

## **PREVALANCE OF THORACIC BACKPAIN AND HYPERKYPHOSIS BY THE IMPACT OF SCHOOL BAGWEIGHT AMONG CHILDREN IN RURAL AREAS OF COIMBATORE-A SURVEY STUDY**

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### **ABSTRACT**

#### **Background of the Study**

*School children usually use school bags to carry their school materials. Carrying heavy school bags can cause several problems such as musculoskeletal problems, postural variations etc. High and increasing prevalence of back pain in children and adolescent is matter of concern. Regular use of heavy school bags and inappropriate carrying methods can put children at the risk of musculoskeletal pain and changes in body posture. Heavy backpack is one of the important underlying causes and adolescent spine is in critical stage of development in the age group of 10 to 14 years. Traditional school bags place the backpack load closer to the body's center of mass resulting in changes in gait as well as energy expenditure, while carrying such backpacks the body leans in anterior forward direction where it has to balance upper body, head, skull, weight of the backpack and causes alteration in COG and BOS. This study set out to determine the prevalence of thoracic back pain and hyperkyphosis by the impact of school bags weight among school children in rural areas of Coimbatore.*

#### **Methodology**

*The study was survey study and 200 school children were selected based on the selection criteria aged between 10-14 years. The purposive sampling technique was used for the study. School children with back pack weight >10% of their body weight was noted and were assessed with self-marked content of thoracic back pain using Revised Oswestry Thoracic Backpain Disability Questionnaire and hyperkyphosis was measured using Debrunner Kyphometer.*

#### **Result**

*In analysis of Revised Oswestry Thoracic Backpain Disability Questionnaire, the result were found, in total 200 school children 180 were responded to thoracic backpain with 70(38.8%) mild pain, 65(36.1%) moderate pain, 30(16.6%) severe pain and 15(8.3%) complete. Increased kyphotic angle was measured using Debrunner Kyphometer.*

## Conclusion

The study concluded that there was a significant prevalence of thoracic backpain by the impact of school bag weight in school children and it provides insights into future preventive measures and therapeutic strategies for framing treatment goals for thoracic back pain.

**KEYWORDS:** School bags, Thoracic back pain, Hyperkyphosis, Revised Oswestry Thoracic Backpain Disability Questionnaire, Debrunner Kyphometer.

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## Article History

Received: 16 Jun 2024 | Revised: 16 Jun 2024 | Accepted: 25 Jun 2024

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## INTRODUCTION

In present times, school children have to carry heavy schoolbags due to number of books, notebooks and variety of other materials they are required to bring in their school. Heavy school bags can lead to musculoskeletal problems like backache, shoulder pain, wrist and hand pain and spinal deformities among children. <sup>(1)</sup> Carrying backpacks is common practice in children and is prevalent all over the world including India. The adolescent spine is in critical stage of development. Selection of backpacks with unsafe characteristics, wrong method of carrying it and use of heavy backpacks is associated with the musculoskeletal, postural and systemic adverse effects. Most studies endorse the observation of overall increasing incidence of backpain in children and its correlation with increasing weight of backpack. Use of heavy backpack by children especially in this sensitive period of vertebral column growth, may cause possible adverse effects on spine, musculoskeletal system, posture and respiratory system making them prone for development of mobility problems during adulthood. <sup>(2)</sup>

**Upper back pain** is classified as pain or discomfort in the area between your shoulder blades. This type of back pain can be mild or severe. This is because the bones in your upper and middle back are attached to your ribcage and are not as mobile as those in your neck or lower back. <sup>(3,4)</sup> Upper back pain can start slowly and develop over time. Signs and symptoms of upper back pain include pain that is sharp, stabbing, dull, achy, or cramping. Some people also experience muscle spasms or headaches. Upper back pain can sometimes be severe and limit mobility. <sup>(6)</sup>

**Hyper kyphosis** is a therapeutic condition in which an excessive outward curvature of the spine results in an abnormal rounding of the upper back. This condition is also known as hunch back or roundback. Normal angle of kyphosis is 20 to 40 degrees, in which the angle exceeds than 40 degrees is known as Hyper kyphosis. Kyphosis may occur at any age, but common in adolescent age of 10-14 years. <sup>(8,9)</sup>

