International Journal of Physical Education and Sports Sciences
Vol. 13, Issue No. 04, July-2018, ISSN 2231-3745

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

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Abstract – The primary purpose of the study was to find out the interaction effect of region and gender the degree of lordosis among the school children of Madhya Pradesh. The secondary purpose of the study was to find out that whether the degree of lordosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender. 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 was selected as the sample for the study. Lordosis 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 lordotic. The data was analyzed by employing descriptive statistics and 2×4 way factorial Anova. The level of significance was set at .05.

Results of the study revealed that 43 percent of school children in different regions of Madhya Pradesh were suffering from lordosis. It was found that Shivpuri region has the highest percentage of lordosis followed by Morar, Bhopal and Bhind. The two way factorial analysis revealed insignificant mean difference of degree of lordosis among the male and female children. Results also revealed a significant mean difference of degree of lordosis among the different regions as well as when the region combines with the gender (interaction). Thus it can conclude that there is a significant effect of interaction on the school children of Madhya Pradesh.

The results showed that mean difference of degree of lordosis among the male school children of Bhind and Morar is significantly higher than the female children. Contrary to this the Bhopal and Shivpuri has the significantly higher mean degree of lordosis among females than male children. Thus it can be concluded that mean degree of lordosis is not equally distributed over to different genders in all the selected regions of Madhya Pradesh.

Keywords: Lordosis, Spinal Deformity, School Children, Two Way Factorial Anova, Madhya Pradesh

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INTRODUCTION

The spine is made of 33 individual bones stacked one on top of the other. This spinal column provides the main support for your body, allowing you to stand upright, bend, and twist, while protecting the spinal cord from injury. Strong muscles and bones, flexible tendons and ligaments, and sensitive nerves contribute to a healthy spine. The normal spine viewed from the side forms a gentle "S" shape. When viewed from the back, the normal spine appears straight. The naturally occurring soft curves of the spine are designed to distribute mechanical stress in the body when at rest and during movement. When the curvature is even slightly abnormal, a person may experience occasional mild or annoying discomfort. If the curve is severely abnormal, the pain is usually severe and accompanied by disability. Abnormal curves are referred to as spinal deformities, and include scoliosis, Lordosis, excess lordosis, and flatback1.

There are different kinds of spinal deformities prevalent among the school children. Lordosis is one of the most prevalent deformities. Lordosis can be

[1] Adolfo Correa , Spinal Curvature retrieved on http://www.boneandjointburden.org/2013-report/medical-burden/iiia2

defined by an excessive inward curve of the lumbar region in 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. Lordosis affects people of all ages but children are more vulnerable to this problem. It affects the lower back, it can cause back pain making movement difficult and painful. Spondylolisthesis, osteoporosis, and even obesity may lead to abnormal lordosis.[2] Another common cause of excess lordosis in the low back excessive sitting, which shortens the muscles in the front of the hips, pulling them forward and creating more curve in the lower back. Anything that pull the hips forward, including excess abdominal weight, can cause swayback.

The children who sit a lot or carrying heavy backpacks followed by wrong lifestyle, poor posture, weak spine can easily be affected by lordosis. Looking at the vulnerability of lordosis among the children the following purpose of the study is as follows.

PURPOSE OF THE STUDY

- To find out whether the degree of lordosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender.
- To find out that whether there is an interaction effect of region and gender on the degree of lordosis among the school children of Madhya Pradesh.

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. Lordosis was measured by measuring the degree of lumbar curvature of the spine. Anyone who had equal to or more than 45 degree of curvature was kept into the category of lordotic category.

Measurement of Lordosis

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

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 L_1 and L5 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 lumbar spine. The span of the spinal curve was noted down by using the flexicurve ruler.

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

Lordotic Angle = 4 X [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 lordosis irrespective of the gender and being into the category of lordotic. Table also gives the percentage of lordosis prevalent among the school children of different selected regions/districts of Madhya Pradesh

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

	Descriptive Statistics				
	Dependent Variable: degree of Lordosis				
Lordotic/non lordotic	Zonal Region	N	Percent	Mean	Std. Deviation
NON LORDOTIC	BHIND	77	61.6	35.31	6.11
	BHOPAL	77	61.6	35.49	6.35
	MORAR	71	56.8	35.25	6.76
	SHIVPURI	58	46.4	35.77	6.19
	TOTAL	283	56.6	35.44	6.33
LORDOTIC	BHIND	48	38.4	54.68	7.09
	BHOPAL	48	38.4	54.70	7.34
	MORAR	54	43.2	56.18	7.80
	SHIVPURI	67	53.6	56.61	10.84
	TOTAL	217	43.4	55.65	8.62
TOTAL	BHIND	125	25	42.75	11.46
	BHOPAL	125	25	42.87	11.54
	MORAR	125	25	44.30	12.65
	SHIVPURI	125	25	46.94	13.75
	TOTAL	500	100	44.21	12.46

It is clearly visible from the above table that approx. 43 percent of school children in Madhya Pradesh are suffering from lordosis deformity. The table further reveals that Shivpuri region has the highest percentage (56.61) of lordosis followed by Morar, Bhopal and Bhind. Below given figure presents the graphical explanations of the above table.

