EAS Journal of Orthopaedic and Physiotherapy
Abbreviated Key Title: EAS J Orthop Physiother
ISSN 2663-0974 (Print) | ISSN 2663-8320 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-3 | May-Jun, 2025 | DOI: https://doi.org/10.36349/easjop.2025.v07i03.001

Original Research Article

Comparism of Tumour Necrotic Factor, Physical Activity Level, Pain Intensity and Body Adiposity in Patient with Non-Specific Chronic Low Back Pain in Relation to their Healthy Counterparts

Nweke Chinonso Vincent[1*], Ezema Charlse[2], Nweke, Augustine Chidera[3] Anelechi Kenneth Madume[4], Dr Ime Mathias Ubom[5]

[1]Senior Physiotherapist Proactive Rehab, Hamilton, New Zealand, Department of Physiotherapy, Faculty of Health Science, University of Nigeria Nsukka, Enugu Campus, Enugu state, Nigeria
[2]Department of Physiotherapy, Faculty of Health Science, University of Nigeria Nsukka, Enugu Campus, Enugu state, Nigeria
[3]Senior Physiotherapist, NHIS, Dorchester, United Kingdom, Department of Physiotherapy, Nnamdi Azikiwe University Awka, Anambra State, Nigeria
[4]Dept of Physiotherapy,College of Medical Sciences,Rivers State University, Port Harcourt.
[5]Director of Physiotherapy, University of Port Harcourt Teaching Hospital, Port-Harcourt Rivers State.

Article History
Received: 09.05.2025
Accepted: 14.06.2025
Published: 23.06.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background:*** Low back pain (LBP) is the fifth most common reason for hospital visits, which affects nearly 60-80% of people throughout their lifetime (Tillotson, 1995). The prevalence of low back pain is reported to be as high as 84%, and the prevalence of chronic low back pain is about 23%, with 11-12% of the population being disabled by low back pain (Koes, 2006). According to Damian (2014), In the 2010 Global Burden of Disease study the global age-standardised point prevalence of LBP (from 0 to 100 years of age) was estimated to be 9.4%. The same study showed that prevalence in 2010 was highest in Western Europe followed by North Africa/Middle East, and lowest in the Caribbean followed by central Latin America. ***Aim:*** The purpose of this study is to ascertain the level of tumour necrosis factor, physical activity and body adiposity in patients with non-specific chronic low back pain in relation to their apparently healthy counterparts between the age of 30 to 60 years in River's state. ***Methodology:*** This is a quasi-experiment / cross sectional research design. Those that agreed to participate were included and they were selected randomly. All Patients with Non-specific chronic low back pain within the ages of 30 - 60, that complained of pain within 6 months, without any history of spinal decompression, non-pregnant women who presented with low back pain, who presented for treatment at the hospital participated in the study for the period of 6 months. Subjects with a history of heart disease, hypertension, diabetes, Pott's disease, and use of drugs like steroids and pregnant women was excluded from the study because the cause of their back pain is known. Also, some of their back pain is temporary. They were of 2 groups. First group are the patients diagnosed of non-specific chronic low back pain and the second group are the apparently healthy individuals that serve as control. Their blood samples were taken by the lab scientist. and sent for analysis.

Keywords: Non-Specific chronic low back pain, BA- body Adiposity, PAL – physical Activity level, PI – pain intensity.

INTRODUCTION

The incidence of low back has been on the increase in our society today due to the lifestyle and the occupation of the populace. Aging, occupation and activity of daily living has been a major contributing factor to this condition. It has been termed to be associated with Tumour necrosis factor, physical activity level and body adiposity, thereby leading to the reason for this study. According to Balagué *et al.,* (2012) non-specific chronic low back pain (NSCLBP) is low back pain that is idiopathic in origin. It has an unknown

***Corresponding Author:** Nweke Chinonso Vincent
Senior Physiotherapist Proactive Rehab, Hamilton, New Zealand, Department of Physiotherapy, Faculty of Health Science, University of Nigeria Nsukka, Enugu Campus, Enugu State, Nigeria

specific pathology (e.g., infection, tumour, osteoporosis, lumbar spine fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome). Non-specific chronic low back pain is usually categorized in 3 subtypes: acute, sub-acute and chronic low back pain. This subdivision is based on the duration of the back pain. Acute low back pain is an episode of low back pain for less than 6 weeks, sub-acute low back pain between 6 and 12 weeks and chronic low back pain for 12 weeks or more (Balagué *et al.,* 2012). Koes *et al.,* (2006), stated that Over 90% of patients presenting to primary care has low back pain.

