

# Spinal Deformities & School Bags: Role of school bags in developing spinal Deformities in Northern India

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**Abstract – The primary objective of study was to find out the status of spinal deformities among the school children of northern region. The secondary objective of study was to find the impact of school bags on the spinal health of school children in Northern India. The data was collected from two major states namely Punjab and Uttrakhand of Northern India. The total sample size was 1000 school children (525 male & 475 females) in the age range of 10-15 years. The selected spinal deformities were kyphosis and lordosis. The selected deformities were measured by measuring the angles of thoracic curve and lumbar curve with the help of a flexicurve ruler. Anyone who was having 45 or more than 45 degree was kept into the category of spinal deformity. The heaviness of school bag was assessed with the help of a questionnaire asking whether the student finds his/her bag heavy and if yes then how does s/he carries it. The data was analyzed by employing descriptive statistics and chi square test. The level of significance was set at .05. the results of the study revealed 87 percent of the children in northern India are suffering from either of the deformity. The study further revealed that kyphosis was more prevalent in comparison to lordosis deformity. It was also found that 37 percent of the children were having both deformities i.e. Kypho-lordosis. the results of the study further revealed a significant association of heaviness of school bag with the spinal deformity as whole and with occurrences of lordosis. Status of kyphosis was found insignificant with the heaviness of school bag. It has been further revealed that gender has no role play in the incidences of spinal deformities among the school children in Northern India. The results of study have showed significant results at same time it is giving an alarming information for the need of rehabilitative classes.**

**Keywords: Spinal Deformities, Kyphosis, Lordosis and School Bags.**

## INTRODUCTION

Our health is largely dependent on our spinal health. Our spine is basically made up of 33 irregular vertebrae's stacked one over the other. Together they make three major curves. First curve is found in cervical region, named as cervical curve. The second curve can be clearly observed in the upper back region of thoracic region. The third curve is found in the lumbar region of the spine and called as lumbar curve. The spinal cord among the children of developing age and growth are very much vulnerable to have many health issues including deformities. The word deformities here, refers to the deviation of natural curvatures from the spine. Along with different causing factors like the lifestyle, schools have a very keen role to play in developing one's spinal health.

It has been observed and reported that growing children have developed various types of spinal

problems and deformities. A very important causing factor is carrying heavy back packs or school bags. The carriage of heavy weights on both shoulder or on a single side shoulder for almost every day in a week regularly for a prolonged period causes various deformities. The most common spinal deformities among the children are kyphosis and lordosis.

The word Kyphosis is defined by an excessive outward curve of the spine and may cause a deformity of humpback or hunchback. Abnormal kyphosis is more commonly found in the thoracic or thoraco-lumbar (chest area/low back). It can affect the neck too.

Lordosis is defined by an excessive inward curve of the spine. Although it primary affects the lumbar spine, it does occur in the neck too. Patients with excessive lumbar lordosis may appear swayback, the

buttocks more prominent, and in general their posture appears exaggerated.

By keeping the current scenario the present study has been constituted with following purpose

**PURPOSE OF THE STUDY**

The primary purpose of the study was to find out the status and association of spinal deformities among the school children of northern region. The secondary purpose is to find out the association of selected spinal deformities i.e. kyphosis and lordosis with the heaviness of school bag.

**METHODOLOGY**

**Sample:** the data was collected from the two states namely Punjab and Uttarakhand of northern India. The total sample size was 1000 school children (500 from each state) studying from different kinds of schools. All the children were ranging into the age group of 10-15 years.

**Criterion measures. Kyphosis and lordosis** was measured by measuring the spinal curvature. Anyone who is have equal to or more than 45 degree of curvature was kept into the category of kyphosis, lordosis and spinally deformed category.

**Heaviness of school bag** was measured with help of questionnaire. There were two specific questions seeking the info of heaviness in the school bag and the way they are carried on to the shoulders.