Adolescent school children using backpacks, in the age group of (11–14) years was selected as it is a critical age group for spine development. Effects of relative weight of backpacks were compared with musculoskeletal symptoms and signs in relation to age and gender. The prevalence of musculoskeletal pain was high in school-going children. In children, carrying higher backpack weight, and a higher percentage of the backpack to bodyweight had a significant association with musculoskeletal pain. Gender, height, body mass index, and backpack weight to body weight >10% had no association with musculoskeletal pain. <sup>(13)</sup>

Combined effects of heavy backpacks, duration carrying the backpack, manipulating and handling of backpack, method of carrying, position of load on the body of students are determinant factors for backpain complaints associated with backpack carriage.

Children with backpack weight >10% of their body weight has higher prevalence of backpain than those with backpack weight <10%. Students who experience a period of accelerated growth and development of skeletal and soft tissue. The spinal structures are thus different from those adults. Children have relatively larger heads and also have higher center of mass about T12 compared to L5-S1 in adults. As growth of spinal structures extend over a longer period of time than the other skeletal tissues incongruities in rate of tissue development can pose a threat to postural integrity. <sup>(16)</sup>

The subjects were instructed to remove their shoes and to stand on the force plate (Bertec Corporation, USA) and the weight was recorded before taking measurements. The subjects were then instructed to stand on the stadiometer and the height in centimeters was noted. From the weight recorded, 5%, 10%, 15%, 20% and 25% of their bodyweight was calculated, which was implemented as their respective backpack loads. The subject was asked to stand erect near a wall with the right lateral side towards the wall to measure the arm length.

## **METHODOLOGY**

**STUDY DESIGN:** The survey study design was used in school childrens of age 10 to 14 years in rural areas, to assess thoracic backpain and hyperkyphosis by revised Oswestry thoracic backpain questionnaire and inclinometer.

**SUBJECTS:** The study was conducted in the government schools in and around Keertham. The children of age 10 to 14 years were selected for this study. The children in rural areas who experience pain over carrying backpack but the ignorance of upper back pain may lead to further complication. The selected age group has the higher prevalence of having upper back pain and it may also lead to affect the growth of spinal vertebra, which may lead to cause thoracic hyperkyphosis. The criteria adopted to include the subjects with thoracic backpain and hyperkyphosis consists of 1) Age between 10 to 14 years 2) Both boys and girls can participate. 3) Children who carry bags in single and both sides 4) Children who are willing to participate in the study.

**METHODS:** The aim and objective of the study was clearly explained to ethical committee of PPG COLLEGE OF PHYSIOTHERAPY, Coimbatore and permission were obtained. Study data was collected in four government school in and around Coimbatore. The gross count of the childrens in age of 10 to 14 is about 200 children, the mean count of childrens based on the selection criteria is 180 children. The subjects were screened based on selection criteria. The Revised Oswestry thoracic pain disability questionnaire was distributed to the subjects and explained about the questionnaire. The Revised Oswestry thoracic pain disability questionnaire consists of ten questions addressing functional activities (10-15) minutes should be given to fill the questionnaire.

Revised Oswestry thoracic pain disability questionnaire (ROTQ) was used to identify the level of disability, stage of patient's acuity status and monitor change over time. The Revised Oswestry thoracic pain disability questionnaire was developed by the Fairbank et al, in 1980. This questionnaire made up of 10 questions based on daily life activities. Depending on the responses the result was analysed. The ROTQ can be used as a questionnaire or as a structured interview. However, significantly higher frequencies of backpain problem were reported when the questionnaire was administered as part of a focused study on backpain issues and work factors than when administered as part of a periodic general health examination. The study was conducted in the government schools in and around Keertham. The children of age 10 to 14

years were selected for this study. The children in rural areas who experience pain over carrying backpack but the ignorance of upper back pain may lead to further complication. The selected age group has the higher prevalence of having upper back pain and it may also lead to affect the growth of spinal vertebra, which may lead to cause thoracic hyperkyphosis.

The weight of the student and backpack were recorded using Digital weighing scale. The students carrying backpack with weight more than 20% of their body weight were noted. The Inclinator was used to measure the kyphosis level of the thoracic spine. If the thoracic spine angle exceeds 15 degrees are also noted.

