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Statistical evaluation of effect of anthropometric measurements on adolescent idiopathic scoliosis

O. A. Odetunmibi [1], T. J. Akingbade [1], O. S. Ale [2], G. J. Oghonyon [1], and J. R. Oluwadare [1]

[1] Department of Mathematic, Covenant University, Ota, Ogun State, Nigeria
[2] Department of Statistics, University of Ilorin, Ilorin, Kwara State, Nigeria

(oluwole.odetunmibi@covenantuniversity.edu.ng (0000-0003-1395-579X), toluwalase@covenantuniversity.edu.ng (0000-0002-5920-7394), alegok@gmail.com, godwin.oghonyon@covenantuniversity.edu.ng (0000-0002-8514-3160), julius.oluwadare@covenantuniversity.edu.ng)

Corresponding email: oluwole.odetunmibi@covenantuniversity.edu.ng

Abstract. Scoliosis is a deformity in which there is sideways curvature to the spine. Curves are often S shaped or C shaped. Most common type is the idiopathic type which occurs in 10-12 years of age and early teens, females are more affected than males while the body is growing fast and the curve is commonly to the right side of the body. It however affect all ages of about 3% of general population. This study was set out to evaluate statistically, the effect of age, gender and anthropometric measurements (such as height, weight and body mass index) to the curve formed using 51 patients from Lagos State University Teaching Hospital, Ikeja. It was discovered from the analysis that the ailment is common among females than males. The result also shows that the curve is most common to right hand side. The test of hypothesis conducted reveals that the anthropometric measurements of height, weight and body mass index though positively correlated with but do not have significant effect on the Adolescent Idiopathic Scoliosis curve.

Keywords: Scoliosis, Adolescent, Idiopathic, Anthropometric Measurement.

1. Introduction

Scoliosis is defined by the Scoliosis Research Society as a lateral spinal curve of more than 10 degrees when measured by the Cobb method on a standing radiograph [1] while the American Association of Orthopaedic Surgeons defines it as a lateral spinal curve of 11 degrees or greater [2]. When a rotation of the spine coexists with the deformity, it will be obvious from the front or back (in the sagittal plane) of the body. Normal spine, when viewed from the side should have curves but viewed from the front it should be straight. Scoliosis on plain radiograph posterior-anterior view of the spine is “S” shaped [3].
There are four major classifications of scoliosis and they are: 1) Structural and non-structural, 2) Congenital (as a result of birth vertebral anomalies), 3) Idiopathic (the causes still unknown, some classified as infantile 0-3years, juvenile 3-10 years, adolescent 10-15years or adult late onset) and; 4) Secondary to a primary condition [4]. This may primarily results from diseases called neuromuscular–spinal bifida, cerebral palsy, spinal muscular atrophy, or physical trauma, or complex syndromes such as Chiari malformation and the bone dysplasia [5].

Signs and symptoms include: one side of the spine feels uneven musculature, prominent shoulder caused by rotation of the ribcage in thoracic scoliosis or rib prominence [1, 6]. Uneven hips, arms, or limb length discrepancies and slow nerve action occur in some cases [3]. Most

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cases of scoliosis without complications having reached skeletal maturity are less likely to have a worsening of their deformity. Severe cases of scoliosis usually result in back pain, diminishing lung capacity, pressure on the heart, restricting general physical function, depression as a result of their body image, which makes the natural history of scoliosis being associated with increased morbidity.

Scoliosis is often times related with other connective tissue diseases such as Ehlers-Danlos syndrome, Arachnodactylia-Marfans syndrome and Arthrochalasia (congenital joint laxity).

The bone dysplasia associated with scoliosis include; achondroplasia, ontogenesis imperfecta, Charcot-Marie-Tooth disease, Prader-Willi syndrome, congenital kyphosis. The neuromuscular variety include: familial dysautonomia, muscular dystrophy, spinal muscular atrophy, cerebral palsy, CHARGE syndrome, Friedreich's ataxia, fragile X syndrome [6, 7]. 'Syndromic Scoliosis' refers to the associations with Marfan's and Prader-Willi as a sub classification.

Etiology: It is observed that 65% of scoliosis are idiopathic, 15% are congenital and about 10% are secondary to a neuromuscular disease [8]. The remaining percent are associated with complex syndromes. Idiopathic scoliosis however has been linked to genetics [9, 10]. One gene CHD7, and three microsatellite polymorphisms in the MATN1 gene consisting of 103,101, and 99 base pairs.

Diagnosis is by physical examination followed by radiological, – plain radiograph of the erect spine with bending views. Serials are done in growing children at 6 to 12 months intervals to monitor curve progression. Magnetic resonance imaging (MRI) is used to investigate the extent of involvement of the spinal cord. Genetic studies are still indicated concurrently where the facility is available. [7, 8].

