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An assessment of selected adipose tissue indices in patients with mechanical low back pain

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Abstract. The adipose tissues distribution in patients with low back pain has not been thoroughly investigated. *Aim:* This study was designed to assess the adipose tissue distribution using selected adipose tissue indices in patients with mechanical low back pain (MLBP). *Material and Methods*: Ninety six (96) patients with MLBP participated in this study. The following anthropometric indices were assessed: Body Mass Index (BMI), waist circumference, waist to hip ratio, and skinfold thickness. Data obtained were analysed using descriptive statistics of mean, standard deviation, and percentages. *Results:* The findings revealed that 41.70% of the subjects had grade 1 obesity using BMI as an index while 20.80% had grade 11 obesity and 4.20% had grade 111 obesity. The result also showed that 66.70% of the patients were severely obese using waist to hip ratio index (WHR), 16.67% had mild obesity and 16.67 were moderately obese. Using an index of waist circumference, 54.2% had a high waist circumference while 6 (25.0%) had a moderate waist circumference (WC) and 20.9% were normal. *Conclusion:* The study concluded that most patients with low back pain who participated in this study were obese using BMI, WHR and WC indicating that increase in body fat may influence the prevalence of MLBP.

Key words: *low back pain, Body Mass Index, Waist to Hip Ratio, Waist Circumference*.

Introduction

One of the major public health problems in the world is low back pain. Hans et al (1997) in a cross-sectional study carried out in Netherlands which involved a random sample of 5,887 men and 7,018 women aged 20-60 years (1). They found hat the prevalence of low back pain in men and women in the past 12 months were 46% and 52%, of whom 17% and 21% had low back pain for a total of 12 or more weeks, and 13% and 18% had symptoms suggestive of intervertebral disc herniation. Another study carried out in Africa by Louw et al (2007), revealed that the mean LBP point prevalence among the adolescents was 12% and among adults was 32% (2). 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 supported the global burden of disease of LBP, and suggested that LBP prevalence among Africans is rising and is of concern. More, so in South Western part of Nigeria, Omokhodion (2002) conducted a survey 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 (3).

The possible causes of acute mechanical low back pain is still unknown (4). The pain arises from spontaneous and in many cases there are no anatomical or physical manifestation to indicate the sources of pain. Low back pain arising from physical causes can be mechanically diagnosed particularly if the lesion is periarticular or degenerative . There are likely factors which could be associated with low back pain. The factors that have been explored were in 3 categories: physical, occupational and psychological. The only physical factors that emerged as predictor of the onset of back pain is age, between 35 years and 65 years and a past history of back pain (5). Obesity is a worldwide health problem leading to a range of adverse health consequences (6). Obesity as a causal for low back pain has been controversial with no definite conclusion.

Previous studies on the associations between weight-related factors and LBP have yielded inconsistent findings (7). Some have reported an association between obesity and LBP, (8) but this association has not been confirmed by others (9). The association between obesity and LBP has been reported to be stronger among women than among men (10,11). The mechanisms underlying the association between obesity and LBP are not yet fully known. Obesity may increase the risk of LBP, because of lumbar disc disorders (12, 13,14) through mechanical load. It has been suggested that mechanical load is the principal factor initiating the degenerative process in the lumbar spine (15). Research on body adiposity in relation to mechanical low back pain in Nigeria is scanty.

Material and Method

The patients that participated in this study were referred from the orthopaedic clinic of Obafemi Awolowo University Teaching hospitals. They were presented with symptom of mechanical low back pain having been diagnosed to have non traumatic, non infectious and non cancerous low back pain of at least 3 months 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 96 patients were found suitable for the study. They consist of 52 males and 44 females with age ranged from 35 years to 75 years and mean age of 52.33 years.

*Procedure.*Name, age and sex of each patient was recorded. The body weight was measured using calibrated bathroom scale, each patient stood on the bathroom scale bare footed, the measurement was then taking after adjusting for parallax error. The height of each patient was measured while standing without foot wear with recalibrated height meter to the nearest 0.01m (16). Waist and hip circumferences were measured with an inextensible tape rule according to Bray and Gray (17). The pain intensity was also recorded using Semantic Differential Scale by Olaogun et al (18).

The skin fold was measured with Lange skinfold calliper for male at chest, subscapularis and suprailliac, and for female at thigh, suprailliac and triceps using the procedure of Lee and Neiman (19).

The following were computed (20, 21, 22, 30):

Body Mass Index = weight/ heigh^2 in Kg/m^2

Body Density for male = 1. 112 – 0.0004399X1 + 0.00000055(X1)^2 – 0.0002828X8

Body Density for female = 1.097 – 0.00046971X1 + 0.00000056X1 – 0.00012828X8

X1 for male = sum of chest, subscapularis and suprailliac skin fold.