**Measurement of Kyphosis**

**Research Instruments:** A flexible ruler (flexicurve) was used to measure the degree of kyphosis.

**Administration of Test:** Each student was asked to come one by one in private ward (with the permission of principal of the concerned school) in the presence of physical education teacher, and remove their shirts off so that the spinous processes of C<sub>7</sub> and T<sub>12</sub> can be marked with a skin marker. The child was asked to inhale and exhale without forcing out the breath. The flexicurve was carefully conformed to the thoracic spine. The span of the spinal curve was noted down by using the flexicurve ruler.

**Converting Raw Scores into Degrees:** The kyphosis angle was calculated with the trigonometric calculation using the following formula:

$$\text{Kyphosis Angle} = 4 \times [\text{arc tan } (2H/L)]$$

Where,  
**H** is the height of the curve (perpendicular to length).  
**L** is the length of the curve.

**Measurement of Lordosis**

**Research Instruments:** A flexible ruler (flexicurve) was used to measure the degree of lordosis.

**Administration of Test:** for measuring lordosis the spinous processes of T<sub>12</sub> and S<sub>2</sub> was marked with a skin marker. The child was asked to inhale and exhale without forcing out the breath. The flexicurve was carefully conformed to the lumbar spine. The span of the spinal curve was noted down to the graph paper by using the flexicurve ruler.

**Converting Raw Scores into Degrees:** The lordosis angle was calculated with the trigonometric calculation using the following formula:

$$\text{Lordotic Angle} = 4 \times [\text{arc tan } (2H/L)]$$

Where,  
**H** is the height of the curve (perpendicular to length).  
**L** is the length of the curve.

**Statistical test employed:** The data was analyzed by descriptive analysis and chi square test. The level of significance was set at .05

**RESULTS AND FINDINGS**

Results of the study revealed that the mean age, height, weight of the selected sample was 12.88±1.08, 152.17±9.67 and 42.42±10.15 respectively. The mean degree of kyphosis and lordosis is 53.37±10.84 and 44.31±11.58 respectively. Table no. 1 gives the aforesaid details.

**Table 1: Descriptive Statistics on all the parameters selected of the sample**

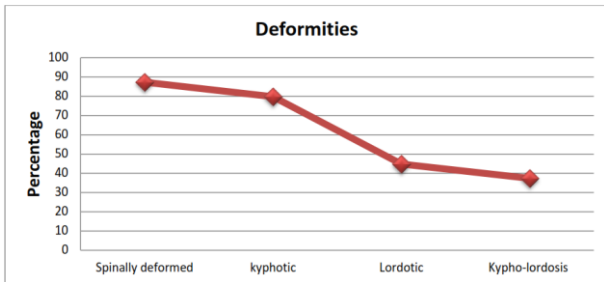
| Parameters                | Mean   | Std. Deviation |
|---------------------------|--------|----------------|
| <i>Age</i>                | 12.88  | 1.08           |
| <i>Height</i>             | 152.17 | 9.67           |
| <i>Weight</i>             | 42.42  | 10.15          |
| <i>Degree of kyphosis</i> | 53.37  | 10.84          |
| <i>Degree of lordosis</i> | 44.31  | 11.58          |

The below given table shows that 87 percent school children are spinally deformed. They are either kyphotic, lordotic or having both deformities.

**Table 2: Frequency and percentage of Selected Spinal deformities**

| Status                   | Frequency | Percent |
|--------------------------|-----------|---------|
| <i>Spinally deformed</i> | 873       | 87.3    |
| <i>kyphotic</i>          | 798       | 79.8    |
| <i>Lordotic</i>          | 448       | 44.8    |
| <i>Kypho-lordosis</i>    | 373       | 37.3    |

The table explains that 79 percent school children were having kyphosis. 44 percent school children were having lordosis as spinal deformities. The results also revealed that approx 37 percent of the children were having both spinal deformities i.e. kypho-lordosis.



**Fig 1: Status of spinal deformities among the children of northern India**

The data was further analyzed to find out the association of heaviness of school bag and the status of spinal deformities among the children of northern India.

