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# The Effects of Patients BMI on Lumbo Pelvic Parameters in Patients with Chronic Low Back Pain in Jos North Central Nigeria

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**Abstract:** Introduction. The pelvic posture is defined by measurable radiologic parameters which are related to the lumbar and sacral spine. These parameters include, pelvic tilt (PT), lumbar Lordosis (LL), Sacral slope (SS), Pelvic incidence (PI) and the Lumbosacral angle (LSA) The lumbopelvic parameters in the lower back have been noticed to be altered in patients presenting with low back pain. Increased BMI has been found to be a contributing factor in the onset and course of low back pain. Increased weight especially around the trunk affects the dynamics of posturing to maintain sagittal balance. We set out to determine the extent BMI influenced the lumbopelvic parameters in patients presenting with chronic nonspecific low back pain. Methods. This was a prospective cross sectional study. There were three BMI groups; normal weight (BMI19-24.9), overweight (BMI 25-29.9) and obese (BMI>30). All subjects had standing lateral radiographs of the spine. The pelvic parameters; PI, LL PT, SS and LSA, were measured. The mean values and standard deviations of the parameters in each group was determined. Analysis of variance was used to determine differences in means The relationships between all parameters were assessed using Spearman's coefficients and statistically significant correlation coefficients were determined. The level of significance was set at P<0.05 Results. A hundred and forty patients participated in the study. Their ages ranged from 18 to 65years. M:F 1:1.1. 31 (22.1%) of them were of normal weight, 55 (39.3%) of them were overweight, and 54 (38.6%) were obese. None was underweight. The sacral slope was; 34.29±6.29 in the normal weight group, 36.20±5.97 in those overweight and 37.81±5.98 in the obese. (P=0.036). Pelvic incidence was: 51.19±6.35 in the normal weight group, 52.55±7.37 in those overweight and 54.43±9.23 in the obese (P=0.176). Lumbar lordosis was; 40.48±8.16 in the normal weight group, 40.35±8.06 in those overweight and 43.17±10.92 in the obese (P=0.032). The pelvic tilt was; 16.84±5.33 in the normal weight group, 16.29±3.54 in those overweight and 16.61±5.20 in the obese. (P=0.862). The Lumbosacral Angle was 12.74±3.14 in the normal weight group, 13.45±3.79 in those overweight and 12.98±3.55 in the obese. (P=0.634) Conclusion. Increasing BMI had a statistically significant effect on increased lumbar lordosis and sacral slope in patients with chronic low back pain. Pelvic Incidence showed an increase with increasing BMI but was not statistically significant. Pelvic tilt and lumbosacral angle did not show any relationship with BMI.

**Keywords:** BMI, Back Pain, Sacral Slope, Lumbar Lordosis, Pelvic Incidence

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## 1. Introduction

Low back pain is a common disorder affecting a large number of people worldwide. It forms a large proportion of

health care expenditure and its contribution to loss of man hours at the workplace also places additional economic burden on the society. [1-3] There are multiple causes of low back pain and even though low back pain is not a diagnosis

but a symptom, its frequent occurrence and the constellation of pathologies that result in it make this symptom of low back pain a symptom of clinical significance. Low back pain is a fairly common complaint with a life time prevalence reported as high as 50%-80%, [4] and a point prevalence of 11% to 39% worldwide. [2, 5] The one year prevalence has been found to be above 50% in Africa with a fifth of these cases progressing to chronic low back pain which back pain lasting more than three months. [5, 6] Low back pain is a very common musculoskeletal condition and one of the major sources of debility in industrialized countries. [3] Low back pain can be described as specific or nonspecific. [3, 7] Specific low back pain is that attributable to clearly defined pathologies such as, Nerve irritation, infection, tumors, trauma etc. The nonspecific back pain constitute a large majority of low back pain complaints. [7] There is a rising prevalence of back pain from the fourth decade of life and this peaks in the elderly. [8] Low back pain can be very debilitating and can result in a reduction of quality of life and places a burden on care givers, the health care system and the economy at large. The onset and the course of low back pain is affected by multiple factors which can be personal or environmental. These include; occupational posture, Obesity, depression, job dissatisfaction, height, workplace welfare, sedentary lifestyle, stress etc. [1, 6, 9] The sagittal balance of the spine is required to keep the individual in an erect position, place the least mechanical loads on the spine and improve functionality. [10] The pelvic posture is also defined by measurable radiologic parameters which are related to the lumbar and sacral spine. These parameters include, pelvic tilt (PT), lumbar Lordosis (LL), Sacral slope (SS), Pelvic incidence (PI) and the Lumbosacral angle (LSA) The lumbo pelvic parameters in the lower back have been noticed to be altered in patients presenting with low back pain.. Abnormalities in these parameters causes abnormal posturing resulting in increased loading of the discs and other structural elements of the spine, causing greater speed of degeneration, strain on the muscle and ligamentous structures around the spine, all playing significant roles in the onset and course of low back pain. [11] Increased BMI has been found to be a contributing factor in the onset and course of degenerative spine disease and in other forms of low back pain. [1, 12] Increased weight especially around the trunk affects the dynamics of posturing and results in an increase in contact forces around the spinal unit. The alteration in the lumbopelvic parameters determine whether the forces act more on the discs and vertebral bodies (anteriorly) or on the facet joints and ligaments (posteriorly). [13-15]