X1 for female = sum of triceps, thigh and suprailliac skin fold.

X8 = Age.

Percent body fat = (495/body density)- 450.

Waist to hip ratio = waist circumference / Hip circumference.

Data Analysis. Data was analyzed using descriptive statistics and percentages.

Results

Presented in table I is the physical characteristics of the participants. There were 96 patients (52 males, 44 females) that participated in the study. Their age ranged from 35 to 75 years old with the mean age of 52.33± 10.24 years. The means of height, weight and body mass index were 1.65m± 0.07, 74kg ± 13.26, 27.43 ± 5.67 respectively while the means of waist circumference, hip circumference and waist to hip ratio were 132.17 ± 17.38, 100.75cm ± 9.86 and 0.94 ± 0.09 respectively. The result of the study showed that the mean BMI was 27.43% ± 5.67kg/m^2 while the mean waist circumference was 132.17 ± 17.38cm. Also, the means of hip circumference and waist to hip ratio were 100.75 ± 9.86cm and 0.96 ± respectively. Classification of patients according to BMI was presented in table II. The result showed that 40 participants (41.67%) had grade 1 obesity while 20 (20.83%) had grade 2 and 4.1 % had grade 3 obesity while 32 (33.3%) were found to have normal BMI. More so, more male were found in normal category (23) than female (8) but number of female found in grade 11 obesity (16,16.7%) was 4 times more than that of male(4, 4.2%).

Table I. Physical characteristics of subjects (N = 96)

Variables	Combined ±SD	Male ± SD	Female± SD	t	P value
Age/Yrs	53.33±10.24	52.46 ±10.00	52.18±10.00	0.07	0.80
Weight/Kg	74.79±13.26	72.38±1.62	77.63±11.40	6.96	0.56
Height/m	1.65±0.09	1.69±0.08	1.6±0.05	3.34	0.45
BMI/kg/m^2	27.43±5.67	24.92±4.27	30.38±5.85	2.63	0.45
Waist Cir/cm	132.17±17.38	93.38±14.58	100.68±18.39	1.17	0.89
Hip Cir/cm	100.75.±9.86	95.25±9.00	107.27±6.16	3.72	0.36
W/H	0.96±0.09	0.98±0.08	0.93±0.11	1.17	0.93

Table II. Classification of patients according to BMI (N = 96)

	ALL PATIENTS		MALE		FEMALE	
LEVEL OF FATNESS	N	%	N	%	N	%
LEAN (< 18)	-	-	-	-	-	-
NORMAL (19-24.9)	32	33.3	24	25	8	8.3
GRADE I OBESITY (25 – 29.9)	40	41.8	24	25.0	16	16.7
GRADE II OBESITY (30-40)	20	20.8	4	4.2	16	16.7
GRADE III OBESITY (>40)	4	4.1	0	0	4	4.1
TOTAL	96	100.0	52	54.2	44	45.8

The classification according to waist to hip ratio was shown in table III. It was revealed that 66.67% of the participants had severe level of fatness while 16 fell to the category of mild and moderate obesity respectively. The same number of patients were found to have severe level of obesity for male and female (20). The result of the classification of patients to level of fatness using waist circumference was shown in table4. Twenty patients were of low level of fatness. These are those that there waist circumference were less down 92 cm for male and less down 79 cm for female. It was observed that all those that have low level of fatness were male.

Those that the level of fatness were moderate that is between 94 – 107cm for male and between 80 – 87cm for female were 24 patients, 16 males and 8 females. Fifty two patients had high level of fatness (16 males and 36 females). These are with waist circumference greater than 102 cm for male and greater than 88cm for female. Presented in table V was the classification according to percent body fat using skinfold measurement. Twenty four patients were lean which comprises of 16 male and 8 female and 52 patients were of optimal level of fatness which includes 28 males and 24 females. Those that were slightly over fat were 20 (20.83 %) comprised of 8 male and 12 female.

