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BODY MASS INDEX RELATIONSHIP WITH LUMBAR RADIOGRAPHIC FINDINGS AMONG PATIENTS WITH LOW BACK PAIN IN USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL SOKOTO

Abubakar U[1], Yunusa G. H[2], Nafisa S[1], Adamu Y*[3], Dlama J. Z[3], Yusuf A[4], Dimas J. S[3],Emmanuel C. Nwokorie [5]

[1]Department of Radiography, Faculty of Allied Health Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto Nigeria
[2]Department of Radiology, Faculty of Clinical Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto Nigeria
[3]Department of Medical Radiography, Faculty of Health Sciences, College of Medicine, Federal University of Lafia, Nigeria
[4]Department of Radiology, Abubakar Tafawa Balewa University Teaching Hospital, Bauchi, Nigeria.
[5]Department of Radiography and Radiation Science, Baze University Abuja
*Corresponding author: umar.abubakar5@udusok.edu.n, +2348062847518

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ABSTRACT

Background: Adolphe Quetelet's Body Mass Index (BMI) is linked to obesity, higher mortality rates, and musculoskeletal diseases. Understanding fat-bone relationships could lead to new treatments for osteoporosis and low back pain. Imaging techniques like radiography diagnose low back pain. Low back pain prevalence is increasing, but obesity and body mass index may contribute. No information exists on concurrent findings and correlation between radiographic lumbar findings, body mass index, and chronic low back pain features.

Objective: To investigate the association between body weights, body mass index, age, features and clinical findings in patients with low back pain.
Materials and Method: A prospective study of 91 patients who presented for radiographic examination of the lumbar spine due to low back pain, at Usmanu Danfodiyo University Teaching Hospital Sokoto, was conducted from July to October 2019 Statistical package for social science (SPSS) version 23.0 was used to analyze the data, using Pearson correlation function.
Result: The frequency of males referred for the radiographic examination of the lumbar spine due to low back pain was more than females, 58.1% against (41.9%). For the concluded clinical diagnosis, the highest frequency of pathology for referred patients was spondylosis. There was no significant association and there is negative correlation between BMI and the concluded clinical diagnosis ($p \leq 0.05$).

Conclusion: This result shows that males are referred for radiographic examination of the lumbar spine due to LBP than females.it shows no significant correlation and there is negative association between BMI and the concluded clinical diagnosis made. The occupational contribution was also noted.

Background

The body mass index (BMI), also called the Quetelet index, is determined by a person's height and weight. Adolphe Quetelet, a Belgian polymath, developed it between 1830 and 1850 as part of his work on "social physics" [1]. This can be helpful as a rough method of calculating body fat percentage.

There are more deaths associated with obesity and overweight than underweight. Raised BMI is a key Risk factor for musculoskeletal illnesses specifically osteoarthritis, a profoundly disabling degenerative disease of the joints [2]. Being overweight or obese can greatly contribute to symptoms linked with osteoporosis, osteoarthritis, rheumatoid arthritis, degenerative disc disease, spinal stenosis, and spondylolisthesis.

The relationship between fat and bone can be explained by a variety of mechanisms, such as the impact of soft tissue mass on skeletal loading, the correlation between fat mass and the release of hormones that promote bone formation, such as leptin and estrogens, from adipocytes and pancreatic beta cells [3]. Novel approaches for treating osteoporosis and low back pain may be made possible by a better understanding of this aspect of bone biology [2].

Eighty percent of people will have low back pain, also known as lumbago, at some point in their life. It can be brought on by a variety of conditions, including mechanical, infectious, psychological, and inflammatory ones. According to Casazza (2012), most cases of low back pain are classified as non-specific low back pain since they lack a clear etiology [4]. It is thought to be caused by benign musculoskeletal issues such sprains or strains of the muscles or soft tissues. In many developed nations, including Nigeria, this prevalent ailment has been characterized as a major health concern [5]. Takeyachi and his team in 2003 discovered that low back discomfort severely impairs a person's quality of life by reducing their ability to perform labor-intensive and professional tasks [6].

When the spinal column is loaded, the annulus fibrosus bulges radially and fluid is released from the nucleus pulposus and annulus fibrosus, causing the intervertebral discs to shrink [2, 3]. The two processes cause the spinal column to shorten (also known as spinal shrinkage) and the height of the discs to decrease. According to Oishi et al. (2003), spinal shrinkage reduces the spine's capacity to absorb and transmit stresses, which puts an unnatural or increased strain on the spine's other components, such as the facet joints and spinal ligaments. This has a role in the onset of low back discomfort [7].

