Section: Orthopaedics

Original Research Article

ASSESSMENT OF LOW BACK PAIN IN OVERWEIGHT PATIENTS AND IT'S LUMBOSACRAL ANGLE CORRELATION

Hardik Shah[1], Rahul Subhashbhai Agola[2], Shah Suril Atulkumar[3], Manish Barot[4], Keyurkumar M Vaghela[5]

[1,5]*Assistant Professor, Department of Orthopaedics, GMERS Medical College, Gandhinagar, Gujarat, India.*
[2]*Senior Resident, Department of Orthopaedics, GMERS Medical College, Gandhinagar, Gujarat, India.*
[3]*Associate Professor, Department of Orthopaedics, GMERS Medical College, Gandhinagar, Gujarat, India.*
[4]*Professor and Head, Department of Orthopaedics, GMERS Medical College, Gandhinagar, Gujarat, India.*

Received *: 02/05/2025*
Received in revised form *: 21/05/2025*
Accepted *: 09/06/2025*

Corresponding Author:
Dr. Keyurkumar M Vaghela,
Assistant Professor, Department of Orthopaedics, GMERS Medical College, Gandhinagar, Gujarat, India.
Email: keyurvaghela1810@gmail.com

DOI: 10.70034/ijmedph.2025.3.23

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 129-133

ABSTRACT

Background: Low back pain (LBP) is a widespread complaint in outpatient clinics globally. As a crucial component of the kinetic chain, LBP affects the biological infrastructure that supports movement. This study aimed to investigate the correlation between LBP and lumbosacral angle in overweight patients.

Materials and Methods: This study was conducted on 200 patients with LBP at the Department of Orthopaedics, Jawaharlal Nehru Medical College, and Acharya Vinoba Bhave Rural Hospital. Patients were divided into test and control groups. Anthropometric measurements, including height and weight, were taken, and BMI was calculated. Self-reported pain was assessed using a visual analog scale (VAS). Radiographs of the lumbosacral spine were evaluated for angle measurements.

Results: The mean age of the test group was 46.48 years, and the control group was 43.52 years. Average VAS scores were significantly higher in the test group ($p=0.0375$), indicating more severe pain. Lumbosacral angles were also significantly higher in the test group. Notably, females in both groups had significantly higher lumbosacral angles ($p<0.001$).

Conclusion: This study demonstrates that overweight and obesity are potential risk factors for LBP, as they cause biomechanical alterations in the lumbosacral spine. Maintaining a healthy weight is crucial to prevent LBP. The findings of this study highlight the importance of weight management in reducing the risk of LBP.

Key Words: Low back pain, Overweight.

INTRODUCTION

Low back pain is a global health concern since antiquity and the ranks high among the top conditions contributing to the "disability-adjusted life-years" metrics.[1] Low back pain is commonly observed in the out-patient clinics worldwide.[2] It comprises about 65% of chronic musculoskeletal pain indication and is graded as the general state among males with individual indication. This pain indication is due to diseases and injuries in Annual Health, Labour and Welfare Report.[3] It affects the health of workers, their ability to work, as well as other problems, leading to loss in economy.[4,5] Low back pain is characterized by sudden or subacute pain presenting mostly in an acute form and can become chronic over time. It may also cause functional limitations and even lead to painful and restricted movements or loss of any movement.[6]

Pain in the lower back is one of the chief motives of discussion with a doctor all over the world. Low back pain affects eight out of ten people and results in poor quality of life, affecting their work activities and even their daily activities.[7] These epidemic proportions of back pain and its consequences like lost days at work and poor quality of life prompt to look out for the reasons or risk factors that are associated with low back pain. Additionally, back pain is also recognized as the major reason for filling workers' compensation claims.[8]

The National Health Interview Survey (NFHS) -3 conducted in 2005-06, they proposed that 4.6% was frequency of lost –workdays because of back pain and 101.8 million workdays were wasted by individuals with work related cases due to back ache.[9] According to Centre for Disease Control (CDC), unable to work is due to discomfort in back in the U.S. and it is resulted in reimbursement up to $50 billion per year in health care workers. Low back ache is the fifth and third reason for hospitalization and for surgical procedures respectively in ranking. Patients give reason of their spinal Introduction 2 pathology behind their inability to work and remain indicative, and it contributes to additional burden of disease.[10-12] Study of the lower back with respect to its anatomy reveals that it is an intricate structure of bones, ligaments, muscles, tendons and nerves. This complex structure combinedly work to various ranges of movement and function.[13]

It is a form of infrastructure in a biological machine that functions as an anchor for the kinetic chain. One of its main functions is the transfer of biomechanical forces in order to perform coordinated functional activities. The spine has many functions such as a conduit for transferring important neural structures and have physiological functions like crane for lifting and a crankshaft for walking. But the complex structure renders it vulnerable to injury. Many factors such as standing or sitting postures at desks for extended periods of time make our muscles and tendons tighten, reducing their pliability and causing back pain due to wrong postures adopted for long periods of time.[14,15] Another factor contributing to chronic low back pain is overweight and obesity.[16-19]