Obesity is becoming a public health problem worldwide especially in industrialized countries of the west. Other parts of the world where western diets and sedentary lifestyles are becoming more prevalent have begun to experience an upsurge in patients who are overweight or obese. [16-18] The effects of the truncal load on the spine and the subsequent adjustments (compensatory mechanisms) to maintain an erect posture put a load on the intervertebral discs and spine structures, speeding up degeneration of these structures and

resulting in low back pain. [19-21] We set out to determine the changes if any, and to what extent BMI played a role in the lumbopelvic parameters in patients presenting with chronic low back pain in our institution.

## 2. Methodology

This was a prospective cross sectional study carried out at the Jos University Teaching Hospital, Nigeria from April 2018 to March 2019. Patients who presented to the outpatient department with chronic nonspecific low back pain, who were Nigerian and between the age of 18 to 65years, who gave consent to participate were recruited into the study. Patients with identifiable causes of low back pain such as infection, tumors, trauma, spine, hip or lower limb deformities or those who had previous spine surgeries, were excluded from the study. Following a detailed history and thorough clinical examination of patients who met the inclusion criteria, the body mass index was then calculated. (Weight in kilograms divided by height in meters, squared). Thereafter, laboratory investigations were carried out to rule out any infections or tumors. All subjects had standing lateral radiographs of the spine. The radiograph was taken with the subject standing in a comfortable position, knees fully extended, hips in neutral position. RadiAnt DICOM Viewer 4.6.9. Was used to evaluate the images and from which the lumbo pelvic parameters (Pelvic incidence, lumbar lordosis pelvic tilt, sacral slope and lumbo sacral angle) were measured. Data collected from the study was entered into a worksheet and analyzed. The mean values and standard deviations of the parameters in each group was determined. Analysis of variance was used to determine differences in means. The relationships between all parameters were assessed using Spearman's coefficients and statistically significant correlation coefficients were determined. The level of significance was set at  $P < 0.05$ . The statistical analysis was carried out with use of the SPSS for windows program (version 23.0; SPSS Inc., Chicago, Illinois).

## 3. Results

A total of 140 subjects with chronic nonspecific low back pain who satisfied the inclusion criteria were included in the study. The mean duration of low back pain amongst the subjects was  $31.4 \pm 21.9$  months (range: 3 – 144 months). Their ages ranged from 18 to 65 years. 51 (37.1%) of them fell within the age group 51- 60 years. 97 (82%) of the patients assessed were above 40 years. Table 1 The male female ratio was M:F 1:1.1. 31 (22.1%) of them were of normal weight (BMI 19 – 24.9), 55 (39.3%) of them were overweight (BMI 25- 29.9), and 54 (38.6%) were obese (BMI 30 and above). None was underweight. Figure 1 The occupational distribution noticed was; civil servants 36 (25.7%), the farmers 22 (15.7%), traders 16 (11.4%), teachers 15 (10.7%), artisans 13 (9.3%), housewives 11 (7.9%) and others 6 (4.3%). Table 2 The sacral slope was;  $34.29 \pm 6.29$  in the normal weight group,  $36.20 \pm 5.97$  in the overweight

group and  $37.81 \pm 5.98$  in the obese group. ( $P=0.036$ ). Table 3 Pelvic incidence was:  $51.19 \pm 6.35$  in the normal weight group,  $52.55 \pm 7.37$  in the overweight group and  $54.43 \pm 9.23$  in the obese group ( $P=0.176$ ). Table 4 Lumbar lordosis was;  $40.48 \pm 8.16$  in the normal weight group,  $40.35 \pm 8.06$  in the overweight group and  $43.17 \pm 10.92$  in the obese group ( $P=0.032$ ). Table 5 The pelvic tilt was;  $16.84 \pm 5.33$  in the normal weight group,  $16.29 \pm 3.54$  in the overweight group and  $16.61 \pm 5.20$  in the obese group ( $P=0.862$ ). Table 6 The Lumbosacral Angle was  $12.74 \pm 3.14$  in the normal weight group,  $13.45 \pm 3.79$  in the overweight group and  $12.98 \pm 3.55$  in the obese group ( $P=0.634$ ). Table 7.