**Table3: Chi Square for the data on incidences of Spinal Deformities in relation to its Association with the Heaviness of school bag**

| Status of deformity | Deformed     | Observed | Heaviness of school bag |           | Total              | $\chi^2$ |
|---------------------|--------------|----------|-------------------------|-----------|--------------------|----------|
|                     |              |          | Non heavy               | Non heavy |                    |          |
|                     | Observed     | 246      | 627                     | 873       | 6.660 <sup>a</sup> |          |
|                     |              | Expected | 234.0                   | 639.0     |                    | 873.0    |
|                     | Non deformed | Observed | 22                      | 105       |                    | 127      |
|                     |              | Expected | 34.0                    | 93.0      |                    | 127.0    |
| Total               | Observed     | 268      | 732                     | 1000      |                    |          |
|                     | Expected     | 268.0    | 732.0                   | 1000.0    |                    |          |

$\chi^2_{0.05}(1) = 3.841$ , \*significant at 5% Level

The above table is showing the testing of null hypothesis i.e. there is no association of incidence of spinal deformities with the heaviness of school bag against the research hypothesis that there is a significant association between spinal deformities and heavy school bags. The results of the analysis give the chi square value of 6.660 which is significantly higher than the tabulated value. And hence it can be concluded that there is a significant association between the incidences of spinal deformity with the heaviness of school bag.

**Table 4 : Chi Square for the data on incidences of kyphosis in relation to its Association with the Heaviness of school bag**

| Status of deformity | Kyphotic     | Observed         | Heaviness of school bag |                  | Total              | $\chi^2$ |
|---------------------|--------------|------------------|-------------------------|------------------|--------------------|----------|
|                     |              |                  | Non heavy               | Non heavy        |                    |          |
|                     | Observed     | 221 <sub>a</sub> | 577 <sub>a</sub>        | 798              | 1.610 <sup>a</sup> |          |
|                     |              | Expected         | 213.9                   | 584.1            |                    | 798.0    |
|                     | Non kyphotic | Observed         | 47 <sub>a</sub>         | 155 <sub>a</sub> |                    | 202      |
|                     |              | Expected         | 54.1                    | 147.9            |                    | 202.0    |
| Total               | Observed     | 268              | 732                     | 1000             |                    |          |
|                     | Expected     | 268.0            | 732.0                   | 1000.0           |                    |          |

$\chi^2_{0.05}(1) = 3.841$ , insignificant at 5% Level

The above table is showing the testing of null hypothesis ( $H_0$ ) i.e. there is no association between heaviness of schoolbag and the status of kyphosis among the school children of Northern India against the research hypothesis that there is a significant association between heaviness of schoolbag and the status of kyphosis among the school children of Northern India. Results revealed a significant association, as the calculated chi square ( $\chi^2$ ) is 1.610 which is less than the tabulated value of chi square ( $\chi^2_{0.05}(1) = 3.841$ ).

Thus, it may be concluded that there was a significant association between heaviness of schoolbag and the status of kyphosis among the school children of Northern India. In other words it may be inferred that the heaviness of school bag is not a major causing factor for the incidences of kyphosis in Northern India.

**Table 5 : Chi Square for the data on incidences of lordosis in relation to its Association with the Heaviness of school bag**

| Status of deformity | Lordotic     | Observed         | Heaviness of school bag |                  | Total | $\chi^2$ |
|---------------------|--------------|------------------|-------------------------|------------------|-------|----------|
|                     |              |                  | Non heavy               | Non heavy        |       |          |
|                     | Observed     | 136 <sub>a</sub> | 312 <sub>b</sub>        | 448              | 5.235 |          |
|                     |              | Expected         | 120.1                   | 327.9            |       | 448.0    |
|                     | Non Lordotic | Observed         | 132 <sub>a</sub>        | 420 <sub>b</sub> |       | 552      |
|                     |              | Expected         | 147.9                   | 404.1            |       | 552.0    |
|                     | Total        | Observed         | 268                     | 732              |       | 1000     |
|                     |              | Expected         | 268.0                   | 732.0            |       | 1000.0   |

