistically significant (t=4.78, df=174, P<0.0001), $The difference between mean bag weights after first and second interventions and between baseline and second intervention was statistically significant (t=3.007, df=174, P<0.003, and t=7.95, df=174, P<0.0001). SD: Standard deviation

Discussion

Heavy schoolbags, hazards, and safety limits

The back-pack has become a global convenience for students to carry the load and walk hands free. However, the back-pack can influence the shoulder and back region through various factors such as load, bag length, method of strapping, the gait, and bending forward to negotiate ease. The increasing loading of curricula and expectations about standards of education has bloated the schoolbag load worldwide, affecting the tender shoulders and backs of the young and adolescents. Safety limits for bag weight are routinely expressed in terms of percentage of student body weights. A recent review article based on 17 cross-sectional studies, stated that all but three studies reported average bag weights heavier than 10% of student bodyweights.[2] Our baseline study showed that average bag weight for 8–9 standard students was 3.8 kg and 47% of students carried heavier schoolbags assessed against the limit of 10% individual bodyweight and walked variable distances.[4] Several country studies also reported the problem of heavy schoolbags.[6-11] Due to public outcry, Maharashtra Govt reportedly limited the school bag weight to 10% of body weight.[12] Several Indian studies have recorded the same issue.[13-15] An Indian study showed that bag pack weights and postural habits of school going students were related.[16]

Interventions

The literature on interventions for optimizing schoolbag weights is scant. The sole Malaysian trial employed both ergonomics and schoolbag load reduction, and this was found to work.[9] There are three areas for interventions as follow: (a) reduce bag-loads by limiting items and rearranging schedules, (b) educate students on ergonomics--about bag-loads, proper strapping, lifting and carrying, and (c) schools to make storage space and keep two sets of books, so that effective carriage is smaller.

The Guidelines from the Central Board of Secondary Education prescribe measures to contain the problem but define no safe upper limits.[17] The Maharashtra State Education Department had already responded to a public interest litigation and state legislature question stating that the problem of heavy schoolbags was contained. The guidelines include (a) awareness programs for teachers and students, (b) no need for bags for standard first and second standards, (c) upper limit for each age group in terms of bag weight in kilograms, (d) reducing daily subject list to 4, implying fewer books and notebooks to carry, (e) drinking water facility in school to eliminate the one kg bottle.[3] This is helpful because age-wise body weights vary widely and 10% of the average body weight may be heavier for frail students. It is easier to monitor the bag loads with a uniform upper limit rather than individualized limits. The cap for 8th standard (3.4 kg) is lower than the 10% of stated mean bodyweight (42.5 kg) for this class in the GR. Our rural study found that the mean student bodyweights (36 kg) was lower than the GR-stated 42.5 kg, but the prescribed bag-weight cap of 3.4 kg is prudent and safe enough for frail students too.

However, it seems that the schools in the study did not follow all the guidelines diligently, despite awareness among teachers about the GR. About 47% of students in the baseline study were found with higher than prescribed limit of 3.4 kg for 8th standard suggesting a poor compliance.[3] This study showed a significant improvement with simple interventions [Table 1], but about 29% of students still brought bags heavier than 10% body weight. Teacher-awareness is important for changing academic schedules to lighten bags. However, student and parental awareness are also important. The proportion of girls with heavy bags is a common finding including this study. Hence, special attention to bag loading practices among girls is necessary.

However, even after two interventions the proportion of unsafe bag weights was (a) about 29% by criterion of 10% of individual bodyweight and (b) the proportion was 19% by the GR cap of 3.4 kg for 8th standard. This suggests mere awareness programs are not enough. Furthermore, the GR is limited from first to 8th standard, but 9th and 10th standard should also be included in safety considerations as bone ossification process is still on and some studies report harm even at a higher age.[15]

Systemic constraints about schoolbag loads

A perusal of the typical current classroom schedule of 8th standard suggested that in about 6 clock h the schools manage nine classroom periods (35 min' tasika) daily on five weekdays and five periods on Saturdays. The 6–7 tasikas are used for academic subjects and the remaining two to three are allocated to sports, personality, and crafts. No subject is repeated on the same day to ensure variety and a mix of academically hard: Soft subjects. The students bring a back-pack with books and notebooks of over six subjects on all 5 weekdays, with a 1 L water bottle and other articles. It is, therefore, necessary for schools to follow the guidelines for reduction of a number of subjects taught daily from above six to four.[3] In one school, we found a repeat of language subjects, but even then the daily average was above six subjects. Downsizing daily subject load can be a sure way of slashing bag weights given constraints such as walking distances, limited transport facilities, school infrastructure without storage facilities, dependable safe-water facilities in schools, little possibility of shifting to Tabs, and disadvantages of dividing books and notebooks. Most of these issues require more investment and maintenance for schools and parents. Reducing daily subject list from above to four can be an immediate, easy and effective single change to reduce bag load and the GR supports this measure.[3] School administrations must lead to bring such a lasting change. This can be done by repeating two subjects each day, with reasonable free time in between.

Limitations

This study follows an earlier baseline study on convenience and therefore had a limited choice of sample.

Conclusions

This study of interventions for mitigating a rather disturbing proportion of heavy schoolbags in rural schools shows that

awareness measures with teachers and students helped to reduce the problem at least halfway. However, for the complete elimination of the problem more efforts are necessary at school management level to follow (a) uniform upper limits for each standard and (b) cap the daily subject list from above six to four.

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Conflicts of interest

There are no conflicts of interest.

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