Table III. Classification according to waist to hip ratio (N = 96)

	COMBINED		MALE		FEMALE	
LEVEL OF FATNESS	N	%	N	%	N	%
NORMAL (M≤0.75, F ≤0.84)	-	-	-	-	-	-
MILD OBESE (M= 0.84-0.91, F= 0.75-0.79)	16	16.67	16	16.67		-
MODERATE OBESE M=0.92-0.98, F=0.80-0.85	16	16.67	4	4.16	12	12.50
SEVERE M=>0.95, F= > 0.86	64	66.67	32	33.33	32	33.33
TOTAL	96	100.0	52	54.16	44	45.83

Table IV. Classification according to waist circumference (N = 96)

	ALL PATIENTS		MALES		FEMALES	
LEVEL OF FATNESS./CM	N	%	N	%	N	%
Low: M < 93, F < 79	20	20.83	20	20.83	-	-
Moderate: M= 94-101,F= 80-87	24	25.00	16	16.66	8	8.33
High: M= > 102, F=>88	52	54.16	16	16.66	36	37.50
TOTAL	96	99.99	52	54.14	44	45.83

Table V. Classification according to % body fat using skin fold (N= 96)

LEVEL OF FATNESS IN %	ALL PATIENT		MALE		FEMALE	
	N	%	N	%	N	%
Lean: Male <8,Female <13	24	25.00	16	16.66	8	8.33
Optimal: Male 8-15,Female 13-15	52	54.16	28	29.17	24	25.00
Slightly Over fat: Male 16-20, Female 24-27	20	20.83	8	8.33	12	12.5
Over fat: Male 21-24, Female 28-32	-	-	-	-	-	-
Obese: Male. >25, Female >33	-	-	-	-	-	-
TOTAL	96	99.99	52	54.16	44	45.84

Discussion and conclusion

Obesity especially morbid obesity carries a high risk of chronic musculoskeletal pain specifically low back pain. Body mass index assesses generalized body fat; body density, total body water and total body potassium (21). Using BMI classification, the study revealed that most of the participants (66.7 %) with low back pain were categorised to have between grade 1 to grade 3 obesity. Higher percentage of patients with low back pain had high body density and consequently high-generalised body fat. In addition to this the mean value of BMI obtained in this study for all the patients (27.43kg/m^2) was higher than the normal value and it fell within the range of grade 1 obesity. The mean value for female was of grade 2 obesity (30.0kg/m^2). Garrow documented that BMI above 25kg/m^2 was associated with slowly increasing mortality and morbidity but above 30kg/m^2, there is increase in morality (22). Guo et al (23) reported that BMI exceeding 24 kg/ m^2 or waist to hip ratio exceeding 0.85 might cause overweight, obesity or central obesity. Extremely high BMI has been associated with LBP in men (24). Increase in BMI may increase the inter- discal and intra-discal pressure in the vertebral disc of lumbar vertebrae, especially L4 and L5 inter vertebra disc (23). Urguhart et al (2011) in their study in which body composition was measured using dual radiograph absorptiometry with a weight limit of 130 kg, their upper and lower limbs, trunk and abdomen as well as their total body mass were measured (25). The result indicated that for each 5 % increase in body fat mass the odds of intensity of low back pain increase by 19 %. This inferred that increase in low back pain intensity among people with high BMI was only related to their higher body fat content not just the fact that they were heavier. The increase in weight resulted in to abnormal pressure at low back which then predisposes the disc into prolapse and hernation.

All patients assessed for this study were categorised obese, using WHR. A feature delineation of fat distribution or fat topography, comes from observation that individual differ in their fatness in the upper trunk versus lower trunk as estimated by waist-hip circumference ratio (26). Waist circumference and BMI measure different aspects of obesity. Waist circumference is a strong predictor of both visceral and subcutaneous adipose tissues. Thus, waist circumference is a better measure of abdominal obesity (27). This study suggested that abdominal obesity is the primary weight-related risk factor for LBP. The weight constitutes by this fat might have a significant pressure effect on the inter vertebra disc in the lumbar 4 and lumbar 5 vertebrae (28).

Visceral fat and central fatness can be evaluated with waist circumference. In women a waist circumference greater than 88cm (35 inches) indicates central fatness. In men the cut off point is 102cm (40inches), (28). The result showed that most subjects fell into the categories of high and moderates obesity using waist circumference classification. This finding was supported by Hodselmans (2010), who reported that there is an increased body fat percentage in nonspecific chronic low back pain patients compared with healthy participants (31).

The mechanisms underlying the association between obesity and LBP are not fully known. Obesity may increase the risk of LBP, for example, because of lumbar disc disorders (11, 12, 13) through mechanical load. It has been suggested that mechanical load is the principal factor initiating the degenerative process in the lumbar spine (15). In addition to mechanical load, obesity may cause LBP via low-grade systemic inflammation (11, 12, 13, 32).

This study concluded that most of the subjects with low back pain who participated in this study were obese, although the sample size is small. Future studies should increase the sample size and the relationship between adipose tissue indices back pain should be established.

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