

Prevalence of Kyphosis in Madhya Pradesh: A Study Seeking the Interaction Effect of Region and Gender on Degree of Kyphosis in Madhya Pradesh

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Abstract – The purpose of the study was to find out that whether the degree of kyphosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender. The next purpose of the study was to find out the interaction effect of region and gender among the school children of Madhya Pradesh. Another purpose of the research was to study the association of gender with the status of kyphosis. A total of 500 school children in the age range of 10-15 were selected from the four districts (Bhind, Bhopal, Morar and Shivpuri) of Madhya Pradesh. Kyphosis was measured by measuring the angles of thoracic curve with the help of a flexicurve ruler. Anyone who was having 45 or more than 45 degree was kept into the category of kyphotic. The data was analyzed by employing descriptive statistics, chi square test and 2×4 way factorial Anova. The level of significance was set at .05.

Results of the study revealed that 58 percent of school children were suffering from kyphosis. It was found that Shivpuri region has the highest percentage of kyphosis followed by Morar. 2×4 way factorial Anova gives a significant p-values for gender, region and the interaction (Gender × Region) effect. Hence, it may be concluded that there is a significant mean difference of degree of kyphosis among the different regions as well as in different genders. It may also be concluded that the interaction of gender and region has significant on the degree of kyphosis. Further, results also revealed significant association between the status of kyphosis and the gender, as the calculated chi square (X^2) is 10.547 is higher than the tabulated value of chi square ($X^2_{0.05}(1) = 3.841$). Thus, it may be concluded that there was a significant association between the genders and the kyphosis among the school children of Madhya Pradesh.

Keywords: kyphosis, two way factorial Anova, flexicurve ruler, Madhya Pradesh

INTRODUCTION

“A good stance and posture reflect a proper state of mind”

The aforesaid statement shows the necessity and validity of the right postures in one's life of productivity and efficiency. Yet very few have the aptitude and habit of maintaining good posture. The upright posture which distinguishes human beings from all other animals is the products of perhaps thirty five billion years of human evolution and civilization. Therefore we all need to know about proper posture, postural problems, its different aspects and role in the various spheres of life. It is the high time when we need to educate our people and make them aware regarding the same.

In fact the word "posture" comes from the Latin word "ponere" which means "to put or place."¹ The general concept of human posture refers to "the carriage of the body as a whole, the attitude of the body, or the position of the limbs (the arms and legs)." It is the position in which we hold our body upright against gravity while standing, sitting or lying down. Good posture is the position which is attained when the joints are not bent or twisted and the spine is aligned. In its most common usage the word *posture* refers to the appearance of the human body in relation to the shape of the spine.

Any deviation from the required/correct/suitable posture for an activity can be termed as postural

¹Poor posture treatment London bridge SE1, Retrieved on 23 June, 2011 from : <http://www.chirolondon.com/posture%20london%20bridge.shtml>

deviations, if these basics postural deviations continued for a longer period of time than the body acquires/adapts that faulty posture, which may be called as postural deformities.

The most popular postural abnormalities include forward head, rounded shoulders, excessive thoracic kyphosis and lumbar Lordosis, and Asymmetrical shoulder heights. The most commonly found deformity is Kyphosis.

Kyphosis is defined by an excessive outward curve of the spine and may cause a deformity such as a humpback or hunchback. Abnormal kyphosis is more commonly found in the thoracic or thoraco-lumbar (chest area/low back), but can affect the neck too. Patients with excessive kyphosis may appear with a pitched-forward appearance.

The spine is made up of three segments. When viewed from the side, these segments form three natural curves. The "c-shaped" curves of the neck (cervical spine) and lower back (lumbar spine) are called lordosis. The "reverse c-shaped" curve of the chest (thoracic spine) is called kyphosis.

Kyphosis affects the sagittal plane, or side view. The thoracic spine should have a gentle rounding behind the shoulders. Normal thoracic kyphosis ranges from 20° to 40° when viewed from the side. If the curvature grows larger than that, the problem of kyphosis initiates.

Kyphosis can vary in severity. In general, greater the curve, severe the condition is. Milder curves may cause mild back pain or no symptoms at all. More severe curves can cause significant spinal deformity and result in a visible hump on the patient's back. Kyphosis can affect patients of all ages. The condition, however, is common during adolescence—a time of rapid bone growth.

The present study has been constituted by keeping the gender and the impact of being into a specific region on the degree of kyphosis. Here comes the purpose of the study.

PURPOSE OF THE STUDY

- The study was constituted with the purpose to find out whether the degree of kyphosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender.
- The next purpose of the study was to find out the interaction effect of region and gender among the school children of Madhya Pradesh.
- Another purpose of the research was to study the association of gender with the status of kyphosis

METHODOLOGY

Sample: the data was collected from four different districts of Madhya Pradesh. The total sample size was 500 school children (125 from each district) studying from different kinds of schools. All the children were ranging into the age group of 10-15 years.

Criterion measures. Kyphosis was measured by measuring the spinal curvature. Anyone who have equal to or more than 45 degree of curvature was kept into the category of kyphotic category.

