



FACULTY OF MANUFACTURING ENGINEERING

ANALYSIS OF SCHOOL BAG WEIGHT CARRIAGE AMONG PRIMARY STUDENTS

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ANALYSIS OF SCHOOL BAG WEIGHT CARRIAGE AMONG PRIMARY STUDENTS

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A report submitted

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DECLARATION

I declare that this report entitled “Analysis of school bag weight carriage among primary students” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any degree.

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Date : 5 SEPTEMBER 2018

APPROVAL

I hereby declare that I have read this report and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Manufacturing Engineering (Quality System Engineering).

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Date : 5 SEPTEMBER 2018

ABSTRAK

Beg sekolah di kalangan pelajar sekolah rendah di Malaysia sangat penting kerana setiap hari mereka membawa beg ke sekolah. Beg sekolah yang berat boleh mengakibatkan banyak gejala buruk kepada kanak-kanak terutama di sekolah rendah. Kanak-kanak yang membawa beg sekolah juga dikaitkan dengan kecenderungan sakit belakang yang lebih tinggi. Terutama keadaan kesihatan mereka boleh menjejaskan prestasi mereka di sekolah. Berat bag yang disyorkan adalah kurang daripada 10-15% dari berat badan kanak-kanak tersebut. Kajian ini dijalankan untuk menilai berat beg sekolah dan berat badan pelajar di sekolah rendah. Justeru, mencari kesan atau akibat apabila pelajar membawa beg sekolah yang mempunyai berat yang berlebihan kepada tulang belakang. Kaedah yang digunakan dalam kajian ini adalah soal selidik. Sebanyak 100 pelajar sekolah terlibat dalam kajian ini daripada tiga sekolah rendah di Malaysia. Satu set soal selidik telah diedarkan di mana tinjauan itu digunakan untuk mendapatkan berat bag sekolah, berat badan pelajar, dan gejala sakit belakang yang terdedah pada murid sekolah rendah. Berat beg sekolah dan kanak-kanak sekolah diukur. Skala likert digunakan untuk pelajar sekolah selepas membawa beg sekolah di sekolah. Hasilnya menunjukkan bahawa rata-rata berat beg sekolah pelajar adalah lebih daripada 18% daripada berat badan pelajar. Oleh itu, pelajar terdedah kepada gangguan sakit belakang. Sekolah boleh menggunakan kaedah mengurangkan beban dan memantau berat beg sekolah. Ibu bapa boleh membawa kanak-kanak untuk melihat kiropraktik untuk mengelakkan keadaan tidak sihat anak-anak mereka.

ABSTRACT

School bags carriage among primary students in Malaysia is very important because every day the children carry their school bag to school. Heavy school bags may result to many bad symptoms to the children. The school bag carriage also associated with a higher prevalence of low back pain. Especially their health condition may affect their performance in school. The recommended weight of schoolbags is less than 10-15% of the body weight. This study was conducted to assess the weight of school bags in relation to primary school children weight, and to look for the effect or any pain among them in primary school in Malaysia. The method used in this study is questionnaire survey. A total of 100 school children were included in this study from three primary school in Malaysia. A set of questionnaire was distributed in which the survey was used to get the students school bag weight, body weight, and symptoms of back pain the school children are exposed. The weight of the school bags and the school children was measured. The likert scale are used for the school children to get the symptoms after carrying a school bag in school. The result shows that the average school bag weight of the students is more than 18% of the student body weight. Therefore, the students are exposed to the back pain disorder. Lessen the load and keep track of school bag weight are recommended for schools to apply. Parents can bring the children to see chiropractic to prevent any unhealthy condition of their kids.

DEDICATION

To Ibu and Ayah

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CHAPTER 1

INTRODUCTION

1.1 Background

Carrying school bag is a daily activity for most children when going to school. School bag carried by school children today are heavy. The weight of the school bag is important for those parents that have concerns about their children. It is because of the negative consequences of such heavy school bag weight may cause a back pain and damage the spine in children. Especially kids that carrying more weight than what they could possibly carry. (The central Right of Children to Free and Compulsory Education Act,2009) are also known as Right to Education (RTE) Act clearly states that a schoolbag should not weight more than 10% of student's body weight.

For the children at primary school age around 7-12 years old, they always looking for school bag that is very fashionable and give interest to them without looking of the ergonomic criteria which is easy for them to carry with two shoulders and material that comfortable to wear. As a parents they need to pack for the children follow the timetable that school have given to the children. So that they do not carry all the books to school.