Low back pain is one of the commonest and costliest condition and is second only to the common cold in terms of complain to primary health care professional (Katz, 2006). Low back pain has proven to be one of the major presenting conditions in the health sector, with a high incidence among heavy weightlifters, rig workers and obese people (Collado, 2014). According to Jeffrey *et al.,* (2007) about 90% of the workers who suffer back pain return to work by 3 months while 5% never return at all (Jeffrey *et al*., 2007). Virtually, everyone experiences low back pain at some point in their life and is linked now to high increase in Tumour necrosis factor which is a pro inflammatory cytokine which has been known to be involved in precipitation of inflammation and pain. It affects the quantity of C-reactive protein, some pain mediators including insulin resistance. (Timmerman *et al*., 2016) Exercise has a parallel "protective" anti-inflammatory counter-regulation by increasing circulation and increase movement of metabolic waste (Jordan, 1997). Example of the exercise is cycling stationary bicycle ergo-meter. There is paucity of studies on the relationship between pain intensity, physical activity level, body adiposity and TNF in patients with non-specific chronic low back pain especially in black population. Low back pain has been linked to Tumour necrosis factor, physical activity level, body adiposity and little of no study has been done on that in Africa and Nigeria in particular.

There is paucity of documented literature on relationship between physical activity, body adiposity and TNF in people with NSCLBP.

Brook *et al., (2016)* carried out a study to examine the relationship between adiposity distribution with pain and disability in a CLBP population. All participants' data was collected at a tertiary education facility in Western Sydney, Australia, over a three-year period with two cycles of participant recruitment and data collection. The study involved seventy (n = 70) adult men and women aged 18–76 years. They were recruited through the use of media advertising and leaflet drops in the local area Anthropometric measures height, weight, waist circumference (WC), hip circumference, BMI and waist-to-hip ratio (WHR) were measured while participants were barefoot and wearing lightweight clothing. The results showed that a total of n = 122 individuals were screened for inclusion and n = 70 individuals were eligible and chose to participate in the study. There were no significant correlations observed between self-reported disability and anthropometric or adiposity variables in any of the analysis models. ODI was found to be correlated to VAS in the total sample (r = 0.264, p = 0.028), but not in either of the subgroup analysis models. Stepwise regression showed that 9.1 % (p = 0.007) of the variance in pain was explained by A-L alone in the total sample analysis (n = 70), which was increased to 15.7 % (p = 0.001) when ODI was added to the model. Results of the stepwise regression for the VAS subgroup indicated that 30.5 % of the variance in pain could be explained by A-L/WHR (p < 0.001).

A work by Tsukui *et al*., (2000) checked the anthropometric and biochemical factors in relation to TNF. Anthropometric and biochemical characteristics of lean subjects and overweight to obese subjects were assessed. In overweight to obese subjects, serum TNF-alpha, levels were nearly four-fold higher than those in lean subjects. Overweight to obese subjects had also elevated serum levels of soluble TNF-RI and TNF-RII compared with lean subjects. Simple correlation coefficients of TNF-alpha, TNF-RI and TNF-RII with anthropometric and biochemical parameters was determined. Logarithmic (log) serum TNF-alpha levels were significantly correlated with BMI, percentage body fat, and WHR. Both TNF-RI and TNF-RII levels were positively associated with BMI and percentage body fat, but not with WHR. Log serum TNF-alpha was significantly correlated with HbA1c and log serum insulin. Although there was a significant positive correlation between TNF-RI and HbA1c, the correlation between TNF-RII and HbA1c did not reach statistical significance. In addition, neither TNF-RI nor TNF-RII was significantly associated with log serum insulin. On the other hand, serum levels of TNF-alpha, TNF-RI and TNF-RII were negatively correlated with HDL cholesterol levels. Those correlations of log TNF-alpha were adjusted for age, because a positive correlation between log serum TNF-alpha and age was found (r=0.38, P<0.05). After being adjusted for age, the associations of log serum TNF-alpha with BMI (r=0.63, P<0.01), percentage body fat (r=0.68, P<0.01), HbA1c (r=0.42, P<0.01), log serum insulin (r=0.31, P<0.05), and HDL cholesterol (r=-0.32, P<0.05) remained statistically significant. The correlation between log TNF-alpha and WHR was of borderline significance (r=0.40, P=0.05) when adjusted for age.

The study of Ferreira *et al.,* (2015) investigated the comparison of general exercises, motor control exercises and spinal manipulative therapy for chronic low back pain. The primary outcomes in this study were patient-specific function (PSFS, 3–30) and global perceived effect (GPE, −5 to 5) at 8 weeks. These outcomes were also measured at 6 and 12 months. Follow-up was 93% at 8 weeks and 88% at 6 and 12 months. The motor control exercise group had slightly

better outcomes than the general exercise group at 8 weeks (between-group difference: PSFS 2.9, 95% CI: 0.9–4.8; GPE 1.7, 95% CI: 0.9–2.4), as did the spinal manipulative therapy group (PSFS 2.3, 95% CI: 0.4–4.2; GPE 1.2, 95% CI: 0.4–2.0). The groups had similar outcomes at 6 and 12 months. Motor control exercise and spinal manipulative therapy produce slightly better short-term function and perceptions of effect than general exercise, but not better medium or long-term effects, in patients with chronic non-specific back pain.