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 C₇ and T₁₂ 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.

Statistical test employed: The data was analyzed by descriptive analysis, chi square test and two way factorial Anova. The level of significance was set at .05

RESULTS AND FINDINGS

Table 1 shows the mean and standard deviation of degree of kyphosis irrespective of the gender and being into the category of kyphotic. Table also gives the percentage of kyphosis prevalent among the school children of different selected regions/districts of Madhya Pradesh

Table 1: Prevalence of kyphosis among the school children of Madhya Pradesh

Kyphotic/Non Kyphotic	Descriptive Statistics				
	Dependent Variable: degree of kyphosis				
Zonal Region	N	Percent	Mean	Std. Deviation	
NON KYPHOTIC	BHIND	59	47.2	38.82	4.78
	BHOPAL	59	47.2	38.85	4.73
	MORAR	53	42.4	37.53	5.18
	SHIVPURI	38	30.4	40.56	3.89
	TOTAL	209	41.8	38.82	4.80
KYPHOTIC	BHIND	66	52.8	50.75	4.57
	BHOPAL	66	52.8	50.75	4.44
	MORAR	72	57.6	53.40	5.89
	SHIVPURI	87	69.6	52.48	6.09
	TOTAL	291	58.2	51.92	5.46
TOTAL	BHIND	125	25	45.12	7.58
	BHOPAL	125	25	45.13	7.51
	MORAR	125	25	46.67	9.64
	SHIVPURI	125	25	48.86	7.78
	TOTAL	500	100	46.44	8.29

It is clearly visible from the above table that 58 percent of school children in Madhya Pradesh are suffering from kyphosis deformity. The table further reveals that Shivpuri region has the highest percentage of kyphosis followed by Morar and then the Bhopal and Bhind. Below given figure presents the graphical explanations of the above table.

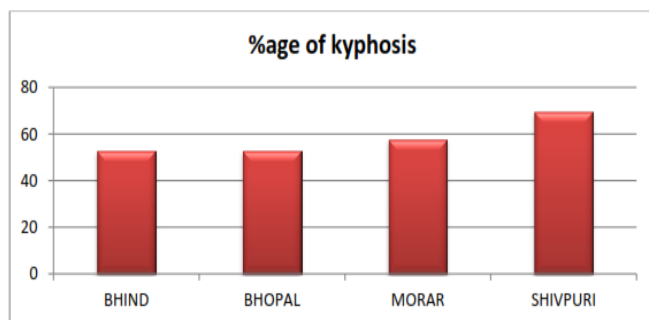


Fig1: Percentage of kyphosis among the different regions of Madhya Pradesh

Table 2: Mean degree of kyphosis among the male female school children of different regions in Madhya Pradesh

Region	Gender	Mean±SD	N
BHIND	Male	43.30±8.52	44
	Female	46.10±6.87	81
	Total	45.17±7.58	125
BHOPAL	Male	48.12±6.20	63
	Female	42.10±7.56	62
	Total	45.13±7.51	125
MORAR	Male	49.13±8.92	79
	Female	42.43±9.45	46
	Total	46.67±9.68	125
SHIVPURI	Male	50.84± 7.43	36
	Female	48.06± 7.81	89
	Total	48.86± 7.78	125
TOTAL	Male	47.96± 8.24	222
	Female	45.23± 8.15	278
	Total	46.45± 8.29	500

Table no. 2 presents the mean and standard deviation of degree of kyphosis among the male and female school children of the different regions of Madhya Pradesh.

To find out whether the degree of kyphosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender, the data was further analyzed with the help of 2×4 way factorial Anova.

Table3: Two way Anova table for the data on degree of kyphosis

Source of Variation	Sum of Squares (SS)	df	Mean Sum of Squares	F	p-value (sig)
Gender	1146.887	1	1146.887	18.629	.000
Region	1506.583	3	502.194	8.157	.000
Interaction (Gender× Region)	1636.460	3	545.487	8.860	.000
Error	30290.430	492	61.566		
Corrected total	34320.270	499			

The p-values for gender, region and the interaction (Gender × Region) in table 3 are less than .05 and hence all the three F- values are significant at 5 % level. Thus the null hypothesis for the gender, region and the interaction (Region× Status of Kyphosis) are rejected at 0.05 level of significance. Thereby it may be concluded that there is a significant mean difference of degree of kyphosis among the different regions as well as in different genders.

Since the F-values was found significant posthoc analysis was done to analyze the gender and region and the interaction analysis

Posthoc analysis for Row (Gender)

For row analysis, critical analysis has been obtained by LSD posthoc Test

$$CD \text{ for row} = t_{.05}(492) \sqrt{2(MSS)E \div nc} \\ = .41$$

Table4: Mean degree of kyphosis for male and female (all four districts of Madhya Pradesh)

Gender		Mean Difference	CD at 5% level
Male	Female		
47.96	45.23	2.73*	.41

*Significant at .05 level

It is clear from the above table that mean difference of male and female is significantly higher than the critical difference. Hence, it can be concluded that the degree of kyphosis among the male school children in

Madhya Pradesh is significantly higher than that of their female counterparts.