[2] https://www.spineuniverse.com/anatomy/normal-curves-your-spine

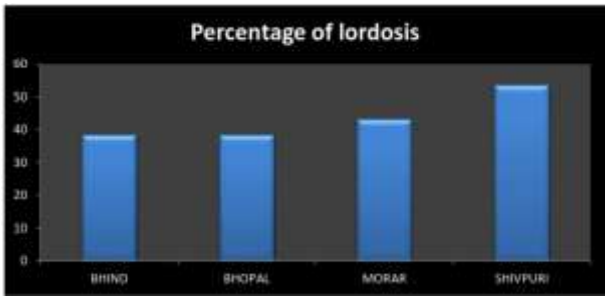

Fig1: Percentage of Lordosis Prevalent among the school children of different regions of Madhya Pradesh.

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

Region	Gender	Mean	SD	N
BHIND	Male	39.01	9.33	44
	Female	44.78	12.04	81
	Total	42.75	11.46	125
BHOPAL	Male	43.72	10.96	63
	Female	41.99	12.13	62
	Total	42.87	11.54	125
MORAR	Male	42.28	11.58	79
	Female	47.75	13.77	46
	Total	44.30	12.65	125
SHIVPURI	Male	48.62	14.44	36
	Female	46.26	13.49	89
	Total	46.94	13.75	125
TOTAL	Male	43.07	11.82	222
	Female	45.12	12.91	278
	Total	44.21	12.47	500

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

To find out whether the degree of lordosis 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 lordosis

Source of Variation	Sum of Squares (SS)	df	Mean Sum of Squares	F	p-value (sig)
Gender	363.694	1	363.694	2.416	.121
Region	1983.271	3	661.090	4.392	.005
Interaction (Gender× Region)	1672.809	3	557.603	3.705	.012
Error	74053.798	492	150.516		
Corrected total	77531.275	499			

The p-values for gender shows an insignificant value of F-ratio and hence it can be said that there is no significant mean differences among the male and female school children in relation to the degree of lordosis. Further the p- values of region and the interaction (Gender × Region) in table 3 are less than .05 and hence these two F- values are significant at 5 % level. Thus the null hypothesis for the region and the interaction (Region× Status of Lordosis) are rejected at 0.05 level of significance. Thereby it may be concluded that there is a significant mean difference of degree of Lordosis among the different regions as well as when the region combines with the gender.

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

Posthoc analysis for column (Region)

For column analysis, CD has been obtained by

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

= 0.91

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

Bhind	Bhopal	Morar	Shivpuri	CD
42.75	42.87			..91
42.75		44.30*		
42.75			46.94*	
	42.87	44.30*		
	42.87		46.94*	
		44.30	46.94*	

*Mean difference is higher than the critical difference

It can be observed from the above table that mean degree of lordosis 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 for interaction effect = $t_{.05}$ (492) $\sqrt{2(MSS)E \div n}$

= 1.28

Table 6: comparison of Mean degree of Lordosis for male and female children in each region

Region	Male	Female	CD
BHIND	39.01	44.78*	1.28
BHOPAL	43.72*	41.99	
MORAR	42.28	47.75*	
SHIVPURI	48.62*	46.26	

*Mean difference is higher than the critical difference

The above table shows that mean difference of degree of lordosis among the male school children of bhind and morar is significantly higher than the female children. Contrary to this finding the same table also gives the Bhopal and Shivpuri the mean degree of lordosis is significantly on higher side among female school children in comparison to male children. Thus it can be concluded that mean degree of lordosis is not equally distributed over to different genders in all the selected regions.

Table7: comparison of Mean degree of lordosis among different cities in gender group

Gender	Bhind	Bhopal	Morar	Shivpuri	CD
Male	39.01	43.72*	42.28*	48.62*	1.28
Female	44.78*	41.99	47.75*	46.26*	

*Mean difference is higher than the critical difference

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

DISCUSSION OF FINDINGS OF CONCLUSION

The data was analyzed in order to the prevalence of lordosis among the children of Madhya Pradesh. results of the study revealed approx. 43 percent of school children in Madhya Pradesh are suffering from lordosis deformity. The table further reveals that Shivpuri region has the highest percentage of lordosis followed by Morar, Bhopal and Bhind. The data was further analyzed to find out whether the degree of lordosis is equal in all the selected regions of Madhya Pradesh irrespective of the different gender, the results revealed that degree of lordosis is equally distributed over the different genders. The results further revealed that degree of lordosis is not equally distributed among the different selected regions of Madhya Pradesh. The interaction effect was also found to be significant and thereby it was concluded that the combination of gender with the selected regions has significant effect on the degree of lordosis.

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