Charlotte *et al.,* (1999) carried out a cross-sectional postal survey of 29,424 twin subjects aged 12-41 years obtained from a population-generated panel to determine whether obesity is associated with low back pain. The association and dose-response connection between body mass index and nonspecific low back pain experienced by subjects in the preceding year were studied. Possible modifying effects of age, gender, type of work, and smoking were investigated. The prevalence of nonspecific low back pain was also studied in monozygotic twin pairs who were dissimilar in body mass index. There was a modest positive association between body mass index and low back pain that increased with the duration of low back pain. The underweight subjects consistently reported lower prevalence of low back pain (odds ratios < 1) than did those higher in weight. The dose-response curve was usually A-shaped. A positive monotonic dose response was apparent mainly in those with long-lasting or recurrent low back pain. The positive association between body mass index and low back pain disappeared when monozygotic twins who were dissimilar in body weight classification were studied. Obesity is modestly positively associated with low back pain, in particular with chronic or recurrent low back pain. However, because the association is weak, because there is no consistent positive monotonic dose response, and because the link disappears in monozygotic twins who are dissimilar in body mass index, it is unlikely that this association is causal. It is possible, however, that obesity plays a part in the chronicity of simple low back pain.

In a work by Jason *et al*., (2016), on the relationship between abdominal-specific subcutaneous and visceral adiposity with pain and disability in NSCLBP individuals. A preliminary explorative study design of seventy (n = 70) adult men and women with NSCLBP was employed. Anthropometric and adiposity measures were collected, including body mass index, waist-to-hip ratio, total body adiposity and specific ultrasound-based abdominal adiposity measurements. Self-reported pain and disability were measured using a Visual Analogue Scale (VAS) and the Oswestry Disability Index (ODI) questionnaires respectively. Relationships between anthropometric and adiposity measures with pain and disability were assessed using correlation and regression analyses. Results Significant correlations between abdominal to lumbar adiposity ratio (A-L) variables and the waist-to-hip ratio with self-reported pain were observed. A-L variables were found to predict pain, with 9.1–30.5 % of the variance in pain across the three analysis models explained by these variables. No relationships between anthropometric or adiposity variables to self-reported disability were identified. Conclusions The findings of this study indicated that regional distribution of adiposity via the A-L is associated with NSCLBP, providing a rationale for future research on adiposity and NSCLBP.

In a meta-analysis study by Rahman *et al*., (2009), which assessed the association between overweight/obesity and low back pain, the authors systematically searched the Medline (National Library of Medicine, Bethesda, Maryland) and Embase (Elsevier, Amsterdam, the Netherlands) databases until May 2009. Ninety-five studies were reviewed and 33 included in the meta-analyses. In cross-sectional studies, obesity was associated with increased prevalence of low back pain in the past 12 months (pooled odds ratio (OR) = 1.33, 95% confidence interval (CI): 1.14, 1.54), seeking care for low back pain (OR = 1.56, 95% CI: 1.46, 1.67), and chronic low back pain (OR = 1.43, 95% CI: 1.28, 1.60). Compared with non-overweight people, overweight people had a higher prevalence of low back pain but a lower prevalence of low back pain compared with obese people. In cohort studies, only obesity was associated with increased incidence of low back pain for ≥1 day in the past 12 months (OR = 1.53, 95% CI: 1.22, 1.92). Results remained consistent after adjusting for publication bias and limiting the analyses to studies that controlled for potential confounders. Findings indicate that overweight and obesity increase the risk of low back pain. Overweight and obesity had the strongest association with seeking care for low back pain and chronic low back pain. TNF exerts multiple effects at different sites. It may influence food intake (either through leptin or IL-1) and thermogenesis both in BAT and skeletal muscle, therefore counteracting fat expansion. Similarly, it modulates LPL and hormone-sensitive lipase activities in adipose tissue, decreasing fat accumulation. On the other hand, it generates a state of multiple insulin resistance (liver, adipose, skeletal muscle) basically by decreasing the expression of GLUT4 transporters and by decreasing IRS phosphorylation and therefore the insulin signaling cascade. The insulin resistance status also contributes to the regulation of the adipose mass.

Obesity

Obesity is a multifactorial syndrome representing one of the most important pathological states in Western countries. It therefore represents a highly expensive problem. This metabolic state is associated with hypertension, atherosclerosis, diabetes, cardiovascular problems and certain types of cancer (Garcia-Lorda *et al.,* 1999).

Obesity is characterized by an increase in body fat stores linked to a lack of control on food intake and/or

energy expenditure. Very recent experimental data have shown that fat tissue plays a pivotal role in the control of its own mass (Argiles *et al.,* 1999). Thus, adipose tissue can synthesize and release molecules which are able to regulate food intake and energy expenditure into the circulation and therefore acts as an endocrine tissue. Among these compounds, leptin and tumor necrosis factor-α (TNF) might play a very important role.

BMI (Body mass index)

Body mass index or BMI is a simple and widely used method for estimating body fat mass (Meiz *et al.,* 2002). BMI was developed in the 19th century by the Belgian statistician and anthropometric Adolphe Quetelet (Quetelet *et al.,* 1999). BMI shows the body fat content. Age, BMI and gender can give accurate fat content to about 4% accuracy (Seidell, 2005).

Table 1: BMI Chart

BMI	Classification
< 18.5	Underweight
18.5 – 24.9	Normal Weight
25.0 – 29.9	Overweight
30.0 – 34.9	Class I Obesity
35.0 – 39.9	Class II Obesity
≥ 40.0	Class III Obesity

BMI is obtained by dividing the mass in KG by the square of the height in meters.

