Relationship Between Pain Intensity and Anthropometric Indices in Women with low back pain –A Cross-Sectional Study.

AO Ojoawo, a* MOB Oloagun, b SO Bamiwoye c

INTRODUCTION

Low back pain (LBP) is a major public health problem all over the world. Most people suffer incapacitating back pain at some stages in their lives. Some had symptoms suggestive of intervertebral disc herniation and others with symptom of osteoarthritis. In Africa, Louw et al.2 reported that the mean LBP point prevalence among the adolescents was 12% and among adults was 32%. The average one year prevalence of LBP among adolescents was 33% and among adults was 50%. The average lifetime prevalence of LBP among the adolescents was 36% and among adults was 62%. Their findings support the global burden of disease of LBP, and suggested that LBP prevalence among Africans is rising and is of concern. More, so Omokhodion3 conducted a survey in South Western part of Nigeria in which nine hundred adults were selected using a multistage sampling technique. It was found that three hundred and sixty one (40% of the population) had low back pain in the last 12 months while (303) 33% had low back pain at the time of the study.

OBJECTIVE: The study aimed to examine the relationship between pain intensity and anthropometric indices in female patients with low back pain.

METHODS: Sixty four women with pain at lumbosacral region participated in the study. Pain caused by trauma, infection and cancer were not included in the study. Weight, height, waist circumference, hip circumference, and skin fold were measured on each patient. The pain intensity of individual patient was also assessed using semantic differential scale. The body mass index (BMI), waist to hip ratio (WHR), body density and percentage body fat were calculated. Pearson’s moment correlation coefficient was computed to know the relationship between the anthropometric indices and pain intensity.

RESULTS: The result revealed that pain intensity had a strong negative correlation with height ($r = -0.665$, $P < 0.01$) and with body density ($r = -0.664$, $p < 0.01$). Pain intensity correlated positively with BMI ($r = 0.545$, $P < 0.01$) and with percent body fat ($r = 0.677$, $P < 0.01$). Hip circumference also correlated with pain intensity ($r = -0.412$, $P < 0.05$). There was also positive correlation between pain intensity and waist circumference ($r = 0.241$, $p < 0.05$).

CONCLUSION: The study concluded that height and body density were inversely related to pain intensity. Percent body fat, BMI and hip circumference also had positive relationship with pain intensity in patients with low back pain.

Key words: Low back pain, Body Mass Index, Waist circumference, skin fold thickness, physical examination.

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ABSTRACT

Low back pain could manifest with any of the following: sclerotomal pain which is the pain from an area of bone and fascia supplied by a single nerve root; radicular pain which is the single nerve root compression that does not produce neurogenic loss.
and radiculopathy which is the pain in the distribution of a single nerve root with neurogenic loss. Other manifestation of low back pain are: dermatomal pain is the pain in the distribution of a single nerve root that innervates a specific area of skin and myotomal pain which is the pain in the distribution of a group of muscle innervates by a single nerve root that may be associated with neurogenic loss.5

Mechanical low back pain (LBP) remains the second most common symptom-related reason for seeing a physician.5 Mechanical low back pain (LBP) exists in every culture and country. Estimates by numerous investigators indicate that at some point in their lives, 80% of all human beings experience LBP.5 For individuals younger than 45 years, mechanical LBP represents the most common cause of disability and is generally associated with a work-related injury. For individuals older than 45 years, mechanical LBP is the third most common cause of disability, and a careful history and physical examination are vital to evaluation, treatment, and management.6 Excessive weight had been found to increases the weight on the spine and pressure on the discs and other structures of the back, this may result in to lumbar disc herniation7 and subsequently pain at the low back.7

Anthropometric measurements include weight, height, waist circumference, hip circumference, BMI, and Skin-fold. Nissinen et al8 found that standing height and sitting height were positively associated with the risk of LBP in boys but these associations were not significant in girls. Some studies9,9 highlighted a weak association between low back pain (LBP) and weight but the findings were in conflict with some other studies9,9 which revealed a strong association while some other studies10,11 did not agree with such an association. Similarly, data on the relationship between body mass index (BMI) and the occurrence of LBP are still conflicting.12,13 Adera14 and Han15 in their separate studies found an association in the development of LBP and BMI.