Consequently, the lumbar spine, which forms the lower back, is one area of the spine that is most susceptible to the consequences of obesity [3]. This can lead to an increased curvature of the low back and pain in other areas of the spine, such as the neck [8].

Imaging techniques used in the investigation of low back pain (LBP) include radiography, computed tomography (CT), magnetic resonance imaging (MRI), myelography, and radionuclide imaging [3, 5]. In certain centers, radiologists are typically the ones who conduct more invasive techniques such epidural venography, vertebroplasty, discography, laser disk decompression, percutaneous nerve root blockage, and percutaneous injection of the facet joints. Patients with mechanical and neurogenic lower back pain frequently have plain radiographs ordered [4, 7].

The identification of the underlying cause of low back pain has become easier with the use of contemporary neuroimaging techniques like CT and MRI [4, 6]. Since they are highly expensive, most communities do not have access to these imaging modalities. Radiography is therefore typically used for the least initial evaluation of lower back pain by doctors. Since there may be a connection between the findings and the patient's features, it is crucial to critically assess patients who present with LBP [5, 6].

Despite the increased prevalence of low back pain, there is still a discussion about whether low back pain can be attributed to obesity or an increased body mass index [9]. No information on concurrent findings in low back pain patients and body mass index in Usmanu Danfodiyo University Teaching Hospital Sokoto. It has not been determined if there might be correlation between radiographic lumbar findings, body mass index, and features of patients with chronic low back pain in UDUTH Sokoto, and hence the need for this study.

Materials and Methods

This is a cross-sectional study and the data was obtained from radiology department UDUTH, Sokoto, from July to October 2019. 91 patients were recruited, all patients that came with x-ray request with indication of low back pain during the study period were recruited in the study. Non-ambulant adult patients with low back pain referred for lumbo-sacral examination were excluded from the study. In accordance with Helsinki declaration, ethical approval was sorted from the from the Health and research Ethics committee of UDUTHS, Sokoto. Convenience sampling method was used for the study. Taro Yamane's formula was used to calculate the sample size and a minimum of 91 participants were recruited. Digital weighing scale, meter rule, patient's identification form, and reports from radiographs of the recruited patients were used as instrument for the data collection.

The measurement of variables was done by first filling the patient's identification form which includes the patient's age, sex, height, and weight, body mass index. The height was measured using a meter rule, and the weight was measured using a digital weighing scale. The patients stand on the digital weighing scale for weight measurement and the height was taken from the vertex to the feet. The body mass index was calculated from the height and weight variables

$$\mathbf{BMI} = \frac{MASS(kg)}{HEIGHT(m2)}$$

The result obtained was entered and analyzed using statistical package for social science (SPSS) version 23.0.0; Pearson correlation coefficient, frequency tables, charts and percentages based on inferential statistics. The data was grouped based on age, sex, height, weight, body mass index, reports based on different headings.

RESULTS

Out of 74 patients studied, 43 (58.1%) were males and 31(41.9%) were females, showing a higher frequency of patients with low back pain in males than in females.

The study also revealed that the BMI of subjects ranged from 16 to 29 with a higher frequency occurring at the BMI of 21 with 13 subjects (17.6%), followed by 9 respondents (12.2%) who had the BMI of 22,23 and 24 The mean BMI of the respondents resulted to 22.50.

Table 4.1: Age distribution of subjects

Age	Frequency	Percentage
19-28	9	12.2
29-38	20	27.0
39-48	17	23.0
49-58	14	18.9
59-68	9	12.2
69 above	5	6.8
Total	74	100
Mean	**44.46**	
Standard deviation	**13.63**	

As presented Table 4.1:9(12.2) respondent are aged 19 -18 years,20(27.0) respondent are aged 29-38,17(23.0) respondent are aged 39-48,14(18.9) respondent are aged 49-58,9(12.2) respondent are aged 59-68,5(6.8) respondent are aged 69 years and above. The mean age of the respondent is 44.46. years.

Table 4.2: distribution of subjects by sex

Sex	Frequency	Percentage
Male	43	58.1
Female	31	41.9
Total	**74**	**100**

Table4.2 above shows that 58.1 of the respondents are males while 41.1 of the respondents are females.