$\chi^2_{0.05}(1) = 3.841$ , \*significant at 5% Level

The above table is showing the testing of null hypothesis ( $H_0$ ) i.e. there is no association between heaviness of schoolbag and the status of lordosis among the school children of Northern India against the research hypothesis that there is a significant association between heaviness of schoolbag and the status of lordosis among the school children of Northern India. Results revealed a significant association, as the calculated chi square ( $\chi^2$ ) is 5.235 which is significantly higher than the tabulated value of chi square ( $\chi^2_{0.05}(1) = 3.841$ ).

Thus, it may be concluded that there was a significant association between heaviness of schoolbag and the status of kyphosis among the school children of Northern India. In other words it may be inferred that the heaviness of school bag is not a major causing factor for the incidences of kyphosis in Northern India.

**Table 6: Chi Square for the data on incidences of Spinal Deformity in relation to its Association with Gender**

|                     |              | Gender   |        | Total | $\chi^2$ |      |
|---------------------|--------------|----------|--------|-------|----------|------|
|                     |              | Male     | Female |       |          |      |
| Status of deformity | Lordotic     | Observed | 461    | 412   | 873      | .259 |
|                     |              | Expected | 458.3  | 414.7 | 873.0    |      |
|                     | Non Lordotic | Observed | 64     | 63    | 127      |      |
|                     |              | Expected | 66.7   | 60.3  | 127.0    |      |
|                     | Total        | Observed | 525    | 475   | 1000     |      |
|                     |              | Expected | 525.0  | 475.0 | 1000.0   |      |

$\chi^2_{0.05}(1) = 3.841$ , insignificant at 5% Level

The above table is showing the testing of null hypothesis ( $H_0$ ) i.e. there is no association between gender and the status of Spinal Deformities among the school children of Northern India against the research hypothesis that there is a significant association between gender and the status of Spinal Deformities among the school children of Northern India. Results revealed insignificant association, as the calculated chi square ( $\chi^2$ ) is .259 which is lesser than the tabulated value of chi square ( $\chi^2_{0.05}(1) = 3.841$ ).

Thus, it may be concluded that there was no association between the genders and the status of Spinal Deformities among the school children of Northern India. In other words it may be inferred that both the genders are equally vulnerable to the spinal deformities.

## DISCUSSION OF FINDINGS AND CONCLUSION

Results and findings of the study revealed that a spinal deformity is highly prevalent among the school children of northern Region of India. It has been observed that 87 percent of the school children were having either of the selected spinal deformities i.e. Kyphosis or Lordosis. Further the results also revealed that kyphosis is more prevalent deformity in comparison to lordosis as there percentages of incidences were 79 and 49 percent respectively. Results also revealed that 37 percent of the school children in Northern India is having both deformities i.e. kyphosis as well as lordosis. This means 37 percent child were not only having hunch back but at the same time an excessive lumbar arch too.

Next to the descriptive analysis the data was analyzed for finding out the association of spinal deformities with the heaviness of school bag. Results showed a significant association. Thereby it can be concluded that heavy school bags are playing a major role in increasing the incidences of spinal deformities among the school children of northern region in India. Results of the study also revealed that there is no association of kyphosis with the heaviness of school bag that means it can be inferred through this finding that heavy backpacks are not responsible significantly for the incidences of kyphosis. Hence, it opens up the gateway for the other scholar to work upon it and find

out the other causing factors. Further the results revealed a significant association of lordosis with heaviness of school bag. Thereby it can be concluded that heavy school bags are highly responsible in increasing the occurrences of lordosis among the school children of Northern India. It was also found that there is no role play of gender in the incidences of spinal deformities. Thereby it can be concluded that both the genders are equally vulnerable as well suffering from the spinal deformities in Northern India.

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