Examination of patients with low back pain is very important in order to define the anatomic pain generator(s) as specifically as possible. Physiotherapists should be aware that some patient presentations can be "diagnostic traps," leading down an unhelpful treatment path.16 Although the differential diagnosis is extensive, most symptoms have biomechanical causes and resolve promptly with little intervention, although recurrence is common. History and physical examination are important in distinguishing potential causes and identifying "red flags" for more serious conditions.17 The present study was purposed to investigate the relationship between anthropometric variables and pain intensity in women that experienced pain at their lower back among those that reported at OAU Teaching Hospitals complex, Ile Ife, Nigeria.

METHODOLOGY

Subjects
The patients were referred from the orthopaedic clinic of the hospital with symptom of low back pain having been diagnosed to have non traumatic, non-infectious and non-cancerous low back pain of various duration. The name, age, sex marital status of each patient was noted. History of the patient was taking followed by clinical examinations. The findings were in agreement with the diagnosis. The consent of each patient was sought to participate in the study.

A total number of 64 women with pain at their low back volunteered were purposely selected to participate in the study. The pain intensity of all the patients was measured individually by the first author using semantic differential scale.18 The body weight was measured using recalibrated bathroom weighing scale and the height was assessed using calibrated stadiometer and the height was assessed using calibrated stadiometer to the nearest 0.01m. The waist circumference was assessed by using an in extensive tape rule. The subject stood erectly, abdominal muscles were relaxed, arms were at the side and feet were together. The measurer faced the subject and placed an inelastic flexible tape measure around the umbilicus. The measurement was taken at the end of a normal expiration. The patient wore light dress accordingly.19 The hip

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COMPUTATION

The following calculations were made during the data collection:

1. Body Mass Index: 
   \[ \text{BMI} = \frac{\text{Weight}}{\text{Height}^2} \]
   
   It is simple ratio of weight and height square, which reflects the body composition: \(^{21}\)

2. Body density for male:
   \[ 1.112 - 0.00043499X + 0.00000055 (X_1^2) - 0.00028826X_8 \]
   
   Body density for female
   \[ 1.097 - 0.00046971 (X_1) + 0.00000056(X_1^2) - 0.00012828 X_8 \]
   
   \(X_1\) for male \(\Rightarrow\) sum of chest, sub scapular and supra iliac. 
   \(X_1\) for female is sum of triceps, thigh and supra iliac 
   \(X_8\) for male & female is Age \(^{21}\)

3. Percent body fat
   \[ = \frac{495 - 450}{\text{Body Density}} \]

4. Waist–Hip Ratio:
   \[ \frac{\text{Waist Circumference}}{\text{Hip Circumference}} \]

circumference was measured at the point of greatest circumference around the hip or buttocks with the subject standing \(^{19,20}\). The measurer squatted beside the subject to see the maximum extension of the buttocks. The tape was placed in a horizontal plane around the hips at the greatest circumference and the measurement was taken with the tape in close contact with the skin but without indenting the soft tissues, the patients wore light dress. \(^{20}\) The skin fold was measured with Lange skin fold calipers at thigh, supra iliac and triceps according to Jackson & Pollock. \(^{21}\) All the measurement were done in that order by the same person to avoid inter tester error.

ANALYSIS

Descriptive statistics, which include mean and standard deviation, was used to analyze the data. Also Pearson’s moment correlation coefficients was used to assess the relationship between the various anthropometric variables and pain intensity. Statistical Package for Social Science version 14 was used for the analysis, an alpha level of 0.05 was set as level of significant.

RESULTS

Patients in this study were of mechanical pain from lower back between one week and year duration. As reported by the patients, the symptoms were not with radiation to the lower limbs. Some patients with longer duration of pain had been tired of series of medication with little effect. All patients were not presently on medication as at the time of investigation. They were visiting physiotherapy for the first time. The measurements were carried out at the first appointment that patient reported in to the department of physiotherapy.

The physical characteristics of the patients were shown in table 1. The sample comprised of (n=64) sixty four women with primary complaint of low back pain for more than one month duration. All patients presented with uncomplicated low back pain with no radiation to lower limb. However digital pressure to the lower vertebrae especially fourth lumbar vertebrae presented with various degree of tenderness on the patients. The mean age was 52.33 years \(\pm\) 10.24 standard deviation. The mean and standard deviation of height, weight and body mass index were 1.65m \(\pm\) 0.07, 74kg \(\pm\) 13.26, and 27.43kg/m\(^2\) \(\pm\) 5.66 respectively. The mean and standard deviation for waist circumference, hip circumference and waist to hip ratio were 132.17cm \(\pm\) 17.38, 100.75cm \(\pm\) 9.86 and 0.94 \(\pm\) 0.09 respectively. The result of Pearson’s moment correlation coefficient was shown in Table II. Pain intensity had positive and significant correlation with hip circumference \((r=0.412\ P<0.05)\). BMI had
**TABLE I: Physical Characteristics of the Patients n = 64**