Some modifications to the WHO definitions have been made by bodies. Surgical literature breaks down class III obesity into further categories, though the exact values are still disputed (Sturm *et al.,* 2007).

***Body Fat Percentage*:**

Body fat percentage is total body fat expressed as a percentage of total body weight. There is no generally accepted definition of obesity based on total body fat. Most researchers have used >25% in men, and >30% in women, as cut points to define obesity (Okorodudu *et al.,* 2010).

Waist circumference and waist-hip ratio

Obesity is identified by the waist circumference of >102 cm (~40") in men and >88 cm (~34.5") in women or the waist–hip ratio (the circumference of the waist divided by that of the hips of >0.9 for men and >0.85 for women) (Yusu *et al.,* 2004).

In those with a BMI under 35, intra-abdominal body fat is related to negative health outcomes independent of total body fat. In a study of 15,000 people, waist circumference also correlated better with Metabolic syndrome than BMI (Larson *et al.,*1992).

Body Adiposity Index:

this is the amount of fat in an individual. It's calculated by using the hip size in comparison to the individual height (Freedman *et al.,* 2012).

The BAI is calculated as:
100 × hip circumference in meter height in m × height − 18

The equations used by this calculator to determine your body adiposity index are shown below.

- $BAI = (HC / (HM)^{1.5}) - 18$

where
BAI = Body Adiposity Index
HM = Height in Meters
HC = Hip Circumference in Centimeters (Gallagher *et al*., 2000).

Pain

A work by Gatched *et al.,* (2016), defined chronic low back pain (CLBP) as pain that remains for longer than three months. CLBP can have a debilitating effect on patients' lives, resulting in disability and reducing their ability to carry out activities of daily living (Hayden *et al.,* 2005). Acute back pain is pain that remains for less than 6weeks. Sub-acute back pain is back pain for between 6 weeks and 3 months. Forty percent of patients with acute low back pain are at an elevated risk of developing CLBP. Back pain is then further categorized into specific or non-specific back pain. Non-specific back pain is diagnosed when the cause of the back pain is unknown, and specific back pain refers to a specific cause for the pain, for example an infection or a fracture (Savigny, 2009). Non-specific low back pain is the most common type of back pain to occur and accounts for 85% of all back pain cases.

Non-specific low back pain can be caused by:

- Traumatic injury
- Lumbar sprain or strain
- Postural strain

  Or can be secondary to conditions such as (Koes, 2006):
- Spondylolysis and Spondylolisthesis
- Disc Herniation
- Lumbar Spinal Stenosis
- Osteoporosis with Compression fracture

***TNF role in the control of adipose tissue mass*:**

In addition to the fact that both adipose and muscle tissue from either obese or diabetic subjects over express the TNF gene, the circulating levels of the cytokine are also correspondingly elevated, thus suggesting that the action of the cytokine is not just limited to the tissue where it is produced (Katsuki, 2000). Indeed, TNF may act as a local signal regulating, in addition to insulin resistance, fat accumulation either directly by means of modulating the expression and synthesis of key enzymes in lipid accretion such as LPL or hormone-sensitive lipase or, indirectly, by controlling the rate of leptin secretion (Winkler, 2001). This molecule has been shown to have important effects on lipid metabolism in the adipocyte.

The causative factor of human adiposity is complex and multifactorial and, based on twin studies, is thought to have a strong genetic component. Genetic studies using sibling pair analysis have shown a linkage between a marker near the TNF locus and body fat content in Pima Indians (Dandona, 2001).

There is a paucity of documented literature on relationship between physical activity, body adiposity and TNF in people with non-specific chronic low back pain (NSCLBP).

S/No	Author	Title	Methods	Results	Knowledge gap
1	Brooks *et al.,* (2016)	Relationship between adiposity distribution with pain and disability in a chronic low back pain population	Western Sydney, Australia. Cross sectional study	There were no significant correlation observed between self-reported disability and anthropometric or adiposity variables in any of the analysis models. Oswestry (ODI) was found to be correlated to visual analogue scale (VAS) in the total sample (r=0.264, p=0.028) but not in either of the subgroup analysis models.	It did not compare the pain intensity with the duration of low back pain and TNF
2	Tsukui *et al*., (2000)	Accessing the anthropometric and biochemical factors in relation to TNF	Japan, Sample of convenience	In overweight to obese subjects, serum TNF alpha, levels were nearly four- fold higher than those in lean subjects. 2. Overweight to obese subjects also had elevated serum levels of soluble TNF R1 and TNF R1 compared with lean subjects.	It did not compare the TNF Alpha level with NSCLBP. Also, it compared obese and lean patient, not Body adiposity in general.
3	Ferreira *et al.,* (2015)	The comparison of general exercise, motor control exercise and spinal manipulation therapy for chronic low back pain	United state of America (USA), Randomized control Trial	Motor control exercise and spinal manipulative therapy produce slightly better short-term function and perception effect than general exercise, but no better medium- or long-term effects in patients with chronic non-specific back pain.	it centres its research on exercise, but fails to measure the PAL.
4	Charlotte *et al.,* (1999)	Relationship between obesity and low back pain among twins	USA, Observational study	Obesity plays a part in the chronicity of simple low back pain	it fail to relate obesity to NSCLBP
5	Jason *et al.,* (2016).	Relationship between abdominal-specific subcutaneous and visceral adiposity with pain and disability in chronic low back pain individuals.	USA, Observational Study	There is no relationship between anthropometric or adiposity variables to self-reported disability were identified. 2. the findings of this study indicated that regional distribution of adiposity via abdominal-lumbar Is associated with chronic low back pain.	It did not relate the pain intensity to TNF
6	Rahman *et al*., (2009)	Association between overweight /obesity and low back pain.	Maryland, Nertherlands, Meta Analysis Study.	The result indicates that overweight and obesity increases the risk of low back pain.	It compared the risk of obesity and low back pain but failed to check the duration of onset.

