

PRELIMINARY STUDY OF LOAD CARRIAGE ON PRIMARY SCHOOL CHILDREN IN MALAYSIA

Fazrolrozi and Azmin Sham Rambely

**School of Mathematical Sciences, Faculty of Science and Technology
Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia**

The purpose of the study is to investigate the weight and content of school bags carried by primary school children in Malaysia. 175 school children (male and female) participated in the study. The subjects are divided into two groups, first year and second year groups. The weights of the children were noted with and without load. Results show that the first year group carries more than 25% of body weight (>25%BW) and the second year group carries >15% BW. The decreasing percentage of body weight is not caused by a decreasing amount of load but it occurs because of the increment of body weight.

KEY WORDS: load carriage, school children

INTRODUCTION:

School children carrying heavy bags are a common phenomenon throughout the world (Sander 1979 & HKSCHD 1988 in Li et al. 2003; Negrini & Carabalona 2002). In Malaysia, starting at the age of 6, primary school children carrying their bags five days a week for six years of school. There are about 200 days in a year school children in Malaysia must carry their backpack in their regular activities. Overloading of schoolbags in a long period can cause bad side effect for the body. The use of backpacks to carry heavy loads to school has recently been postulated as one of the possible causes of back pain in children (Cabaralona et al. 1998. in Merati 2001), neck pain (Navuluri & Navuluri, 2006), foot blisters, metatarsalgia, stress fractures, knee pain, low-back injuries, rucksack palsy and local discomfort and local fatigue during load carriage (Knapik et al. 1996). Whereas, health is the most priority for the children. Furthermore, spinal ligaments and muscles are not fully developed until after the 16th year of life (Patrick, 2000 in Lai & Jones, 2001). It is also commonly known that the skeleton continues to calcify well into the late teens and early twenties and beyond (Di Jorio, 2001). Therefore, it is important to investigate the amount of load carried by this young school children as well as the contents of the school bag that cause the overloading.

METHODS:

175 school children from a local primary school participated in this study. All parents have given their written consent and all of the subjects are free from any injuries before the study was done. The school children were divided into two groups, the first year and the second year groups. The age and mean weights of the first and second year groups are 6.5 year and 21.19 (SD = 4.0) for n = 86 students and 7.5 year and 24.93 (SD = 6.1) for n = 89 students, respectively. Each student was asked to stand on a digital weigh machine with and without school bags. Then the bags' contents (exclude text books and exercise books) were identified and recorded. Data was collected during a physical education school hours. The collected data is analyzed using SPSS in order to recognize load carriage characteristics between first year and second year groups as well as male and female groups respectively.

RESULTS:

Researchers found that 10-15% BW is an acceptable load for school children (Mackie et al. 2005; Shasmin et al. 2007; Michael et al. 2007). It is found that 90% of first year male students (m1) and 97.5% for female student (f1) of the same group carry heavy school bag to school (more than 15%BW). A decreasing number of students carry heavy school bag is found to occur in the second year group, 70% of male student (m2) and 85% for female student (f2) (Figure 1).

From Table 1, in average, load carriage by first year male student is 23.6% BW with maximum and minimum load of 10%BW and 45% BW respectively. For first year female student, average of bag weight is 24% BW with the maximum weight of 38% BW and minimum weight of 12% BW. The decrease of load for second year for male and female (m2 and f2) are 17.7% BW and 21.3% BW respectively. The maximum and minimum weight for the second year group are 30% BW for second year male student, 40% BW for second year female student and 7% BW for second year male student and 11% BW for second year female student respectively.