## DESCRIPTION OF INTERVENTION

### REVISED OSWESTRY THORACIC BACKPAIN DISABILITY QUESTIONNAIRE

The degree to which the dysfunction of the lumbar spine limited the performance of the activities of daily living was determined with the Revised Oswestry Pain Questionnaire<sup>[18,19]</sup>. We used the revised version of the questionnaire as it is the only variant of this instrument which examines the changes in the level of thoracic pain.

### INCLINOMETER

Baseline kyphosis angle was measured using a Inclinator (Proteck AG, Bern, Switzerland), a protractor-like instrument. The ends of the device are placed over the spinous process of C7 superiorly and T12 inferiorly, and the protractor reads the kyphosis angle formed at the crotch of the two arms<sup>(20)</sup>. This measurement of kyphosis angle has excellent reliability and repeatability.

## STATISTICAL ANALYSIS

**Table 1: Shows subjects according to AGE**

AGE	NO. OF STUDENTS	PERCENTAGE
10-11	25	13.8%
11-12	40	22.2%
12-13	50	27.7%
13-14	65	36.1%

This table shows the subjects according to their age and number of students were included was mentioned.

**Table 2: Shows Subjects Distributed According to GENDER**

GENDER	NO. OF SUBJECTS	PERCENTAGE
BOYS	83	46.1%
GIRLS	97	53.8%

The table.2 shows the subject distribution according to gender, number of boys was 83 and girls was 97. The percentage of number of boys was 46.1% and girls was 53.8%.

**Table 3: Shows Subjective Distribution According to AGE, HEIGHT, WEIGHT, BMI**

AGE	HEIGHT	WEIGHT	BMI
10	139 cm	34 kgs	17.5
11	144 cm	37 kgs	18
12	150 cm	40 kgs	18.5
13	157 cm	43kgs	19.4
14	163 cm	48 kgs	20

**Table 3** shows the subjective distribution according to average age, height, weight and BMI. Subjects belongs to age group of 10 years was 139 cm, 34 kgs, 17.5. Subjects belongs to age group of 11 years was 144 cm, 37 kgs and 18. Subjects belongs to age group of 12 years was 150 cm, 40 kgs and 18.5. Subjects belongs to age group of 13 years was 157 cm, 43 kgs and 19.4. subjects belongs to age group of 14 years was 163 cm, 48 kgs and 20 BMI.

**Table 4: Shows a Comparison of Average Weight of Back Packs which should be Carried to School and Weight of Backpacks which is Practicing**

AGE	AVERAGE WEIGHT OF STUDENT	AVERAGE WEIGHT OF BACKPACK STUDENTS SHOULD CARRY (10%)	AVERAGE WEIGHT OF BACKPACK (>15%)
10 - 11	35 KGS	3 - 3.5 kgs	4.8 - 5.2 kgs
11 - 12	38 KGS	3.5 - 3.8 kgs	5.3 - 5.7 kgs
12 - 13	41 KGS	3.8 - 4 kgs	6 - 6.5 kgs
13 - 14	47 KGS	4.5- 4.9 kgs	7 - 7.5 kgs

**Table 4** shows the comparison of average Weight of the backpack, which should be carried to school and the average weight of backpack, which is in practice. The average weight of the subject, average of backpack and actual weight of the backpack carried by the 10-11 years children were 35 kgs, 3- 3.5 kgs and 4.8 - 5,2 kgs. 11-12 years children were 38 kgs, 3.5-3.8 kgs and 5.3 - 5.7kgs. 12-13 years children were 41 kgs, 3.8- 4 kgs and 6 - 6.5 kgs. 13-14 years children were 47 kgs, 4.5- 4.9 kgs and 7-7.5kgs.

**Table 5: shows Number of Participants with Spinal pain During Backpack Carrying**

	MALE	FEMALE	TOTAL
<b>BACKPAIN DUE TO CARRYING BACKPACK (n)</b>	<b>83</b>	<b>97</b>	<b>180</b>
NEVER	18	15	33
ALMOST NEVER	25	27	52
SOMETIMES	15	25	40
OFTEN	10	12	22
ALWAYS	15	18	33

Table 5 shows the number of children with spinal pain during the time of carrying backpack. The number of male, female and total children experience backpain during backpack carrying were 83, 97 and 180. The number of boys, girls and total number of children who never experienced pain on carrying backpack were 18, 15 and 33. The children who experience pain on almost never category were 25, 27 and 52. Children who experience back pain sometimes were 15, 25 and 40. Children who experience backpain in often were 10, 12 and total of 22 children. Children who always experience back pain were 15, 18 and 33.