METHOLOGY

This is a quasi-experiment / cross sectional research design. Those that agreed to participate were included and they were selected randomly. All Patients with Non-specific chronic low back pain within the ages of 30 - 60, that complained of pain within 6 months, without any history of spinal decompression, non-pregnant women who presented with low back pain, who presented for treatment at the hospital participated in the study for the period of 6 months. Subjects with a history of heart disease, hypertension, diabetes, Pott's disease, and use of drugs like steroids and pregnant women was excluded from the study because the cause of their back pain is known. Also, some of their back pain is temporary. They were of 2 groups. First group are the patients diagnosed of non-specific chronic low back pain and the second group are the apparently healthy individuals that serve as control. Their blood samples were taken by the lab scientist. and sent for analysis. Convenience sampling technique was used in selecting the participants. Convenience sample, in which the patients that consented to be involved in the research was allowed to participate. Those that declined were left out. Prior to the data collections, Aim and objectives of the research was explained to the participants and informed consent gotten. The questionnaires were administered to the participants by direct contact method, filled in and collected immediately. The collected data was analysed with both descriptive and inferential statistics. The descriptive statistics – frequency, percent, mean and standard deviation were used to summarise the data. The inferential statistics – Independent Samples t-test, Mann-Whitney U test, Chi-Square Test of Independence, Fishers Exact Test, Pearson Correlation, Spearman Correlation and Point-biserial Correlation were used to make comparisons and ascertain relationships between the variables at 5% level of significance. Hence, significant difference/relationship existed if p-value is less than .05, $p < .05$; otherwise, no significance. Choice of statistics was based on type of data and whether assumptions needed for using a particular statistic was met or not.

The instrument for data collection:

1. Questionnaire: International Physical Activity Questionnaire (IPAQ).
2. ELISA kit for analysis of TNF
3. Weighing scale (Salter Max Digital r scale)
4. Tape rule (Butterfly type, China)
5. Body fat analyzing Machine (OMRON Digital Analyzer scale).
6. Numeric scale

IPAQ

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on

health–related physical activity. The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages and are suitable for national population-based prevalence studies of participation in physical activity.

Procedure for Data Collection

Prior to the distribution of the questionnaire, the aim and objectives of the study were clearly explained to all the participants. Their signed informed consent was sought and obtained. The participants were assured of the confidentiality of the information they provided. The questionnaires were administered to the participants by direct contact method, filled in and collected immediately.

Ethical approval was obtained from University of Nigeria Teaching Hospital Research and Ethics Committee Ituku-Ozalla, Enugu, Enugu state.

An informed consent form was also shared to the participants to fill in, showing that they agree to every procedure and the use of their data for research.

Patients and controls

The patients that were presented to the hospital were diagnosed and clerked by the physiotherapist. Those that were found eligible were included and offered the informed consent form. Those that agreed and filled in the form were included in the research. They were of 2 groups. The first group are the patients diagnosed with non-specific chronic low back pain and the second group are the apparently healthy individuals that serve as control. Their blood samples were taken by the lab scientist and sent for analysis. They were assessed by the physiotherapist for body adiposity using OMROM fat analyzer that worked with the principles of bipedal impedance. Their weight measure and height were obtained using a measuring meter. Their physical activity level was obtained using an IPAQ questionnaire.

These statistics were done with the aid of the Statistical Package for the Social Sciences (SPSS) version 25 and Microsoft Excel 2007.

FINDINGS

Profile of Participants*:*

Of the forty-four questionnaires distributed to patients with non-specific chronic low back pain and a control group, forty-four were returned. (18 males and 26

females). This represents a return rate of 100%. The mean age of apparently healthy subjects and NSCLBP being 44.91±7.26 and 44.27±7.11. The mean body mass index (BMI) of both groups being21.74±3.72 for the apparently healthy subjects being normal, and 26.58±3.73 for the patients being overweight respectively. The international Physical Activity Questionnaire (IPAQ) revealed that Majority had moderate physical activity level (72.7%); only 18.2% had vigorous physical activity level.