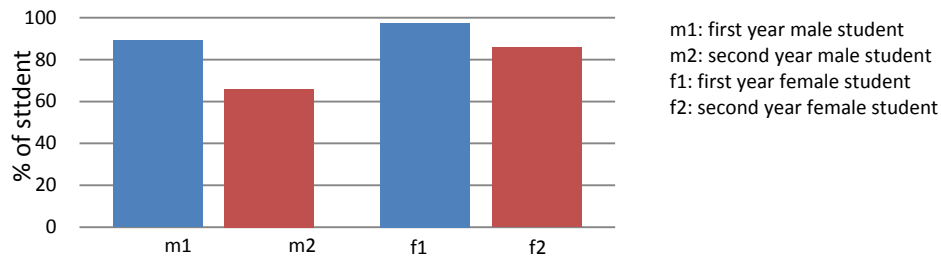


Figure 1 Percentage of students who carry heavy school bags (>15%BW) to school

Table 1 Descriptive table of student body weight, load and %BW

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
						Lower Bound	Upper Bound		
Body weight (kg)	m1	46	22.19565	4.467311223	0.658669106	20.8690245	23.52227985	13.5	42.2
	f1	40	20.185	3.559714048	0.562840211	19.04654822	21.32345178	14.1	30.3
	m2	47	26.60213	6.963866035	1.01578426	24.55745999	28.64679533	15.3	47.8
	f2	42	23.26667	5.246586192	0.809565825	21.63171531	24.90161802	16.7	43.2
	Total	175	23.17657	5.72639279	0.432874607	22.32221052	24.03093233	13.5	47.8
Load (kg)	m1	46	5.043478	1.26133125	0.185973147	4.668909116	5.418047406	2.7	9.5
	f1	40	4.745	0.856333867	0.135398273	4.471131143	5.018868857	3	6.7
	m2	47	4.512766	1.2525829	0.182707994	4.14499384	4.880538075	2.4	8.4
	f2	42	4.77619	1.02833266	0.158675174	4.455739461	5.096641492	2.9	7.8
	Total	175	4.768571	1.130296327	0.085442371	4.599934552	4.937208305	2.4	9.5
%BW	m1	46	23.65217	7.880263366	1.161881446	21.31202456	25.99232327	10	45
	f1	40	24.075	5.394144499	0.852889132	22.3498689	25.8001311	12	38
	m2	47	17.78723	5.544037809	0.808681028	16.15944356	19.41502452	7	30
	f2	42	21.28571	6.101921786	0.941546973	19.3842216	23.18720697	11	40
	Total	175	21.60571	6.778852464	0.51243308	20.5943295	22.61709907	7	45

It is found that students bring other things to school besides text books and exercise books, for example; water tumbler (83.7%), lunch box (34.9%), slippers (62.8%), pencil boxes (82.6%), color pencils (62.8%), and others (17.4%).

DISCUSSION:

Based on a research done by Ministry of Education Malaysia (MoE), load of school bag for first to third year students is 3.5 kg, in average (Ministry of Education Malaysia, 2007). However, in this research, it is found that the load of school bag is 4.9 kg, in average, for first year and 4.6 kg for second year group. This means that these young school children carry excessive loads to school for more than 50% of their time in a year. From Figure 2, it is found that the average percent of body weight of first year student is higher than that of second year group. However, statistically, the value is insignificant ($p = 0.387$, $\alpha = 0.05$). A decrease percentage of load carriage between the first and second year group is not because a decrement amount of load, for the difference of load carriage is insignificant ($p = 582$, $\alpha = 0.05$). However, it is because the increment of body weight for the second year group ($p = 0.002$, $\alpha = 0.05$), Figure 3. From the study, it is found that the weight load carried

by the primary school children is about the same, whereas the increment of body weight is significant. Thus, it shows that the first year group carries heavier load compare to that of the other group. Therefore, it is suggested that the load carried by younger school children should be proportional to the increment of body weight.

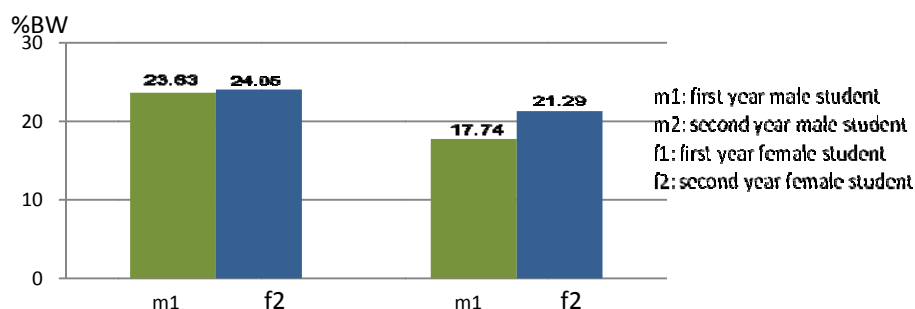


Figure 2 Comparison of % BW of first year and second year students



Figure 3 Comparison of body weight and load carriage of (a) first years and (b) second year students

On the other hand, the Text Book Department, MoE Malaysia tries to intervene the load issue through the said strategy “to ensure all text books with 128 pages or more should be divided into two volumes and to stricthen the use of all exercise books where school can only use endorsed exercise books by MoE”. For example, usage of a set of activity and text book and use of any other exercise books is not allowed (Text Books Department website, 2007). Yet the study shows that the strategies do not seem that effective.