**Table 1.** Age distribution of the study participants.

Variable	Frequency	Percentage
Age group (years)		
≤30	14	10.0
31-40	11	7.9
41-50	46	32.9
51-60	51	37.1
>60	17	12.1
Total	140	100.0

**Table 2.** Occupational distribution of the study participants.

Variable	Frequency	Percentage
Occupation		
Student	11	7.9
Civil servant	36	25.7
Farmer	22	15.7
Teacher	15	10.7
Artisan	13	9.3
Housewife	11	7.9
Retiree	10	7.1
Business	16	11.4
Others	6	4.3
Total	140	100.0

**Table 3.** Relationship between BMI and Sacral Slope.

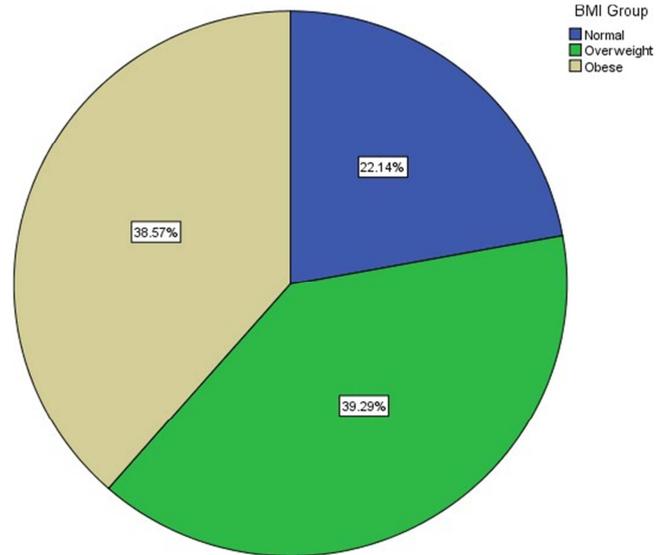
Variable	BMI	(Mean±SD)	F	P
Sacral Slope	Normal	$34.29 \pm 6.29$	3.399	0.036
	Overweight	$36.20 \pm 5.97$		
	Obese	$37.81 \pm 5.98$		
	Total	$36.40 \pm 6.15$		

**Table 4.** Relationship between BMI and Pelvic Incidence.

Variable	BMI	(Mean±SD)	F	P
Pelvic Incidence	Normal	$51.19 \pm 6.35$	1.759	0.176
	Overweight	$52.55 \pm 7.37$		
	Obese	$54.43 \pm 9.23$		
	Total	$52.97 \pm 7.99$		

**Table 5.** Relationship between BMI and Lumbar Lordosis.

Variable	BMI	(Mean±SD)	F	P
Lumbar Lordosis	Normal	$40.48 \pm 8.16$	3.478	0.032
	Overweight	$40.35 \pm 8.06$		
	Obese	$43.17 \pm 10.92$		
	Total	$41.46 \pm 9.32$		



**Figure 1.** BMI distribution.

**Table 6.** Relationship between BMI and Pelvic Tilt.

Variable	BMI	(Mean±SD)	F	P
Pelvic Tilt	Normal	$16.84 \pm 5.33$	0.149	0.862
	Overweight	$16.29 \pm 3.54$		
	Obese	$16.61 \pm 5.20$		
	Total	$16.54 \pm 4.63$		

**Table 7.** Relationship between BMI and Lumbosacral Angle.

Variable	BMI	(Mean±SD)	F	P
Lumbosacral Angle	Normal	$12.74 \pm 3.14$	0.458	0.634
	Overweight	$13.45 \pm 3.79$		
	Obese	$12.98 \pm 3.55$		
	Total	$13.11 \pm 3.55$		