Table 4.3: Distribution of subjects by weight

Weight (Kg)	Frequency	Percentage
44-56	14	18.9
57-69	44	59.5
70-82	16	21.6
Total	74	100
Mean	62.72	
Standard	9.28	

Table 4.3: shows that 14 (18.9) respondents weigh 44-56kg,44(59.5) respondents weigh57-69kg,16(21.6) respondents weigh 70-82kg.the mean weight of the sample respondent is 62.72kg.

Table 4.4: Distribution of subjects based on height

Height	Frequency	Percentage
Less than 1.40	1	1.4
1.40-1.52	2	2.7
1.53-1.65	29	39.2
1.66-1.78	35	47.3
1.79 above	7	9.5
Total	74	100
Mean	3.76	
Standard deviation	18.05	

Table 4.4:1(1.4) respondents are greater than 1.40,2(2.7) respondents are 1.40m to 1.52m tall,29(39.2) respondents are 1.53m to 1.65m tall,35(47.3) respondents are 1.66m to 1.78m tall, 7(9.5) respondents are 1.79m tall an above. The mean height of the respondent is 3.76m.

Table 4.5: distribution of subject based on BMI

BMI (Kg/m^2)	Frequency		Percentage	Remark
	Male	Female		
16.00	2	1	4.1	Underweight
17.00	3	1	5.4	Underweight
18.00	1	2	4.1	Normal
19.00	3	1	5.4	Normal
20.00	3	3	8.1	Normal
21.00	7	6	17.6	Normal
22.00	7	2	12.2	Normal
23.00	3	6	12.2	Normal
24.00	3	7	12.2	Normal
25.00	5	1	8.1	Normal
26.00	2	0	2.7	Overweight
27.00	1	1	4.1	Overweight
28.00	1	0	1.4	Overweight
29.00	2	0	2.7	Overweight
Total	43	31	100	
Mean	**22.50**			
Standard deviation	**3.04**			

Table 4.8: Findings based on BMI

BMI	Disc prolapse	spondylitis	spondylolysis	leaching	osteophyte	osteoporosis	Reduced density	sclerosis	spondylolisthesis	spondylosis	straightening	normal	Total
16.00	0	0	0	0	0	0	0	0	0	2	1	0	3
17.00	0	0	0	0	0	0	0	0	0	3	1	0	4
18.00	0	1	0	0	0	0	0	0	0	2	0	0	3
19.00	1	0	1	0	0	0	0	0	2	0	0	0	3
20.00	0	2	0	0	0	0	0	0	0	2	0	1	5
21.00	0	0	0	0	0	0	0	1	1	6	2	3	13
22.00	0	0	0	0	1	2	0	0	1	5	0	0	9
23.00	0	2	0	1	1	1	0	1	1	0	0	2	9
24.00	0	0	2	1	0	0	1	0	1	4	0	0	9
25.00	0	0	0	0	0	0	1	0	2	1	1	1	6
26.00	0	0	0	0	0	0	0	0	0	2	0	0	2
27.00	0	0	1	0	0	0	0	0	0	1	1	0	3
28.00	0	0	0	0	0	0	0	0	1	0	0	0	1
29.00	0	0	1	0	0	0	0	0	0	1	0	0	2
Total	1	5	5	2	2	3	2	2	9	29	7	7	74
R	-0.241	-0.210	0.305	0.101	0.000	-0.016	0.203	-0.051	0.086	-0.282	-0.228	-0.068	
P-value	0.407	0.472	0.289	0.730	1.000	0.957	0.487	0.864	0.769	0.329	0.434	0.816	

Table 4.8: As presented in Table 4.8, the major diagnosis occurrence reveals that spondylosis occurs more in respondents with BMI of 21, 22 and 24. With p values < 0.05, BMI does not correlate significantly with any of the concluded clinical diagnosis observed in the sampled respondents (p-values >0.05).

Table 4.9: Findings based on age

Table 4.5: BMI of the respondents ranges from 16 to 29 with a higher frequency of respondent 13(17.60 having BMI of 21, followed by 9(12.2) having BMI of 22,23 and 24.

