



Relationship between Age and Lumbosacral Angle (LSA) of Adult Nigerians: A Cross-sectional Study

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: The lumbar angle (LSA), is a key morphometric parameter important in the management of patients with low back disorders.

Aim: The study evaluated the relationship between age and lumbar angle of adult Nigerians.

Methods: Two hundred and twenty-six (226) radiographs (113 males to 113 females) were obtained from Radiology departments of Federal Medical Centre (FMC), Owerri. Inclusion criteria were, lateral radiographs of lumbar region marked above 18 years of ages and only clear X-ray films were used. Using the Ferguson's approach, the lumbar angle was measured. All data obtained were expressed both in descriptive and inferential statistics.

Results: Both male and female categories showed a progressive increase in lumbar angle across age groups, but later decreased in the age group of 60 years and above. The mean lumbar angle of male subjects was 35.74° while that of females was 41.46°. There was a significant difference ($t = 3.16$, $p = 0.002$) between the lumbar angle of male and female

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categories. However, there was a weak, positive correlation between age and lumbosacral angle of males ($r = 0.187$) and females ($r = 0.392$).

Conclusion: The males had a lower mean lumbosacral angle compared to the females. Age was significantly correlated with lumbosacral angle in both sexes.

Keywords: Lumbosacral angle; age; Nigerians.

1. INTRODUCTION

The vertebral column, also called the backbone, is a series of approximately 33 bones called vertebrae, which are separated by intervertebral discs that perform protective, supportive, and axial and movement functions. There are about 23 intervertebral discs in the vertebral column which account for one-quarter of the total length of the backbone and vary from one individual to another. The thoracic and pelvic curvatures are called primary curvatures whereas cervical and lumbar curves are termed secondary curvatures [1].

The most important region in the vertebral column in terms of mobility and weight bearing is the lumbosacral region. It is the key weight-bearing region of the vertebral column [2,3]. Abnormality and pathologies of the lumbar vertebral region contributes to the development of a collection of pathological symptoms such as low back pain [4,5].

The lumbar lordotic curve is the anterior curvature of the lumbar spine in the mid-sagittal plane [6]. One of the major postural analyses of an individual is lumbar lordosis. Lumbar lordosis is defined to be the inwardly concave curvature which extends from the first lumbar vertebrae to the fifth lumbar vertebrae, formed majorly by the wedging of the intervertebral discs of each of these vertebrae and counters the forward inclination of the sacrum and thus restores the upward inclination of the spinal column [7].

Of all these methods, radiography remains the gold standard and lordotic measurement can accurately be measured in a supine lateral lumbosacral spine radiograph [8]. The lumbosacral angle (LSA), one of the clinically important radiographic angles related to this curve, and frequently measured by the Ferguson's technique is important in the management of patients with low back disorders because it may be affected by disorders such as inflammation, and degeneration [9,10].

Various study data on lumbosacral angle (LSA) available suggest differences with respect to

sexual dimorphism, racial or ethnic populations [11-14]. Few studies have examined the effects of body type and size on LSA [15,16]. However, there is no consensus of opinion on the significance of either a decreased or an increased LSA with age. Madufuro et al. [17] concluded that lumbosacral angle does not increase significantly after the age 36–40 years. There is need to update current knowledge on the relationship between age and LSA of adult Nigerians, hence this study.

2. MATERIALS AND METHODS

This study was retrospective and non-interventional. The information was gathered from lumbosacral radiographs as well as a sample of anthropometric and demographic information from x-ray films in the Radiology department of Federal Medical Centre (FMC), Owerri. The clinical research and ethics committees of this hospital granted approval for the study's execution. As part of the study inclusion criteria, only lateral radiographs of lumbosacral region marked above 18 years of ages and clear x-ray films were used. Exclusion criteria included x-ray films with any macro trauma to the low back region, x-ray films with a clinically or radiographically detectable scoliosis and/or kyphosis of the lumbar spine and x-rays films with any spinal surgery or instrumentation.

In order to measure the Lumbosacral Angle/Ferguson's angle, the Ferguson's approach was employed in this study since it is the most often used technique for calculating this angle. It is calculated from the lumbosacral spine's lateral projection using the following procedure:

- Draw a line parallel to the sacral base, plane of the lumbosacral joint (AB)
- Draw another plane horizontal to the sacral base (AC) as part of Ferguson's approach for calculating the lumbosacral angle
- Measure the angle created between the horizontal plane and the plane parallel to the sacral base.