Table 1: Age and Sex of the Participants

	Healthy Subjects n = 22	**NSCLBP n = 22**	**Statistic**	**p-value**
Age (M±SD)	44.91±7.26	44.27±7.11	.294[t]	.770
30-40	7(31.8)	10(45.5)		
41-50	10(45.5)	9(40.9)		
51-60	5(22.7)	3(13.6)		
Sex			.376[c]	.540
Male	8(36.4)	10(45.5)		
Female	14(63.6)	12(54.5)		
Statistics Used: Independent Samples t-test (t) and Chi-Square test (c)				

Table 1 presents the age and sex of the study participants. The age of the participants ranged from 32-60 years and 30-60 years with mean and standard deviation age of 44.91±7.26 and 44.27±7.11 and modal age group of 41-50 years (45.5%) and 30-40 years (45.5%) for the healthy subjects and NSCLBP patients respectively. Males were fewer than females in both groups [male healthy (36.4%); male patient (45.5%)]. The age and sex distribution for both groups were not significant [age (p = .770) and sex (p = .540)].

Table 2: BMI of the Participants

	Healthy Subjects n = 22	**NSCLBP n = 22**	**Statistic**	**p-value**
BMI			14.985[f]	.001
Underweight	3(13.6)	0(0.0)		
Normal	15(68.2)	6(27.3)		
Overweight	4(18.2)	10(45.5)		
Obese	0(0.0)	6(27.3)		
M±SD	21.74±3.72	26.58±3.73		
Mean Rank	15.36	29.64	85.0[m]	< .001
Statistics Used: Fishers Exact Test (f) and Mann-Whitney test (m)				

From Table 2, the BMI distribution between the two groups was significant (p = .001); the healthy subjects were mainly normal (68.2%) while majority of the patients were overweight (45.5%). To note also is that none of the health subjects were obese while no patient was underweight. The mean and standard deviation was 21.74±3.72 for the healthy being normal, and 26.58±3.73 for the patients being overweight; the comparison was also significant (p < .001).

Table 3: Pain Intensity and Duration of the NSCLBP Patients n = 22

	Frequency	**Percent**	**Range**	**M±SD**
Pain intensity			**4-9**	**6.00±1.93**
4	8	36.4		
5	3	13.6		
7	7	31.8		
9	4	18.2		
Pain duration (in weeks)			**8-14**	**10.45±2.39**
8	9	40.9		
10	3	13.6		
12	6	27.3		
14	4	18.2		

From Table 3, the pain intensity level ranged from 4-9 with mean and standard deviation of 6.00±1.93, and majority that had pain intensity level of 4 (36.4%) and 7 (31.8%) respectively. The pain duration was 8-14 weeks for the range, 10.45±2.39 for mean and standard deviation, and 8 weeks for the majority (40.9%).

EAS Journal of Orthopaedic and Physiotherapy
Abbreviated Key Title: EAS J Orthop Physiother
ISSN 2663-0974 (Print) | ISSN 2663-8320 (Online)
Published By East African Scholars Publisher, Kenya
Volume-7 | Issue-3 | May-Jun, 2025 | DOI: https://doi.org/10.36349/easjop.2025.v07i03.001

Table 4: Adiposity of NSCLBP patient n = 22

	Frequency	Percent	Range	M±SD
Adiposity			23.0-39.0	34.67±4.65
Optimal	1	4.5		
Moderate	4	18.2		
High	17	77.3		

Findings in Table 4 showed that the adiposity of the patients ranged from 23.0-39.0 with mean and standard deviation of 34.67±4.65. Very many of the patients had high adiposity (77.3%); only 1 patient had optimal adiposity (4.5%).

Table 5: Relationship between Pain Intensity, Body Fat and Physical Activity Level with TNF in Patient with NSCLBP

		Pain intensity	Adiposity	PAL
Adiposity	Spearman Correlation	.123		
	p-value	.587		
PAL	Spearman Correlation	-.759	-.164	
	p-value	< .001	.466	
TNF	Spearman Correlation	.680	.223	-.932
	p-value	.001	.319	< .001

In Table 5, findings showed a positive significant relationship between TNF and pain intensity (r = .680, p = .001), and a negative significant relationship between TNF and physical activity level (r = -.932, p < .001). TNF also had a positively trended relationship with adiposity, although not significant (r = .223, p = .319). Higher TNF hence was associated with lower physical activity level, higher pain intensity and somewhat higher adiposity.

There was also a significant negative relationship between pain intensity and physical activity level (r = -.759, p < .001). The relationship between adiposity and pain intensity (r = .123, p = .587) and between adiposity and physical activity level (r = -.164, p = .466) was not significant.

Table 6: Relationship between Age, Sex and TNF in Patients with NSCLBP

		Age	Sex
TNF	Correlation	.401[p]	.214[b]
	p-value	.065	.339
Statistics Used: Pearson Correlation (p) and Point-biserial Correlation (b)			

Findings in Table 6 showed there was a positively trended relationship between age and TNF, which however was not significant (r = .401, p = .065). TNF was also not significantly related to the gender of the patients (r = .214, p = .339).

Table 7: Serum Level of TNF in NSCLBP Patients n = 22

	Frequency	Percent	Range	M±SD
TNF			9.8-23.2	16.17±3.92
< 10	2	9.1		
10.0-14.9	5	22.7		
15.0-19.9	11	50.0		
20.0 +	4	18.2		

From Table 7, the TNF level ranged with 9.8-23.2 with mean and standard deviation of 16.17±3.92. Majority of the patients had TNF of 15.0-19.9; only very few had below 10 (9.1%); those with TNF level 20 and above were 18.2%.