Table 4.6: Distribution of subjects based on occupation

Occupation	Frequency	Percentage
Business	25	33.8
Civil servant	10	13.5
Farming	20	29.0
House wife	8	10.8
Retired	5	6.8
Student	6	8.1
Total	74	100

Table 4.7: Radiographic Findings

Findings	Frequency	Percentage
Disc prolapse	1	1.4
spondylitis	5	6.8
Spondylolysis	5	6.8
Leaching	2	2.7
Osteophyte	2	2.7
Osteoporosis	3	4.1
Reduced density	2	2.7
Sclerosis	2	2.7
Spondylolisthesis	9	12.2
Spondylosis	29	39.2
Straightening	7	9.5
Normal	7	9.5
Total	74	100

Age	Disc prolapse	spondylitis	spondylolysis	leaching	osteophyte	osteoporosis	Reduced density	sclerosis	spondylolisthesis	spondylosis	Straightening	normal	Total
19-28	0	2	1	0	0	0	0	0	2	3	1	0	9
29-38	0	2	0	1	1	0	1	1	2	9	3	0	20
39-48	1	1	3	0	1	1	0	1	1	5	2	1	17
49-58	0	0	1	1	0	1	0	0	3	6	0	2	14
59-68	0	0	0	0	0	0	1	1	1	4	1	1	9
69 above	0	0	0	0	0	0	0	0	0	2	0	3	5
Total	**1**	**5**	**5**	**2**	**7**	**2**	**3**	**2**	**2**	**9**	**29**	**27**	**74**

Table 4.10: Findings based on Occupation

Occupation	Disc prolapse	spondylitis	spondylolysis	leaching	Osteophyte	Osteoporosis	Reduced density	sclerosis	spondylolisthesis	spondylosis	straightening	normal	Total
business	1	1	0	2	1	1	0	1	3	11	1	3	25
civil servant	0	1	1	0	0	1	0	0	2	2	1	2	10
farming	0	1	4	0	1	1	0	0	3	9	1	0	20
housewife	0	0	0	0	0	0	2	1	0	3	1	1	8
Retired	0	0	0	0	0	0	0	0	0	2	2	1	5
student	0	2	0	0	0	0	0	0	1	2	1	0	6
Total	**1**	**5**	**5**	**2**	**2**	**3**	**2**	**2**	**9**	**29**	**7**	**7**	**74**

As presented in Table 4.10, leaching, normal, spondylolisthesis and spondylosis occur more in respondents that are businessmen/women, spondylolysis occur more in respondents that are farming.

Discussion

This study showed higher frequency of patients with low back pain in male than in female, which is contrary to the observations in a study by Rahman et al. which also showed that low back pain has a strong association with female than male gender [9]. This work disagrees with the strong association shown between low back pain and BMI in his work. In addition, subject selection was randomized and hence no gender was favored against the other.

The study also revealed that the BMI of respondents ranged from 16 to 29 with a higher frequency occurring at the BMI of 21 with 13 respondents (17.6%). The mean BMI of the respondents resulted to 22.50.

Spondylosis had the highest prevalence constituting 39.2% of the abnormalities., It was shown from the result that more respondents with the BMI of 19 experienced disc prolapse.

The study revealed no association between BMI and all the findings and there is negative correlation between BMI and radiographic findings. This is in agreement with the study done by Igbenedion et al which shows that there is no significant correlation between BMI and findings [10]. Likewise, a study done by Ezemagu et al. showed negative correlation between lumbar lordosis and BMI [11]. A study done by Romain et al. also showed that there were no significant differences in severity of spondylosis. According to Ahey et al. there was a significant relationship between lumbar lordosis and body mass index.

This study was not in agreement with the study by Oishi et al. which found increase in osteophyte formation and bone mineral density in the lumbar spine to be influenced by body mass index [7].

Study by Stephan et al, showed an agreement with this study finding, as his findings showed no important influence of BMI on individual radiographic features of the lumbar spine [12].

Reports from the research by Samartzis et al, revealed that an increased extent and severity of disc degeneration was associated with high BMI [13], while this study shows a negative correlation between these two variables. Another finding by Takatalo et al, mentioned a negative correlation between osteophyte and disc space narrowing, presenting different factors affecting the lumbar spine such as gender, smoking, and alcohol consumption on osteophyte formation irrespective of disc space narrowing [14].

In summary, this study shows that there is no correlation between body mass index and the findings on the patient's radiograph.

Conclusion

In this research work, which investigated the relationship between body mass index and the lumbar radiographic findings in patients with low back pain in UDUTH. Using their height and weight to calculate for their body mass index, and the radiologist's reports of their individual radiographs, the findings shows that no significant association between BMI and radiographic findings there is negative correlation between BMI some of the radiographic findings and positive correlation in others, hence implying that the body weight contributed nothing to the clinical diagnosis made. It also revealed that males are more referred to the department for low back pain than females.

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