In Malaysia, the children's school bags overweight is common issue which has existed for so long. But it has no clear-cut solution that can reduce the problem. Parents sometimes are not aware of their children school bags load which can effects on the well-being of their children. But some parents have already prepared the school bag following the timetable for the children including food and water bottle, makes it become heavy for the children.

1.2 Problem Statement

Most of the kids going to school that carry a heavy school bags are afraid to be scolded, so then they will take all books to school. It becomes a burden for them to carry a heavy bag to and from school. Heavy school bags problem not only happens in Malaysia but also in other parts of the world. In Ugandan, for example among 532 students were carried out in the study of musculoskeletal pain when using a school bag, about 88.2% of the children reported having body pain especially in the neck, upper back and shoulders (Mwaka et al., 2014).

A study carried out by University Putra Malaysia (UPM) has revealed that lower back pain significantly associated with school bag weight (Mohd Azuan, 2010) which is they carry a school bag with a weight of 15% more that their body weight. That results are above the upper limit recommendations advocated by many health experts. So many children going to school face the same problem of the heavy weight they carry which can make them less work efficiency.

1.3 Objectives

The objectives of this project are :

- i. To measure the weight of school bag and body weight among primary student
- ii. To identify the effects of heavy school bag weight to lumbar spine
- iii. To proposed suitable methods in reducing the risk of heavy school bag

1.4 Scope

The scope of this project will be measuring the weight of school bag and the body weight of the primary students. Besides that, the student will need to answer the questionnaire according to the school bags that they carried. The question will cover about their reaction while carrying a heavy school bag to school. In order to get the feedback from the students, observation through interview session while they complete the questionnaire. Based from the questionnaire, the suitable methods on how to reduce the risk of the students from exposed to the health hazard when they carry a heavy school bag.

1.5 Significant of study

Basically, as a student school bag is commonly used in a daily basis. It is important to the students to carry a school bag with a suitable weight. In this study, it will give an awareness to the people about the risk of heavy school bag which contribute to the immediate effects and long term effects to the primary students. Based on the weight of the school bag and the weight of the students will be discussed to get the clear understanding of the risk and the effects.

As a parents, they must be proud if their children doing great in school. To maintain the health of the students is important aspect as the children grow up. It is important for the students to carry appropriate weight so that they do not exposed to the lumbar spine or back pain as the effect of carry heavy school bag. The students have the limitation on carrying a school bag. With this study it will help to generate a understanding and actions that can reduce the risk of the students by carrying a heavy school bag to school.

1.6 Organization of the report

This report consists of five chapters, starting from chapter one until chapter five. Each chapter have their own relevant characteristic. In chapter one is about the introduction of the project including problem statement, objectives that need to be focused on and scope about this project. The significant of study and organization of the report are also being discussed in chapter one. In second chapter, it will give the clear understanding about the literature review based on the objective and the related information about the project. To get the literature review journal paper and books become the guideline as the source.

In chapter 3, it will discuss about the methodology to be used in this project. This method need to find the procedures to achieved the objective that has been set in chapter 1. The next chapter is 4 which is results from the chapter 3 that need to be analyse and discuss. The justification will be given with respect to the results obtained related to the objectives. Finally, the last chapter 5 is conclusion and recommendation that based on the overall project conclude and recommend from the study that can summarize the whole chapter and suggestion for people to acknowledge.

CHAPTER 2

LITERATURE REVIEW

This chapter will explain about the literature review. The issues that will be discussed are about school bag that the primary students are using and the weight that is appropriate to their body weight and how the students carrying the bag. It also discusses about the effect when the school children carrying their school bag.

2.1 School bag use

Most of the students in the primary school carrying bag to school because they need to bring all the books and other materials for the study. Some of them carrying a very heavy bag to school without looking for the consequences after carrying the bags for years. During the early school period the children body growth is relatively stable (Kellis and Emmanouilidou, 2010). School bag is one of the important things for the students to carry all their books and other stuff to school.

As far as we concern about the student at the age around 7-12 years old they must carry appropriate weight that not affect their growth. The parents especially need to really look for their children school bag weight so that it is weight as minimizes as possible so that it will not stress or give any bad implication to the children. Students carrying school bag that is heavy will tend to lean forward to balance their centre of gravity, which results in a reduction of lumbar lordosis and increased thoracic kyphosis (Drzal-Grabiec et. al., 2015)

School bag comes in many sizes, colours, materials and shapes those will give the children a range of choices (Adams, 2017). But when it comes to the real purposed or function of the bag need to look into details about the ergonomically suitable for the children to carry to school. From the research conducted have concluded that school bag with many patterns and designs including the weight, method of carriage, strap length, time spent carrying the school bag are one of the factors influence the risk of musculoskeletal symptoms such as pain and discomfort in different body regions of primary school children (Mwaka et al., 2014)