**Table 6: Shows Hyper Kyphosis in Thoracic Spine is Measured using INCLINOMETER**

TOTAL NO. OF STUDENT (n)	NORMAL RANGE (DEGREES)	PERCENTAGE (%)
80	20	44.44%
70	40	38.88%
30	60	16.66%

Table 6 shows the Hyper kyphosis of thoracic spine is measured using Inclinator. Number of children, normal kyphosis range and percentage. 80 children has 20 degree of kyphotic angle was 44.44%, 70 children has 40 degree of kyphosis angle was 38.33% and 30 children has 60 degree of kyphosis angle was 16.66%.

**Table 7: Shows that UPPER BACK PAIN is Assessed using Revised Oswestry Thoracic Backpain Disability Questionnaire (ROTPQ)**

ROTPQ	NO. OF STUDENT (n)	PERCENTAGE(%)
MILD (10-28%)	60	33.3%
MODERATE (30-48%)	50	27.7%
SEVERE (50-68%)	40	22.2%
COMPLETE (Above 72%)	30	16.6%
TOTAL	180	100

Table 7 shows the subjects response to Revised Oswestry Thoracic Backpain Disability Questionnaire (ROTPQ). The number of subjects and percentage of subjects who experienced mild pain was 60 (33.3%), moderate pain was 50 (27.7%), severe pain was 40 (22.2) and complete backpain was 30 (16.6%). The total number of subjects who experience upper back pain was 180 children.

## DISCUSSIONS

School going children are now supposed to be the real asset of parents and country. Heavy Backpack is nowadays more common in school going students. Carrying heavy backpacks will convert into musculoskeletal pain, either a student complains about pain to their parents or not it is well known. The prevention of back pain and other musculoskeletal injuries is important for student's current well-being and long-term health. However, there are wide variations in prevalence of musculoskeletal symptoms related to use of backpacks. This variation may be due to variations in the constitutional buildup, relative weight of backpack, parental awareness and behavioral practices, differences in schooling pattern and curriculum, differences in books accessories and quality of backpacks. It will help in designing strategies to prevent backpack related musculoskeletal injuries. Children were examined in detail to look for any signs of musculoskeletal discomfort. Traditional school bags place the backpack load closer to the body's centre of mass resulting in changes in gait as well as energy expenditure. While carrying such backpacks the body leans in anterior forward direction where it has to balance upper body, head, skull, weight of the backpack and causes alteration in COG and BOS.

In the following studies, Prevalence of schoolchildren experience upper back pain due to the weight of the schoolbag, while 11.4% experience frequent back pain. Half of the schoolchildren carry the schoolbags weighing more than 10% of the student's own weight and heavy schoolbags are more frequently associated with tiredness and back pain. Back pain associated with weight of the schoolbag occurs more frequently in female students. No association was observed between the method of carrying the schoolbag and back pain. The problem of heavy schoolbags is a global problem, and a number of studies addressed this problem in different countries. The most common health problem related to heavy schoolbags is back pain. Other consequences of heavy schoolbags include bad posture, fatigue, exhaustion, and consequently concentration problems and poor school performance. Moreover, heavy schoolbags can affect the bone growth, cause stress injuries, and shift the center of gravity of a body in the same direction as the load.

**According to the World Health Organization recommendations**, the weight of schoolbags should not exceed 10% of child body mass. Schoolbags with a load exceeding 10% of the body mass increase energy consumption, increase the neck and trunk forward lean, and result in decreased pulmonary volume and increased cardiorespiratory parameters.