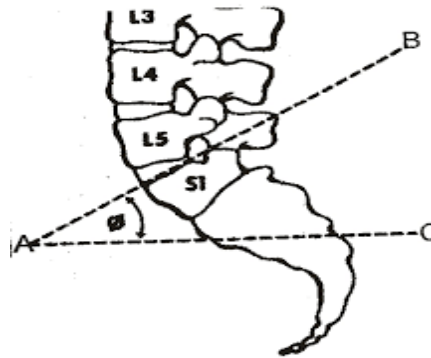


Fig. 1. Ferguson's Method of measuring LumboSacral Angle [18]

Data were analyzed using Statistical Package for social Sciences (SPSS) version 23.0. Both descriptive and inferential statistics were applied. The means of LSA for both male and female categories in line with their respective age groups were expressed in form of tables. Significant differences between male and female LSA were done using Independent Samples t-test, and correlation between age and LSA for both sexes were performed using Pearson's correlation. Level of significance was set at 0.05.

3. RESULTS

The data of two hundred and twenty-six (226) radiographs comprising of one hundred and thirteen (113) radiographs each for males and females, which met the inclusion criteria were analysed. For the male category as shown in Table 1, the mean LSA for age group (<31 years)

was $23.09 \pm 11.21^\circ$, mean LSA for age group (31 – 40 years) was $34.29 \pm 9.02^\circ$, mean LSA for age group (41 – 50 years) was $36.88 \pm 11.70^\circ$, mean LSA for age group (51 – 60 years) was $41.61 \pm 9.37^\circ$, and mean LSA for age group (> 60 years) was $36.80 \pm 12.34^\circ$. For the female category, the mean LSA for age group (<31 years) was $25.42 \pm 7.26^\circ$, mean LSA for age group (31 – 40 years) was $34.21 \pm 12.81^\circ$, mean LSA for age group (41 – 50 years) was $39.50 \pm 12.28^\circ$, mean LSA for age group (51 – 60 years) was $47.61 \pm 11.71^\circ$, and mean LSA for age group (> 60 years) was $46.09 \pm 11.67^\circ$.

There was a significant difference ($t = 3.16$, $p = 0.002$) between the LSA of male and female categories. However, there was a weak, positive correlation between age and LSA of males ($r = 0.187$) and females ($r = 0.392$).

Table 1. Age-based descriptive statistics for LSA by sex

Age group(years)	Male LSA (°)			Female LSA (°)		
	Mean±SD	SEM	CL (95.0%)	Mean±SD	SEM	CL (95.0%)
< 31	23.09±11.21	2.89	6.21	25.42±7.26	15.00	9.01
31 - 40	34.29±9.02	2.07	4.35	34.21±12.81	2.56	5.29
41 -50	36.88±11.70	2.62	5.48	39.50±12.28	2.51	5.19
51 -60	41.61±9.37	2.42	5.19	47.61±11.71	2.44	5.06
> 60	36.80±12.34	1.86	3.75	46.09±11.67	1.94	3.95
All ages	35.74±12.67	1.19	2.36	41.46±13.27	1.25	2.47

LSA = LumboSacral Angle, SEM = Standard Error of Mean, SD = Standard Deviation, CL = Confidence Level

Table 2. Sexual differences between age and LSA of Nigerians

Parameters	Mean±SD	N	SEM	df	t	p < 0.05	Inference
Age							
Female	53.43±15.30	113	1.44	112	0.82	0.412	Not Significant
Male	51.73±16.42	113	1.55				
LSA							
Female	41.46±13.27	113	1.25	112	3.16	0.002	Significant
Male	35.74±12.67	113	1.19				

LSA = LumboSacral Angle, SEM = Standard Error of Mean, SD = Standard Deviation, df = degree of freedom