Table 8: Physical Activity Level of Patients with NSCLBP n = 22

***Corresponding Author:** Nweke Chinonso Vincent
Senior Physiotherapist Proactive Rehab, Hamilton, New Zealand, Department of Physiotherapy, Faculty of Health Science, University of Nigeria Nsukka, Enugu Campus, Enugu State, Nigeria

	Frequency	Percent	Range	M±SD
Physical activity level			4-10	6.27±1.64
Mild	2	9.1		
Moderate	16	72.7		
Vigorous	4	18.2		

From Table 8, the physical activity level of the patients ranged from 4-10 with mean and standard deviation of 6.27±1.64. The majority had moderate physical activity level (72.7%); only 18.2% had vigorous physical activity level.

Table 9: Comparison of Serum Level of TNF between NSCLBP Patients and Healthy Subjects

	N	M±SD	Mean Rank	Mann-Whitney	p-value
TNF				150.00	.031
Healthy subject	22	13.84±3.77	18.32		
NSCLBP	22	16.17±3.92	26.68		

From Table 9, there was a significant serum level of TNF difference between the healthy subjects and the patients (p = .031). The patients were associated with higher TNF level than the healthy subjects. The serum level of TNF mean, and standard deviation were 13.84±3.77 for the healthy subjects and 16.17±3.92 for the patients.

Table 10: Comparison of Physical Activity Level between NSCLBP Patients and Healthy Subjects

	N	M±SD	Mean Rank	Mann-Whitney	p-value
PAL				95.0	.001
Healthy subject	21	7.90±1.30	28.48		
NSCLPB	22	6.27±1.64	15.82		

Findings in Table 10 showed that the physical activity level of the healthy subjects and that of the patients were significantly different (p < .001). Healthy subjects had higher physical activity level than the patients. PAL was 7.90±1.30 for the healthy subjects and 6.27±1.64 for the patients.

Table 11: Comparison of Body Adiposity between NSCLBP Patients and Healthy Subjects

	N	M±SD	Mean Rank	Mann-Whitney	p-value
Adiposity				236.0	.888
Healthy subject	22	35.92±1.75	22.23		
NSCLBP	22	34.67±4.65	22.77		

From Table 11, there was no significant difference between the adiposity of the healthy subjects and that of the patients' (p = .888). For the healthy, adiposity was 35.92±1.75 while for the patients, it was 34.67±4.65.

Table 12: Relationship between Pain Intensity, Pain Duration and TNF in Patients with NSCLBP

		Pain intensity	Pain duration
TNF	Spearman Correlation	.680	.126
	p-value	.001	.576

Findings in Table 12 showed that pain intensity was positively and significantly related to TNF (r = .680, p = .001). Higher pain intensity was associated with higher TNF and vice versa. For pain duration, there was however no significant relationship with TNF (r = .126, p = .576).

SUMMARY OF FINDINGS

The BMI distribution between the two groups was significant (p = .001); the healthy subjects were mainly normal (68.2%) while majority of the patients were overweight (45.5%). To note also is that none of the healthy subjects were obese while no patient was underweight. The mean and standard deviation was 21.74±3.72 for the healthy being normal, and 26.58±3.73 for the patients being overweight; the comparison was also significant (p < .001). Pain intensity level ranged from 4-9 with mean and standard deviation of 6.00±1.93, and majority that had pain intensity level of 4 (36.4%) and 7 (31.8%) respectively. The pain duration was 8-14 weeks for the range, 10.45±2.39 for mean and standard deviation, and 8 weeks for the majority (40.9%). The adiposity of the patients ranged from 23.0-39.0 with mean and standard deviation of 34.67±4.65. Very many of the patients had high adiposity (77.3%); only 1 patient

had optimal adiposity (4.5%). There is a positive significant relationship between TNF and pain intensity (r = .680, p = .001), and a negative significant relationship between TNF and physical activity level (r = -.932, p < .001). TNF also had a positively trended relationship with adiposity, although not significant (r = .223, p = .319). Higher TNF hence was associated with lower physical activity level, higher pain intensity and somewhat higher adiposity. There was also a significant negative relationship between pain intensity and physical activity level (r = -.759, p < .001). Relationship between adiposity and pain intensity (r = .123, p = .587) and between adiposity and physical activity level (r = -.164, p = .466) was not significant. there was a positively trended relationship between age and TNF, which however was not significant (r = .401, p = .065). TNF was also not significantly related to the gender of the patients (r = .214, p = .339). physical activity level of the patients ranged from 4-10 with mean and standard deviation of 6.27±1.64. Majority had moderate physical activity level (72.7%); only 18.2% had vigorous physical activity level. there was a significant serum level of TNF difference between the healthy subjects and the patients (p = .031). The patients were associated with higher TNF level than the healthy subjects. The serum level of TNF mean, and standard deviation were 13.84±3.77 for the healthy subjects and 16.17±3.92 for the patients. the physical activity level of the healthy subjects and that of the patients were significantly different (p < .001). The healthy subjects had higher physical activity level than the patients. PAL was 7.90±1.30 for the healthy subjects and 6.27±1.64 for the patients. there was no significant difference between the adiposity of the healthy subjects and that of the patients' (p = .888). For the healthy, adiposity was 35.92±1.75 while for the patients, it was 34.67±4.65. Pain intensity was positively and significantly related with TNF (r = .680, p = .001). Higher pain intensity was associated with higher TNF and vice versa. For pain duration, there was however no significant relationship with TNF (r = .126, p = .576). The result of the study indicated that there was a significant relationship between obesity and TNF in relation to NSCLBP.