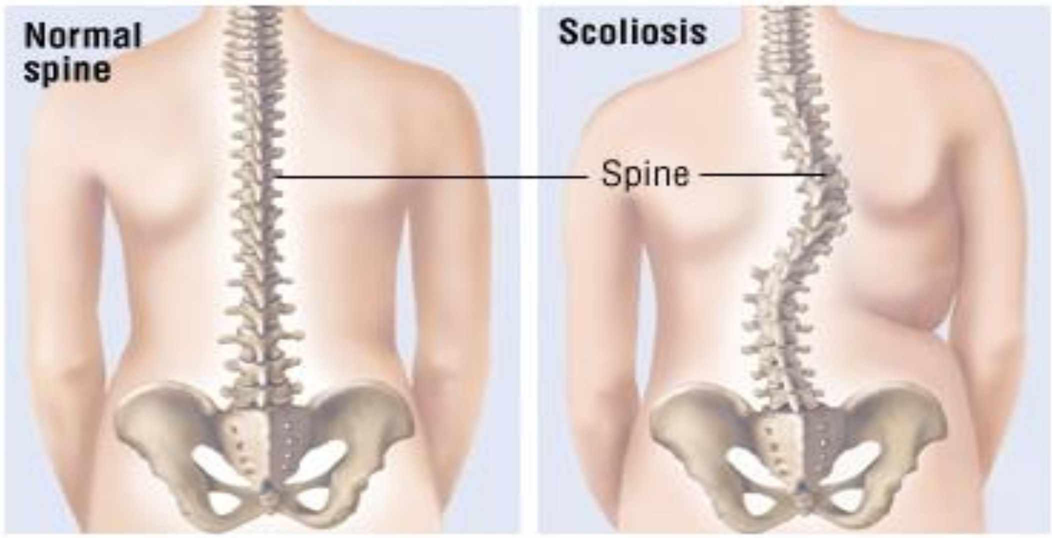

Figure 1: Schematic diagram illustrating normal and scoliosis spine [10]

Management depends on age of onset, degree of curvature, presence of other complicating symptoms and the rate of progression of the curve, which determines conservative or surgical management. Conservative management is done if curve is less than 40 degrees as determined by Cobb's method [1, 9]. Surgery is done when curve is greater than 40 degrees, and when associated with severe pain in the curve, breathing difficulties, progressive deformities and sitting Imbalance [3].

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Scoliosis only manifests at the onset of puberty but is an endpoint of a process which most often times begins in childhood. It gradually progresses with maturity and later presents with preventable consequences including: visible deformation. Incidence of scoliosis is low particularly in the rural areas where there are scanty reports. Idiopathic scoliosis forms 80-85% of all cases of scoliosis and about 3% of general population [8, 11]. AIS is primarily a diagnosis of exclusion. Morbidity and mortality rates resulting from severe scoliosis are not accurately documented in this environment as many cases go unreported. Cardio respiratory compromise can be prevented by screening and monitoring adolescents found to have idiopathic scoliosis [12, 13, 14]. This study aim to investigate the effect of three anthropometric measurements on Idiopathic Scoliosis which in turns augment screening and monitoring of such patients.

2. Material and Methods

For the purpose of this research, fifty one samples were collected from Lagos State University Teaching Hospital.
The variables involved in the data that was collected for this research are: age, gender, curve, body max index, riser and handed of each of the sample point. One of the major outputs expected from the study of this research is the age, gender, curve, riser and handed distribution of our data and this was done through the use of descriptive statistics. Correlation analysis was carried out to examine the relationship that exist between each of the anthropometric measurements (height, weight, and body mass index) and the cure. Test of hypothesis was also carried out using chi-square test of independent to examine whether height, weight and body mass index is independent of curve.
The data collected was analysed using version 25 of SPSS.

3. Results and Discussion

Table 1: Descriptive Statistics of the Variables

	N	Maximum	Minimum	Mean	Std. Deviation
GENDER	51	2.00	1.00	1.0980	.30033
RELIGION	51	2.00	1.00	1.0784	.27152
AGE	51	14.00	10.00	12.7843	1.31626
WEIGHT	51	72.10	26.50	49.4549	8.30273
HEIGHT	51	1.79	1.25	1.6145	.10316
BODY MASS INDEX	51	30.40	11.78	19.0081	3.04954
COBB ANGLE	51	90.00	10.00	39.9412	16.15477
CURVE	51	4.00	1.00	1.9216	.71675

Table 1 gives the descriptive analysis of the data used for this research. The table contains minimum values, maximum values, average values and standard deviation values for all the variables considered for this analysis.

Table 2: Age Distribution

Age	Freq.	Valid Percent	Percent	Cumulative Percent
10.00	5	9.8	9.8	9.8
11.00	2	3.9	3.9	13.7
12.00	14	27.5	27.5	41.2
13.00	8	15.7	15.7	56.9
14.00	22	43.1	43.1	100.0
Total	51	100.0	100.0	

The frequency distribution for age together with its bar chart is presented in table 2 and figure 1. It is discovered that the diseases is common among the age of twelve and fourteen because they account for 87% of the data under considerations.