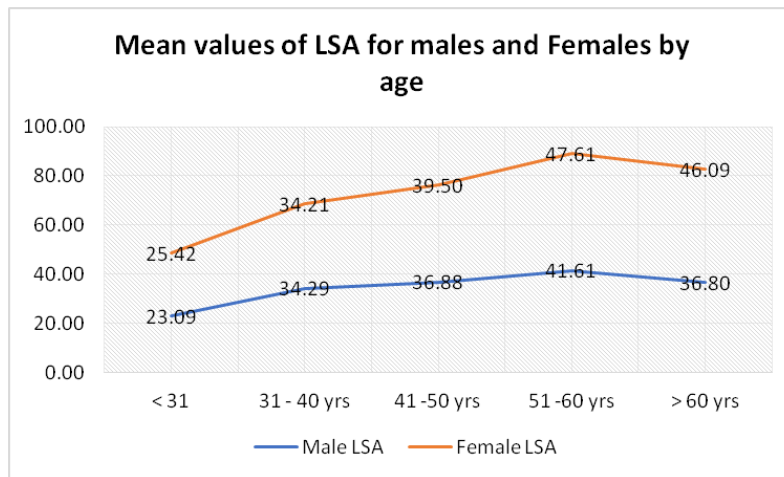


Fig. 2. Mean values of Lumbosacral angles (LSA) for males and females by age

Table 3. Pearson’s correlation between Age and LSA of Nigerians

Parameters		Male		Female	
		Age	LSA	Age	LSA
Age	Pearson Correlation	1	.187*	1	.392**
	Sig. (2-tailed)		0.047		<.001
LSA	Pearson Correlation	.187*	1	.392**	1
	Sig. (2-tailed)	0.047		<.001	

LSA = Lumbosacral Angle

4. DISCUSSION

The present study was done to evaluate the relationship between age and lumbosacral angle (LSA) of adult Nigerians. The mean LSA for age group (<31 years) was 23.09±11.21°, mean LSA for age group (31 – 40 years) was 34.29±9.02°, mean LSA for age group (41 – 50 years) was 36.88±11.70°, mean LSA for age group (51 – 60 years) was 41.61±9.37°, and mean LSA for age group (> 60 years) was 36.80±12.34°. For the female category, the mean LSA for age group (<31 years) was 25.42±35.50°, mean LSA for age group (31 – 40 years) was 34.21±12.81°, mean LSA for age group (41 – 50 years) was 39.50±12.28°, mean LSA for age group (51 – 60 years) was 47.61±11.71°, and mean LSA for age group (> 60 years) was 46.09±11.67°.

In line with a similar study by Maduforo et al. [17], there was a relative increase in LSA with age up to a maximum age group 36-40 years. Okpala [12] also reported from his study that as the age group increased in study population, there was an increase in the LSA until it began to

decrease when the age group was above 65 years of age. Also, earlier research done using a Caucasian population showed that their LSA values varied between 15° and 25° in an erect position and that females have higher values than males [19]. In concordance with this current study, Kalichman et al. [20] concluded there was no difference in the lumbosacral angle between males and females, however, the study found that there was a significant variation between them – which contradicts this current study.

In this study, the mean LSA of male subjects was 35.74° while that of females was 41.46°. These differences were significant and they were in concordance with a study done by Mukherjee et al. [9] which reported that the mean LSA in females were larger compared to that of the study males. In addendum, Agichaniet al. [21] found in their study that the mean LSA was 38.27° (± 8.66) in males and 40.57° (± 7.18) in females. As shown in Table 4, similar studies showed varying LSA values suggesting ethnic and racial differences among the study populations.

Table 4. Comparison of mean LSA of the present study with related literature

Author(s)	Year	Gender	Mean LSA
Okpala [12]	2014	Both	43.38°(males), 45.54°(females)
Agichani et al. [21]	2017	Both	38.27°(males), 40.57°(females)
Naqvi et al. [14]	2020	Both	36°(males), 33°(females)
Mukherjee et al. [9]	2021	Both	37°(males), 45°(females)
Present study	2023	Both	35.74° (males) 41.46° (females)

LSA = Lumbosacral angle

In this present study, there were significant weak, positive correlations between age and LSA ($p < 0.05$) in both male and female subjects. This agrees with a related study done by Wagh et al. [22] which reported significant, weak correlations between age and LSA in both males ($p = 0.0177$) and females ($p = 0.0151$). In another study, a significant relationship was also noticed between age and LSA [23].

5. CONCLUSION

The study concluded that the LSA progressively increased with age across age groups and later decreased at the age group of 60 years and above. The males had a lower mean LSA compared to that of the females. Age was significantly correlated with LSA in both sexes. This study will promote knowledge to the community about what is happening to the vertebral column as individuals age and how it differs between two genders.

6. RECOMMENDATION

In the future, more studies should be carried out to understand the causes of decrease in LSA among people of at least 60 years of age and the sexual differences in LSA values.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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