Findings showed a positive significant relationship between TNF and pain intensity and a positive significant relationship between TNF and physical activity level.

The level of TNF in patients with non-specific chronic low back pain was slightly higher than that of the healthy subjects, there was a significant serum level of TNF difference between the healthy subjects and the NSCLBP patients. The patients were associated with higher TNF level than the healthy subjects.

The results showed that Body fat percentage was significantly associated with NSCLBP and though TNF and PAL variables were not significantly associated with CLBP, they showed a positive trend in healthy individuals and were negatively trended in NSCLBP patients. There was also no significant difference in the association of the above variables with age**,** gender, smoking, pain intensity, and duration of pain but they showed a positive trend in healthy individuals and were negatively trended in NSCLBP patients. Therefore, this section discusses the difference in values of healthy individuals and patients with NSCLBP for serum TNF, PAL, and body fat percentages. As well as the relationship between pain intensity, physical activity level, body adiposity, duration of pain, age, gender, smoking and TNF in patients with non-specific chronic low back pain. The findings are discussed in the following sections.

The result gotten from this study confirmed previously published data which reported TNF cytokines and some pro-inflammatory cytokines to be influenced in the serum of NSCLBP patients as well as act as one of the mediators of inflammation in herniated disc tissues injury. (Timmerman *et al*., 2016). There was a significant serum level of TNF difference between the healthy subjects and the patients (p = .031). The patients were associated with higher TNF level than the healthy subjects. The serum level of TNF means, and standard deviation were 13.84±3.77 for the apparently healthy subjects and 16.17±3.92 for the NSCLBP patients. However, these results confirmed the work of Kraychete *et al*., (2010) which reported a higher level of serum TNF (X=5.6±2.3) in patients of LBP and lower level in healthy subjects because TNF is part of the inflammatory process during low back pain, precipitating pain. With the onset of low back pain, TNF level increases.

Thus, we can agree with the explanation of Timmerman et al. (2016) that TNF rises in the serum of NSLBP patients as it is stimulated to mediate the precipitation of inflammation and pain.

The physical activity level of the patients ranged from 4-10 with mean and standard deviation of 6.27±1.64. The majority had moderate physical activity level (72.7%); only 18.2% had vigorous physical activity level. The physical activity level of the healthy subjects and that of the patients were significantly different (p < .001). Healthy subjects had higher physical activity level than the patients. PAL was 7.90±1.30 for the healthy subjects and 6.27±1.64 for the patients. This shows that the healthy subjects had higher PAL than the patients which suggests a high level of physical among normal subjects but very low on patients with NSCLBP (90.2%). Patients with NSCLBP find it difficult to maintain a normal active lifestyle (Close, 2009; Bigatti, 2002). Though Collado, (2014) reported a high percentage (59%) of PAL in patients of NSCLBP, works on aerobic fitness level showed that patients with NSCLBP had lesser exercise outcomes compared with the healthy subjects (Ferreira *et al.,*2015). Also, Smeets *et al.,* (2006), using maximal oxygen consumption (Vo2max) as a measure of PAL reported a significant difference in

the level of VO2 Max between the healthy subjects and the patients. Just as it is reported from the work of Daniels *et al.,* (2001) who used EMG as a measure of PAL, comparing with healthy subjects found significant lower (p=0.013) EMG activity of walking muscles in patients also had a positively trended relationship with adiposity, although not significant. Higher TNF hence was associated with lower physical activity level, higher pain intensity and somewhat higher adiposity. Works focusing on occupational and daily habitual physical activities reported the contrary as persons with heavy and moderate workload show higher incidence of NSCLBP while the normal subjects reported much milder PAL (Hans *et al.,* 2011).

CONCLUSION

This study has shown that greater percentage of patients with non-specific chronic low back pain are not physically active. It also showed a high prevalence of overweight and obesity among the patients and revealed positive relationship between physical activity and body adiposity and TNF.

According to the finding of the study, it was concluded that TNF is related to NSCLBP due to the inflammatory processes involving TNF. Also, TNF also had a positively trended relationship with adiposity. TNF is also, related to PAL and pain intensity. The parameters have somewhat relationship with TNF both in NSCLBP patients and apparently healthy Subjects.

Conflicting Interest*:* The work has no conflicting interest.

Originality: The work is an original work of the Author.

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Citation: Nweke Chinonso Vincent, Ezema Charlse, Nweke, Augustine Chidera, Anelechi Kenneth Madume, Ime Mathias Ubom (2025). Comparism of Tumour Necrotic Factor, Physical Activity Level, Pain Intensity and Body Adiposity in Patient with Non-Specific Chronic Low Back Pain in Relation to their Healthy Counterparts. *EAS J Orthop Physiother, 7*(3): 27-42.