Research done by Department of Text Books, MoE (2003) found that the average weight of text books for first year and second year National Primary School students is 1.3 kg and 1.6 kg; 1.26 kg and 1.43 kg for Chinese primary school; and 1.19 kg and 1.43 kg for Indian primary school students. Total weight for all text books is 3.0 Kg for first year student and 4.0 Kg for second year student. Besides the text books, student must carry their exercise and activity books everyday. Thus, it is important to monitor the load carriage by these young school children so that they will bring only required text and activity books for a specific school day. This is because the study showed that students carry other things to school, including water tumbler, lunch box umbrella and sport attire (BPPP, 1993) as well as pencil cases, colour pencils and slippers.

CONCLUSION:

More than 90% of first year students (6.5 years) and more than 70% of the second year studentS (7.5 years) carry very heavy bag (more than 15% of body weight) to school. Decreasing amount of percentage of body weight from first year to second year student was not because of decreasing the load, but because of increment of student body weight. No significant difference is found between male and female group in characteristic of load carriage.

Several alternatives have been suggested to reduce the side effect of overloading such as limitation of the amount of weight carried, usage of hip-belt, adjustment of shoulders straps to a fairly loose position, and perhaps positioning the heaviest items closest to the back

(Mackie et al. 2005). Strictly follow the daily schedule also give a good effect in reducing the weight of load (Ab Rashid, 2005).

REFERENCES:

- Ab Rashid, M. S.A. 2005. Effectiveness of Book Scheduling in Reducing the problem of Student Do Not Bring Malay Language Book to School. Prosiding Seminar Penyelidikan Pendidikan IPBA 2005. BPPP. 1993. Study of Load of School Bags on Primary School Student by Research and Development of Education Department. Kuala Lumpur. <http://emoe.gov.my>. [7/1/2007]
- Di Jorio, S. 2001. Children and Backpack: Load and Design Selection Based on Physiological Effects. Physiological Effects of Backpack Use and Design.
- Knapik, J., Harman, E. & Reynolds, K. 1996. Load carriage using packs: A review of physiological, biomechanical and medical aspects. *Applied Ergonomics* 27 (3):207-216.
- Lai, J.P. & Jones, A.Y. 2001. The Effect of Shoulder-Girdle Loading by A School Bag on Lung Volumes in Chinese Primary School Children. *Early Human Development* 62:79-86
- Li, J.X., Hong, Y. & Robinson, P.D. 2003. The Effect of Load Carriage on Movement Kinematics and Respiratory Parameters in Children During Walking. *Eur J Appl Physiol*(2003) 90:35-43.
- Navuluri, N. & Navuluri, R. B. 2006. Study on The Relationship Between Backpack Use and Back and Neck Pain Among Adolescents. *Nursing and Health Sciences* 8 (2006):208–215.
- Mackie, H.M., Stevenson, J. M., Reid, S. A. & Legg, S. J. 2004. The Effect of Simulated School Load Carriage Configurations on Shoulder Strap Tension Forces and Shoulder Interface Pressure. *Applied Ergonomics* 36 (2005):199-206.
- Merati, G., Negrini, S., Sarchi, P., Mauro, F. & Veicsteinas, A. 2001. Cardiorespiratory Adjustments and Cost of Locomotion in School Children During Backpack Walking. *Eur. J. Appl. Physiol.* 2001; 85: 41–48
- Michael J. M, Gregory L. W & Donna L. M. 2007. Association of Relative Backpack Weight With Reported Pain, Pain Sites, Medical Utilization, and Lost School Time in Children and Adolescents. *Journal of School Health* 77:232-239.
- Negrini, S., Carabalona, R., Pinochi, G., Malengo, R. & Sibilla, P. 1998. Backpack and Back Pain in School Children: Is There A Direct Relationship? *Journal of Bone Joint Surgery*,80:247.
- Negrini S. & Carabalona R 2002 Backpacks on Schoolchildren's Perceptions of Load, Associations With Back Pain and Factors Determining The Load. *Spine* 27:187–195
- Ministry of Education Malaysia Portal. <http://emoe.gov.my> [7/1/2007]
- Shasmin, H.N., Abu Osman, N.A. Razali, R., Usman J. & Wan Abas, W.A.B. 2007. A Preliminary Study of Acceptable Load Carriage for Primary School Children. *Biomed 06, IFMBE Proceedings* 15:171-174.

Acknowledgement

The research is supported by grant from MOSTI (06-01-02-SF0452).