<table>
<thead>
<tr>
<th></th>
<th>MEAN</th>
<th>STD DEVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Yrs)</td>
<td>52.33</td>
<td>10.24</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>132.17</td>
<td>17.38</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>74.80</td>
<td>13.26</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>1.78</td>
<td>0.09</td>
</tr>
<tr>
<td>Hip circumference (cm)</td>
<td>100.7</td>
<td>9.86</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.43</td>
<td>5.66</td>
</tr>
<tr>
<td>W/H</td>
<td>0.96</td>
<td>0.09</td>
</tr>
<tr>
<td>% Body Fat</td>
<td>14.51</td>
<td>7.54</td>
</tr>
<tr>
<td>Pain Rating</td>
<td>5.36</td>
<td>1.66</td>
</tr>
</tbody>
</table>

**Key.** BMI = Body Mass Index. W/H = Waist to Hip Ratio, % Body Fat Percent Body Fat.

**TABLE II: CORRELATION COEFFICIENT BETWEEN PAIN INTENSITY AND ANTHROPOMETRIC PARAMETERS N = 64.**

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>HIP cir</th>
<th>W/cir</th>
<th>Weigh</th>
<th>Heigh</th>
<th>BMI</th>
<th>WH</th>
<th>Body /D</th>
<th>%Fat</th>
<th>Pain/Rg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip cir.</td>
<td>0.154</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist cir.</td>
<td>0.119</td>
<td>0.073</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>0.196</td>
<td>0.848**</td>
<td>0.001</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>-0.039</td>
<td>-0.181</td>
<td>-0.173</td>
<td>0.074</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>0.181</td>
<td>0.857**</td>
<td>0.090</td>
<td>0.853*</td>
<td>-0.436*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W/H</td>
<td>0.199</td>
<td>0.250</td>
<td>0.025</td>
<td>0.573**</td>
<td>-0.157</td>
<td>0.585**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body/Density</td>
<td>- 0.187</td>
<td>- 0.624**</td>
<td>- 0.241</td>
<td>- 0.365</td>
<td>0.581</td>
<td>-0.627</td>
<td>**-0.267</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Fat</td>
<td>0.188</td>
<td>0.622**</td>
<td>0.243</td>
<td>0.366</td>
<td>0.582**</td>
<td>0.629**</td>
<td>0.272</td>
<td>-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pain Rating</td>
<td>0.540</td>
<td>0.412*</td>
<td>0.241</td>
<td>0.215</td>
<td>0.665**</td>
<td>0.545**</td>
<td>0.177</td>
<td>-0.664**</td>
<td>0.672**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Key:**

* = Significant at P < 0.05.
** = Significant at P < 0.01

positive significant correlation with pain intensity ($r = 0.545$, $P < 0.01$), but height had negative significant correlation with pain intensity ($r = -0.665$, $P < 0.01$). More so, there was significant positive correlation between pain intensity and percent body fat (PBF) ($r = 0.672$, $P < 0.01$). Pain intensity also correlated weakly with waist circumference ($r = 0.241$, $P < 0.05$) and weight ($r = 0.215$, $P < 0.05$). Height had negative correlation with PBF ($r = 0.582$, $P < 0.01$). There is strong correlation between weight and Hip circumference ($r = 0.848$, $P < 0.001$) weight also correlated with W/H ($r = 0.573$, $P < 0.01$). Hip circumference also correlates with percent body fat ($r = 0.622$, $P < 0.01$).

**DISCUSSION**

Pain in individual is a combination of psychological and social factors which must be included along with the biological variables in order to understand its severity. However, the present study was unable to assess the psychosocial effect on pain intensity of the patients that participated in the study.