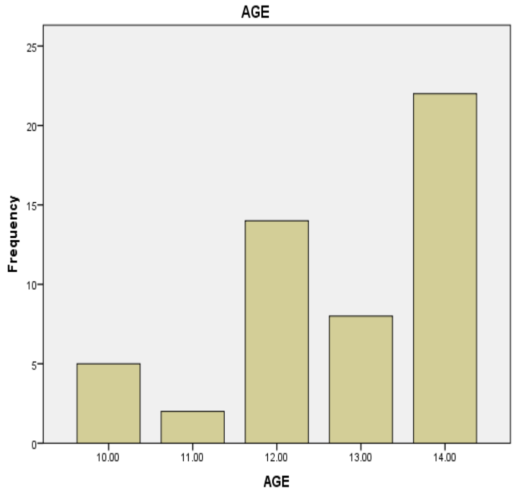

Figure 2: Bar Chart for Age Distribution

Table 3: Gender Distribution

Gender	Freq.	Valid Percent	Percent	Cumulative Percent
F	46	90.2	90.2	90.2
M	5	9.8	9.8	100.0
Total	51	100.0	100.0	

The result for gender distribution is presented in Table 3. The result shows that females are the most affected because it has 90.2% of the data while male is just 5.8%.

Table 4 Curve Distribution

	Frequency	Percent	Valid Percent	Cumulative Percent
RTL	12	23.5	23.5	23.5
RT	34	66.7	66.7	90.2
LTL	2	3.9	3.9	94.1
LT	3	5.9	5.9	100.0
Total	51	100.0	100.0	

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The result of the analysis presented in Table 4 shows that the common curve is RT because the table above gives 66.7% for RT. Bar chart for Curve distribution is presented in Figure 2

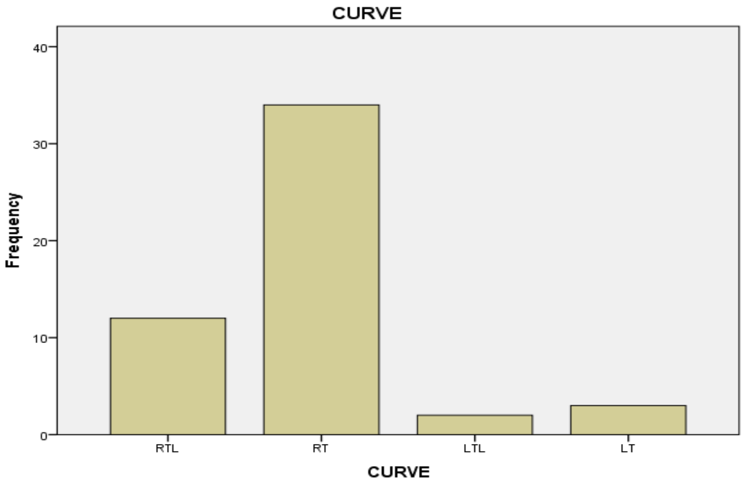

Figure 3: Bar Chart for Curve Distribution

Table 5: Correlation Analysis

		CURVE
WEIGHT	Pearson Correlation	.246
HEIGHT	Pearson Correlation	.287
BODY MASS INDEX	Pearson Correlation	.429

The Table 5 gives the correlation analysis of each of the anthropometric measures with the curve of scoliosis. The result shows that each of the anthropometric measures, which are height, weight and body mass index, are positively correlated with curve of scoliosis with body mass index having highest correlation value (0.429).

4 Test of Hypothesis

In order to carry out a test of hypothesis on the collected data, chi-square test of independence was employed with the null and alternative hypothesis stated below:

H_o: The anthropometric measurements are independent of scoliosis curve
H_a: The anthropometric measurements are not independent of scoliosis curve

Table 6: Chi-Square Tests

	Value	Asymptotic. Sig. (2-sided)
Pearson Chi-Square	1.38	0.86069
Likelihood Ratio	4.309	0.7022

Carrying out test of hypothesis for the data using chi-square method, the result gives chi-square value to be 1.304 and p-value to be 0.86069 as shown in Table 6 above. Since the p-value (0.86069) is greater than 0.05(our significance value), then we can conclude that the test is independent. It means that each of the anthropometric measurements is independent of curve angle

5. Conclusion and Recommendation

The main thrust of this research was to ascertain the anthropometric measurements effect on the scoliosis disease. This was done by collecting data from Lagos State University Teaching Hospital Ikeja. The results obtained were presented and discussed accordingly. Therefore, the results revealed that each of the anthropometric measurements which are height, weight, and body mass index are positively correlated with the curve of the scoliosis. It is also discovered that each of the factor is independent with the scoliosis curve which is in agreement with the findings of [3, 12]

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