Findings showed a significant relationship between backpack weight and prevalence of kyphosis among students. In other words, the prevalence of kyphosis was higher in the students who used heavy backpacks. In recent study the prevalence of kyphosis was 38.7%. Finding were in agreement with studies concluded that non- standard backpack weight increased the prevalence of kyphosis ( $p=0.008$ ). Ilıc concluded that carrying heavy weight cause the postural deformity (33.3%) prevalence of kyphosis which was quite similar to recent study. **According to Rai** stated that carrying a heavy backpack can be a source of back pain and spinal deformity and to prevent this issue, one should reduce the number of items which were of no need for that day such as laptop or any other electronic device, extra books or notepad. Ramprasad stated that backpack weight causes the increase the size and angle of spinal curvature (0.001). **According to Milanese** state that postural angle increases with increase of weight of backpack which was also quite similar to recent study. In recent study all the students had backpack and all students were from public school. No of girls were greater than boys and more students used backpack with regular weight. Barkhordar check the weight and other characteristics of backpack in 783 elementary school students in Yazd-Iran and Half of the schoolchildren carry the schoolbags weighing more than 10% of the student's own weight and heavy schoolbags are more frequently associated with tiredness and back pain. Back pain associated with weight of the schoolbag occurs more frequently in female students. No association was observed between the method of carrying the schoolbag and back pain. The students need help to understand the information in the questionnaire, on average, the interview time and completing questionnaire took approximately fifteen minutes for each student. The weight of the backpack and the weight of the student were measured using Digital Weighing machine. The analysis interprets the weight of the backpack should be 10% of their total body weight. If it exceeds 10%, it is noted for further analyses.

In analyses of Hyperkyphosis, The Inclinator is used, which has essentially a protractor with two arms that are placed on specific body part (Ensrud et al.1997; Huang et al. 2006).it is a non-invasive measurement of sagittal kyphosis angles up to 52 degree. The present study indicates a great knowledge for parents regarding the prevalence of upper back pain and the lifting of heavy schoolbag. This initiative will be further supported by physiotherapists, as specialists in movement and exercise in schools. According to the result it states that upper back pain and hyperkyphosis are increasing rate due to carrying heavy backpack.

## **LIMITATION**

1. The study was survey study
2. This study was done only for school-going children.
3. The study was done only for subjects with age group 10-14 years.
4. The study was done for subjects carrying backpack weight more than 10% of their body weight.
5. This study use a specific tool to assess postural deviation such as Hyper Kyphosis.

## **CONCLUSION**

The study concluded that prevalence of thoracic pain and hyperkyphosis by the impact of school bags weight among school going children in rural areas of Coimbatore and it provides insights into future preventive measures and therapeutic strategies for framing treatment goals for thoracic back pain and hyperkyphosis



## ACKNOWLEDGEMENT

First and foremost, I thank **ALLMIGHTY GOD** for showing me with his divine blessing, enriched love and matchless grace, which gave me inner strength and guidance that carried me throughout my study. I'm deeply indebted to **MY PARENTS**, for their unconditional love, sincere prayers, unstinted support and care without which I would not have accomplished anything. I express my sincere gratefulness to **Dr. L. P. THANGAVELU, M.S., F.R.C.S, Chairman** and **Mrs. SHANTHI THANGAVELU, M.A., Correspondent**, P.P.G group of institutions, Coimbatore, for their encouragement and providing the source for the successful of the study. I express sincere thanks to my **principal Dr. C. SIVA KUMAR M.P.T., MIAP, PhD** who gave me his precious time and with his vast experience helped me to complete this dissertation successfully. To my **VICE- PRINCIPAL Dr. M.PRADEEPA.MPT, MIAP., (PhD)**, I offer my sincere thanks and gratitude. This project would not have completed without her enormous help and worthy experience.

I express my deep sense of indebtedness and heartfelt thanks to my **guide MRS. R. SARANYA MPT, ASSISTANT PROFESSOR** for offering me perceptive inputs and guiding me entirely through the course of my work and without her tired less guidance, support and constant encouragement this project would not have come through. My heartfelt thanks to all **PHYSIOTHERAPY FACULTY** members for their guidance and encouragement for my studies. I Privileged to express my thanks to my dearest friend especially **CONQUERORS** for their marvelous support, help and motivation and encouragement throughout the study, last but not least I also extend my thanks to **PARTICIPANTS** for their willingness and cooperation in this study.

## AUTHORS CONTRIBUTION

I understand my agreement to participation in this study and I am not waiving any of my legal rights. I confirm that **Ms. ABARNA. G / Mrs. SARANYA, MPT , ASSISTANT PROFESSOR** have explained me the purpose of the study, the study procedure and possible risk that I may experience. I have read and understood this concern to participate as a subject in this study.

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