The physical characteristic of the patients in this study as shown in table 1 indicated that the mean value of the waist circumference for patients in the study was 132.17 cm. This value was greater than the 88 cm at which females have been shown to have greater health risk. More, so there was a positive significant relationship between waist circumference and pain intensity ($r = 0.241$, $P < 0.05$). Increase abdominal fat measured by waist circumference leads to increase lumbar lordosis and sacrum slant angle which may be one of the reasons for low back pain in elderly obese women. Considering BMI in this study, an average patient was overweight using the BMI category. According to WHO, BMI of more than 25.0 kg/m$^2$ was considered overweight for a female. The mean BMI for patients in the study was 27.43 kg/m$^2$, meaning that and an average patient in this study was overweight. There was also a positive significant relationship ($r = 0.565$, $p < .001$) between BMI and pain intensity. The finding of this study was supported by the work of Koley and Sandhu who found that BMI and percent body fat had significantly positive correlations with the pain measurements in low back pain patients. Guo et al. reported that BMI exceeding 24 kg/m$^2$ or waist to hip ratio exceeding 0.85 might cause overweight, obesity or central obesity. The foundation of the increasing lumbar lordosis and sacrum slant angle might be the one of reasons of low back pain in elderly obese.

The increase in BMI may increase the interdiscal and intradiscal pressure in the vertebral disc of lumbar vertebrae, especially L4 and L5 intervertebral disc. The pressure could then predisposes the disc into prolapse and herniation. For a patient that has low back pain, large BMI may retard the rate of healing because of the weight bearing on the compromising structure. The weak association between weight and pain intensity in this study was in agreement with the studies of Fairbank et al and Mellin who highlighted a weak association between low back pain (LBP) and weight.

With regard to height, the strong relationship between height ($r = 0.665$, $p < .001$) and pain intensity was in agreement the work of Nissinen et al who found that standing height and sitting height were positively associated with the risk of LBP. More, so, Kujala et al reported in their study association between height and low back pain among men. However, Heliovaara et al and Kelsey et al in their separate studies found no association between stature (height) and low back pain among women. The percent body fat for female participants in this study indicated that the mean value was 20.80% ± 6.45. Based on the recommendation of American Council of Exercise, females with percent body fat between 21 to 24 percent are fit and according to Neiman, an optimal level of fatness for females is between 13% to 23% fatness.

The average female participant in this study was within the optimal percent

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body fat and are therefore considered fit. The positive and significant correlation observed between pain intensity and percent body fat in this study was in agreement with the work of Low et al\textsuperscript{2} who found that in postmenopausal women percent body fat has significantly positive correlations with pain intensity ($r=0.668$), personal care ($r=0.519$), lifting ($r=0.620$), walking ($r=0.648$), sitting ($r=0.515$), standing ($r=0.471$), sleeping ($r=0.533$), sex life ($r=0.255$), social life ($r=0.664$) and travelling ($0.583$). One of the causes of low back pain is degenerative change. This may be due to longstanding segmental instability with remodeling of articular processes at affected level.\textsuperscript{31} Excess accumulation of fat will increase the weight of the body and this will promote degeneration, or spondylolysis and spondylolisthesis.\textsuperscript{31} The body density had significant negative correlation with pain intensity ($r=0.664$, $p<0.01$). This indicated that the less the body density the likely more severe the back pain intensity could be. An individual with high body density has large and strong muscles with less fat. This is common among the athletics\textsuperscript{32} The muscles supports the vertebrae and make it less prone to back pain.

The correlation of pain with hip circumference according to the result could be associated to gynoid obesity. Body adiposity (fat) has been classified into two main types: upper body (android) or male type and lower body (gynoid) or (Female) types.\textsuperscript{33} The hip circumference could be a good predictor of gynoid obesity which forms a significant part of generalized body fat. The weight of this may have a significant pulling effect on the functionality of the ligaments of muscle of lower vertebrae (Intertransversarii and Multifidus).\textsuperscript{34} More so, the more the protrusion of gluteii the more the hip circumference and the more the tendency to have excessive lumbar lordosis. This shifted the center of gravity of the body forward which increases the lumbar curvature with consequence stress on the posterior muscles and ligaments of the lower vertebrae. This may result in low back pain.\textsuperscript{35}

**CONCLUSION AND RECOMMENDATION**

From the study, it could be concluded that an average women with pain at low back may be overweight by virtue of BMI, waist circumference and waist to hip ratio. Increase in body adiposity measured by BMI, waist circumference, percent body fat had significant relationship with intensity of pain in women that are experiencing low back pain.

It could then be recommended that the assessment of low back pain patients should include examination of adipose tissue distribution of that patient.

**Limitation of the study:**

The study did not assess the psychosocial factor affecting the pain intensity of patients involved in the study.

**REFERENCES**


ACKNOWLEDGMENTS
None.

CONFLICTS OF INTEREST
None identified or declared.