Posthoc analysis for column (Region)

For column analysis, CD has been obtained by

$$CD \text{ for row} = t_{.05}(492) \sqrt{2(MSS)E \div nr} = 0.58$$

Table5: Mean degree of kyphosis for different regions (for both genders)

Bhind	Bhopal	Morar	Shivpuri	CD
45.17	45.13			.58
45.17		46.67*		
45.17			48.86*	
	45.13	46.67*		
	45.13		48.86*	
		46.67	48.86*	

*Mean difference is higher than the critical difference

It can be observed from the above table that mean degree of kyphosis is significantly higher than each other in all districts of Madhya Pradesh except the Bhopal and Bhind, irrespective of the gender.

Posthoc analysis for interaction effect (Gender×Region)

$$CD \text{ for interaction effect} = t_{.05}(492) \sqrt{2(MSS)E \div n} = .53$$

Table6: comparison of Mean degree of kyphosis for male and female children in each region

Region	Male	Female	CD
BHIND	43.30	46.10*	.80
BHOPAL	48.12*	42.10	
MORAR	49.13*	42.43	
SHIVPURI	50.84*	42.43	

*Mean difference is higher than the critical difference

The above table shows that mean difference of degree of kyphosis among the male and female school children is significantly higher in male children in comparison to female children in all the regions except the Bhind. The results revealed that the female children in Bhind region is having higher degree of kyphosis than the male children. Thus it can be concluded that mean degree of kyphosis is not equally distributed over to different genders in all the selected regions.

Table7: Comparison of Mean degree of kyphosis among different cities in gender group

Gender	Bhind	Bhopal	Morar	Shivpuri	CD
Male	43.30*	48.12*	49.13*	50.84*	.80
Female	46.10*	42.10	42.43	48.06*	

*Mean difference is higher than the critical difference

The table no.7 shows that among male children the highest degree of kyphosis is found in Shivpuri followed by Morar, then Bhopal and at last the Bhind. Similarly, in case of females the highest degree of kyphosis was found among the children of Bhind region followed Morar and Shivpuri and then the Bhopal. The table further shows that mean difference of Bhopal and Morar in female children is lesser than the critical difference and hence it can be concluded that the degree of kyphosis is equally occurring in both the selected districts of Madhya Pradesh.

The data was again analyzed to find out the relationships of the selected variables with each other.

Table8: Chi Square for the data on incidences of kyphosis in order to find out its Association with Gender

			Gender		Total	χ^2
			Male	Female		
Status of deformity	Kyphotic	Observed	147	144	291	10.547
		Expected	129.2	161.8	291.0	
	Non Kyphotic	Observed	75	134	209	
		Expected	92.8	116.2	209.0	
	Total	Observed	222	278	500	
		Expected	222.0	278.0	500.0	

$\chi^2_{0.05}(1) = 3.841$, 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 kyphosis among the school children of Madhya Pradesh against the research hypothesis that there is a significant association between gender and the status of kyphosis among the school children of Madhya Pradesh. Results revealed significant association, as the calculated chi square (χ^2) is 10.547 is 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 the genders and the kyphosis among the school children of Madhya Pradesh.

DISCUSSION OF FINDINGS AND CONCLUSIONS

The data was analyzed in the light of set purpose. Accordingly the results revealed that 58 percent of school children were suffering from kyphosis. It was found that Shivpuri district was the most affected district by kyphosis followed by Morar, Bhopal and Bhind. 2×4 way factorial Anova gives a significant p-values for gender, region and the interaction (Gender

× Region) effect. Thus, it was concluded that there is a significant mean difference of degree of kyphosis among the different regions as well as in different genders in the school children of Madhya Pradesh. The posthoc analysis for rows (gender) showed a significant mean difference of degree of kyphosis among the male and female school children. It was found that mean difference of male and female is significantly higher than the critical difference. Hence, it was concluded that the degree of kyphosis among the male school children in Madhya Pradesh is significantly higher than that of their female counterparts. It was also observed in the results that mean degree of kyphosis is significantly different from each other in all the selected districts of Madhya Pradesh except the Bhopal and Bhind, irrespective of the gender.

The analysis of interaction effect revealed that degree of kyphosis is significantly higher in male children in comparison to female children in all the regions except the Bhind. The results also showed that the female children in Bhind region are having higher degree of kyphosis than that of the male children. Further it was concluded that mean degree of kyphosis is not equally distributed over to different genders in all the selected regions. The results of further interaction analysis revealed that among male children the highest affected district is Shivpuri followed by Morar, Bhopal and the Bhind. Similarly, in case of females the highest degree of kyphosis was found among the children of Bhind region followed Morar and Shivpuri and then the Bhopal. The table further showed that mean difference of Bhopal and Morar in female children were lesser than the critical difference and hence it can be concluded that the degree of kyphosis is equally occurring in both the selected districts of Madhya Pradesh.

The chi square analysis regarding the association test of status of kyphosis with gender resulted in a significant association with each other as the calculated chi square (χ^2) = 10.547 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 the genders and the kyphosis among the school children of Madhya Pradesh.

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