Average Child Back Sizes for Backpacks by Age (in inches)

Age	Height	Width
4	11"	6"
5	12"	6 - 1/2"
6	12 - 1/2"	7"
7	13"	7"
8	14"	7 - 1/2"
9	14 - 1/2"	8"
10	15"	8"
11	15 - 1/2"	8"
12	15 - 1/2"	8 - 1/2"
13	16 - 1/2"	9"
14	17"	9"
15	17 - 1/2"	9"
16	18"	9"
17	19"	9 - 1/2"
18	19"	9 - 1/2"

Figure 2.1: Size Chart for Children's Backpacks

From the Figure 2.1 shows that the students should have the appropriate size of school bag according to their age, height, and width. The average school bag size can give a good impact for the children in terms of their health. If the students carry a bag that suit to their age it will help the students to carry the bag in comfortable way. The parents can make adjustments for their children to have a suitable size following their maximum heights and widths.

2.1.1 Factors influencing school bag weight

There are many reasons why the children carrying more books to school because they not looking at their timetables when fill up all the books. The students bring the book almost all subject to school everyday. Parents sometimes are busy with their work that makes the children keep the book by themselves without looking at the timetables. Furthermore they don't take the books that is not necessary for the school tomorrow. They keep for the whole week so they don't forget to bring any of the books.

The researchers in Malaysian schoolchildren should consider storage areas, especially with a locking system for their desk drawer. Use of a desk without proper storage, equipped with only a drawer, can lead to students bringing an excessive number of books to school on a daily basis. Therefore, a simple mechanism to reduce the ergonomic risk of schoolbag weight is using a lockable drawer as the main bag storage area (Ismail et al, 2010).

Another perspective that the school and teachers have raised the standards of academic to emphasis the student for success. Therefore, so many homework for the children to be complete at home and also so many books to be finish (Cavallo et al,. 2002). It is for the success of school standards and advantages for the students to get a better grade in school. Parents must be aware of the good ergonomic school bags suitable for the children. They need to measure the maximum height and width of the school bag (Adams, 2017)

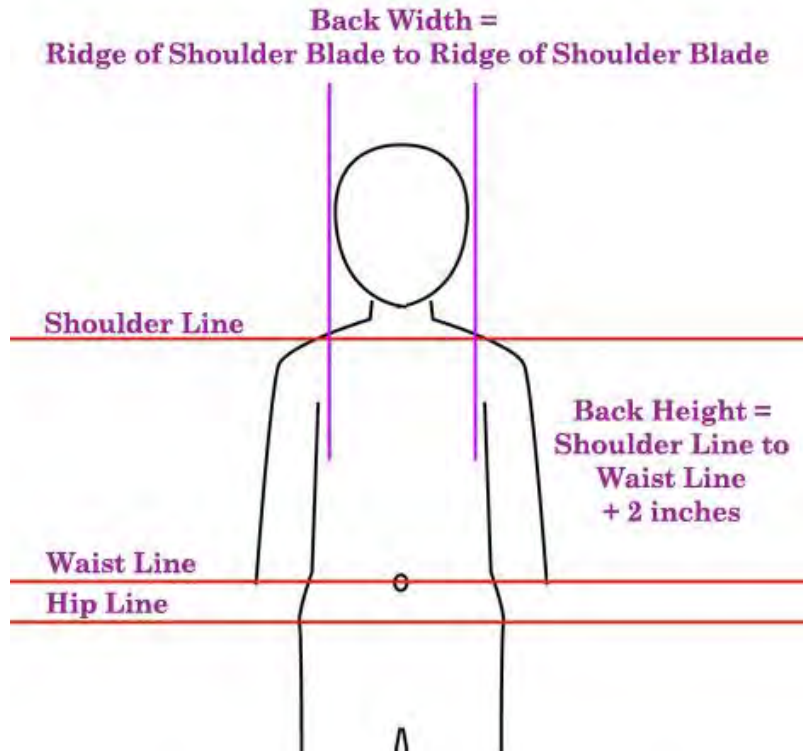


Figure 2.2 : Fitting guide for a child's school bag.

From Figure 2.2 shows that the suitable line that suit to the children to follow as a reference that can guide them to choose the right school bags. Other than books, students sometimes bring other things to school for example they bring extra clothing, lunch boxes, stationery and other personal items to school (Mwaka et al., 2014). Extra clothing for physical education and health so the students need to bring extra clothes. For students that are very particular about eating they always bring lunch made by their parents to school. This helps the student to save money at the same time control their eating healthier food.