## 4. Discussion

The patients who presented with chronic nonspecific low back pain were noticed to be mostly within the age group 51 to 60 years. Other studies have shown the occurrence of chronic low back pain in advanced age with mean ages of around 70 years. [8, 22]. 37.1% of those with low back pain in this study fell within the age group of 51 to 60 years of age the most commonly occurring age group. Those above 40 years of age made up 82% of the study group. The degenerative processes that result in low back pain occurs over time and thus it is not surprising that the older patients are those manifesting with chronic low back pain. In the younger population, back pain tends to be an acute occurrence with symptoms appearing and disappearing within short periods. Also the younger age group tend to present with specific causes of low back pain. The age range of most of the patients is also associated with the age where most people tend to lead a sedentary life style. They are more highly placed in their work places or may have retired from active jobs and now lead less active lives. Sedentary life style has been implicated as an associated factor in obesity and consequently low back pain. This age group is also when a lot of people tend to put on weight and may become

overweight or obese,[17] which also has been associated with repositioning of the trunk to maintain a balanced position and may result in increased loading of the intervertebral discs and the spinal elements resulting in degeneration of these spinal structures and the resultant occurrence of low back pain in such people. [8, 21, 22] There was a slight female preponderance in our study M:F 1:1.1. Erick PN. *et al* had a female preponderance in their study and showed a positive correlation with female gender and low back pain. [23] Tella BA *et al* in their study on prevalence of low back pain in South west Nigeria, demonstrated a male preponderance.(6). 77.9% of those studied had a BMI of over 25 with 38.6% of the study population being obese (BMI greater than 30). Obesity has been associated with an onset of low back pain and has been shown to alter the course of low back pain, has an adverse effect on patients with low back pain, and affect treatment in patients undergoing non operative or operative treatments for low back pain conditions. [12, 20, 22, 24, 25] Obesity has been noticed to be on the rise worldwide and particularly in the west and in countries who are embracing more westernized diets and whose lifestyles are becoming more sedentary. [17, 18]. Low back pain is among the leading causes of disability adjusted life years (DALYs) in patients with a high BMI. [26]

From the pelvic parameters evaluated, Lumbar lordosis was;  $40.48 \pm 8.16$  in the normal weight group,  $40.35 \pm 8.06$  in the overweight group and  $43.17 \pm 10.92$  in the obese group ( $P=0.032$ ). This showed a statistically significant change between the groups as weight increased. This is similar to other investigators who have noticed an increasing lumbar lordosis with weight increase. [13, 27]. This increase in lumbar lordosis noticed in obese patients with low back pain is believed to be a compensatory adjustment to maintain a balanced posture. Other investigators found a linear relationship of Body adipose index (BAI) with increasing lumbar lordosis. [22] Canbek *et al* in their study had a mean lumbar lordosis of  $48.27 \pm 18.06$ , but found no statistically significant change in lumbar lordosis across various BMI groups. [8] Other studies found a reduced lumbar lordosis with increasing weight. [28] The sacral slope was;  $34.29 \pm 6.29$  in the normal weight group,  $36.20 \pm 5.97$  in the overweight group and  $37.81 \pm 5.98$  in the obese group. ( $P=0.036$ ). There was a steady increase in the sacral slope over the increasing BMI categories that was statistically significant. Other researchers have also found an increasing sacral slope with increasing weight. [27, 29] An increase in sacral slope alters the relationship between the sacrum and lumbar vertebrae and in patients with obesity. This has been related to an increase in spondylolisthesis in such patients. [29] We found the pelvic incidence higher with an increase in the BMI over the various groups but not statistically significant. Pelvic incidence was largely believed to be maintained in an individual over a period and even with other changing parameters. However, some studies have shown that Pelvic Incidence (PI) may change with age, posture or increased body weight. [15, 29] as demonstrated in our findings. The pelvic tilt and the lumbosacral angle did not

show any pattern between the various BMI groups. Onyemachi, NO. *et al* in their study found a significant correlation between BMI and lumbosacral angle. [27] Civil servants and farmers were the commonest professions noted 25.7% and 15.7% respectively. Sedentary life style and the occupational posture of peasant farmers in our environment have all been implicated in the aetiology and course of chronic low back pain. [6, 9]

## 5. Conclusion

Increasing BMI had a statistically significant effect on increasing lumbar lordosis and sacral slope in patients with chronic low back pain in this study. Majority of the patients diagnosed with chronic low back pain in this study were elderly and either overweight or obese.. Even though Pelvic Incidence showed an increase with increasing BMI this change was not significant. Pelvic tilt and lumbosacral angle did not show any relationship with increasing BMI. The findings suggest that increased weight may impact the onset and course of chronic low back pain.

## Declaration of Patient Consent

Consent was sought for and obtained, with the assurances of the identity of the patients being protected.

## Financial Support

No financial support was gotten.

## Conflict of Interest

The authors have no conflict of interest to declare.

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