Most of the school they do not provide locker for the students (Neuschwander et al., 2010). This happens in many local school lack of lockers which make the students have no place to store their items. If the school have provides the locker but still not enough room to put the items if the students bring a lot of items to school. Most important thing parents need to monitor the children so they bring only necessary things to school.

2.1.2 School bag weight

Many students carrying bag to school that is heavy which results that affect their spinal column and back muscles give a back and neck pain (Puck Ree et al., 2004). Many studies have shown that school bag that the student carry are heavy can contribute to many discomfort and lead to bad posture. Many research shows that the weight of a school backpack should not exceed 10% of the child's body weight (Goodgold et al., 2002)

Most studies found that an acceptable limit for school children should be between 10% and 15% of their body weight (Bauer et al, 2009, Brackley et al, 2004). So as a parents need to consider the safe limit for their children carrying the school bag to school are safe according to the American Physical Therapy Association (APTA) (2009)

• <u>Weight Of Child</u>	• <u>Maximum Backpack Weight</u>
• 27.21 Kg	• 2.26 Kg
• 27.21 - 34 Kg	• 4.53 Kg
• 34 – 45.30 Kg	• 6.80 Kg
• 45.30 – 56.63 Kg	• 8.16 Kg
• 56.63 – 68 Kg	• 9.07 Kg
• 68 – 90.70 Kg	• 11.33 Kg
No one should carry more than 11.33 Kg in a backpack	

Figure 2.3 : Maximum school bag weight chart for children (APTA, 2009)

But many studies shown that the school children carrying weight more than 10% of their body weight (Mwaka et al., 2014). As shown in Figure 2.3 school bags maximum weight and the range weight of students can carry which the experts say carrying heavy school bag can increase the risk of back problem and deformed spine for a child which can slower growth rate (Avantika and Shalini, 2013). When a heavy school bag is incorrectly placed on the shoulders, the weight's force can pull a child backward.

Geraldin et al (2003) conducted a study on the association of back pack use and back pain in adolescents. A questionnaire was completed by 1126 adolescents related to health, activities and backpack use and also their height, body weight and the weight of the back pack was measured. They concluded that the use of backpack during school day and backpack weights are independently associated with back pain.

Heavy weight that the school children carrying can causes the spine and its tissues to stiffen and become deformed, which may lead to injuries (Kim et al., 2008). Because of the school bag carriage are heavy have raised concerns among parents and teachers. The school children have complaints to school about the back and shoulder pain (Negrini and Carabalona, 2000).

2.1.3 Methods of carrying school bag

School children mostly wear their school bags just over one shoulder because easier for them but end up leaning to one side of that might cause upper and lower back pain. It also gives pressure to the shoulder and neck (Syazwan et al., 2011). Other universal factors students carrying improper school bag to school that influence the incidence of musculoskeletal pain in them.

Table 2.1 : Mode of carrying school bags (Ingrid et al, 2016)

Grade	Sex	Double-strap backpack	Single-strap backpack	Wheeled backpack	Other modes
1 st grade	Male (n=12)	83.3%	0.0%	16.7%	0.0%
	Female (n=11)	63.6%	0.0%	36.4%	0.0%
2 nd grade	Male (n=16)	100%	0.0%	0.0%	0.0%
	Female (n=11)	81.8%	0.0%	9.1%	9.1%
3 rd grade	Male (n=19)	73.7%	10.5%	5.3%	10.5%
	Female (n=18)	83.3%	5.6%	11.1%	0.0%
4 th grade	Male (n=27)	88.9%	7.4%	3.7%	0.0%
	Female (n=22)	95.5%	4.5%	0.0%	0.0%
5 th grade	Male (n=22)	90.9%	0.0%	4.5%	4.5%
	Female (n=33)	81.8%	0.0%	6.1%	12.1%

Two straps or carrying the school bag by both shoulders is distributed evenly and supported by back and abdominal muscles (Zimblre, 2000) as shown in Figure 2.4. When using both straps when carrying a school bag is more stable for the body to support the weight compared to one shoulders (Chiang et al., 2006).

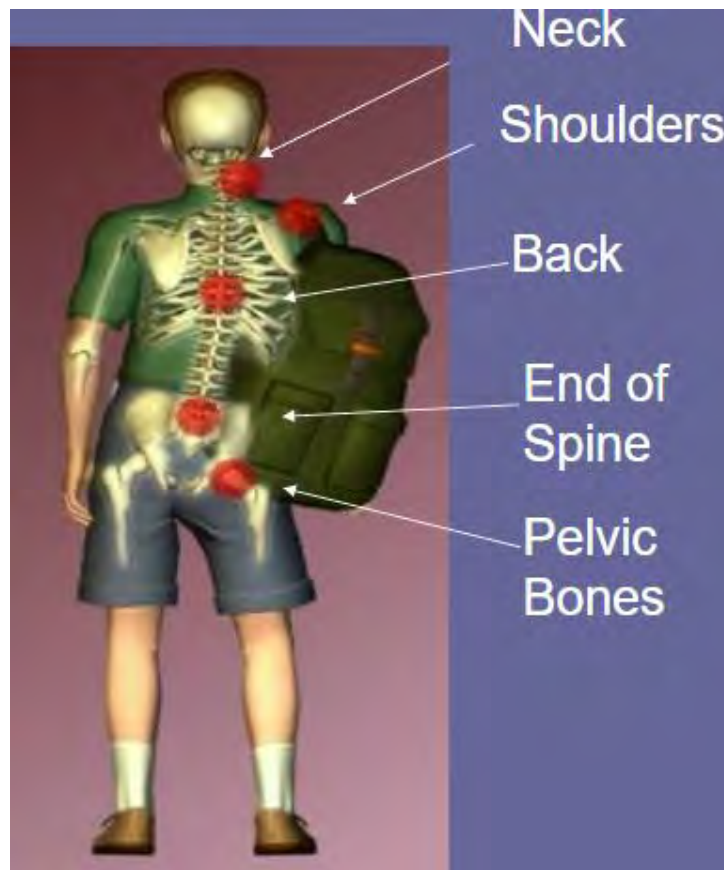


Figure 2.4 : Using one shoulder strap causes pain (Zimblar, 2000)

2.1.4 Duration of carrying school bag

Some of the students carrying school bag while going to classroom and after finish the school. It depends on how far the classroom from the school gate and also the weight of the bag they carry. Sometimes when the students finish school they wait for long durations before their parents or school bus come. It can be one of the factors to get the musculoskeletal symptoms (Mwaka et al., 2014).

From the previous studies have concluded that if the school children spent less time carrying a school bag it shows that the number of students complaining of low back pain (Chiang et al., 2006). Basically when the students especially the children at very young age is time for them to grow but when they using the bag that is heavy and repetitive load which they carry will give a bad effect to their body.

The weight of school bags carried to and from school has significantly increased as curricula changes and extracurricular activities grow, with students sometimes carrying their school learning materials, sports equipment or other materials simultaneously (Cavallo et al 2002). As the students get into higher grade they have a lot of subject that makes them try to carry a lot of books to school.

2.2 Overview of effects to student carrying heavy school bag

Many expert says that the maximum weight a child should carry is one tenth of their body weight which means 10% from the student body weight. They have studied the occurrence of neck, shoulder and back pain in young adolescents. A questionnaire was answered by 745 adolescents about the complaints of neck, shoulder, back and also about psychosomatic factors. School bags were weighed as well as the height and weight of the children. They concluded that psychosomatic factors appear to be more strongly related to the occurrence of neck, shoulder and back complaints (Mohd Azuan, 2010).

According to Kellis and Emmanouilidou, 2010) showed that younger students at the age six to eight years were almost five more times more likely to carry heavier schoolbags than older students. Similarly, more girls than boys carried heavier bags, and girls were twice more likely to experience fatigue symptoms when carrying schoolbags compared with boys. The mean schoolbag weight was 12.4% of the student's body weight and moderately heavier than that reported for other countries.

2.2.1 Musculoskeletal pain

According to Whitfield (2001) are believed musculoskeletal symptoms because of the carrying heavy school bags. It is become contributory factor to the musculoskeletal pain. Some have reported that carrying a heavy schoolbag contributes to musculoskeletal pain (Sheir-neiss et al., 2003). When the body are exposed to the overload school bag they might resulting to get a musculoskeletal pain.

Most of the children carrying a school bag to school daily and some research has been conducted to discuss a safe load limit for children to carrying their school bags. Back pain is becoming a serious health issue in school aged children due to the increased use of heavy school bags. In a study of 140 high school students (mean age 13.6 years) in New Zealand by (Whittfield et al. 2005).

From the previous study shows that ergonomic risk factors for musculoskeletal pain can be modified using the EHPP, which consists of exercises, demonstrations, and training on ergonomic risk awareness, and that these changes are effective in improving body posture in the school environment reported by Nurul (2009)

2.2.2 Body discomfort

The body discomfort scale is one of the method to determine the symptoms through survey. From the observations among the respondent it will evaluates the range of postural discomfort based on the respondent experience Corlett and Bishop's (1976) as shown in Figure 2.5.