Obesity is a known risk factor for several cardiovascular and metabolic disorders.[20] Moreover, high Body Mass Index (BMI) has also been identified as an independent risk factor for Musculo-Skeletal Disorders (MSDs).[21,22] Osteoarthritis and Low Back Pain (LBP) occurs among obese subjects is 34% and 22%, respectively. A reasonable health issue is represented by MSDs globally and LBP is one of it.[23,24]

The effect of excess weight and obesity on lumbosacral spine anatomical angles (lumbosacral angles) is of clinical significance.[25] Several studies postulated that the variations in the angles of the lumbar spine and LBP were corelated. The elevation probability of LBP was related with the raise in lumbosacral angles.[26,27]

“These angles comprise Lumbar Lordosis Angle (LLA), Lumbo-Sacral Angle (LSA), Sacral Inclination Angle (SIA), and Lumbo-Sacral Disc Angle (LSDA).” Age, position, race, diseases and Introduction 3 surgery are conditions which affect Lumbosacral angles.[28-30] Hence, the present study was conducted to assess low back pain in overweight patients and it's lumbosacral angle correlation.

MATERIALS AND METHODS

The study is conducted on patients of Low back pain in Department of Orthopaedics, at Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital, Sawangi, Wardha during the period from December 2020 to November 2022. The present Study is titled as “Study of low back pain in Overweight and obese patients”. The study type is prospective cross-sectional study. The Study sample size is 200 patients, which has been divided into Test and Control group with 100 patients in each group.

Inclusion criteria 1. Patient of age between 20-70 years. 2. Body mass index more than 25 for Test group. 3. Body mass index between 18 and 25 for the Control group

Patients presenting in Orthopaedic department OPD, at Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital with back pain during the study period November 2020 to October 2022 were enrolled for the study. Written informed consent to participate in the study was taken from all the subjects. A data entry method is used to chart the demographic profile of the subjects and the relevant Anthropometric measurements. The data included age, sex, address, education, occupation, phone number, OPD number, IPD number, chief complaints and it’s all details such as localization of pain, severity, aggravating and relieving factors and treatment history. Physical examination included measurement of weight in kgs, height in meters and detailed examination of back. Anthropometric measurements Height and Weight were measured while participants were barefoot and wearing lightweight clothing. BMI was calculated. VAS used to measure self-reported pain. Present levels of LBP were noted by the participant on a 100mm line, with ‘no pain’ on the left anchor and ‘worst pain imaginable’ on the right anchor.

The lateral view of the radio-graphs of the lumbosacral spine was evaluated for study of angles. The Parameters in lumbosacral spine x-ray normally present are the following and these were checked in our patients.

The lumbosacral angles were measured using computer assisted measurement PACS (Picture archive Communication System). All data was entered into Microsoft excel. Backup of the data was maintained. Patient’s identity and information were kept confidential; validity of the data was checked periodically by guides and experts. Mean standard deviation and percentages were calculated. On obtaining a normal distribution of the data, paired T test was used. Chi square test was used for analysis of nonparametric data.

RESULTS

The mean age of the test group was 46.48 years with a standard deviation of 13.31 years and that for the

control group was 43.52 years with a standard deviation of 12.93 years. There were 56 females and 44 males in test the group and 58 females and 42 males.

It was observed that the average BMI scores were significantly higher in the test group as compared to the control group ($p<0.001$). It was observed that the average VAS scores were significantly higher in the test group as compared to the control group ($p=0.0375$). p. It is observed that all the lumbosacral angles as described above are having significantly higher values in the test group as compared to the control group. It is observed that all the LSAs namely the LSA, Sacral inclination angle or SIA, Lumbar lordosis angle or LLA and the Lumbo-Sacral Disc angle or LSDA were significantly higher in the females in both the test and control groups ($p<0.001$).

Table 1: Comparison of BMI

BMI	Test group		Control group	
	Number	Percentage	Number	Percentage
18.5 to 24.9	0	0	100	100
25 to 25.9	81	81	0	0
>30	19	19	0	0
Total	100	200	100	100
p-value	0.001 (Significant)			

Table 2: Comparison of pain score

Pain score	Test group		Control group	
	Number	Percentage	Number	Percentage
1-2	42	42	55	55
3-4	50	50	41	41
>4	8	8	4	4
Total	100	200	100	100
p-value	0.0375 (Significant)			

Table 3: Comparison of LSA

LSA	Test group		Control group		p-value
	Mean	SD	Mean	SD	<0.031*
LSA	39.8	3.11	34.12	2.87	<0.001*
LLA	42.63	5.10	35.37	4.02	<0.001*
SIA	43.22	4.24	36.70	3.73	<0.001*
LSDA	14.79	2.43	13.19	1.88	<0.001*

DISCUSSION

The lumbosacral angles have tremendous clinical significance with regards to their association with LBP,[14,15,18] especially in those who have spinal implants and instrumentations,[22] and spine surgery.[23] In our study, we noted a positive association between LBP and Obesity. Other anthropometric variables like the waist and hip circumference, the Waist- Hip Ratio (WHR) and LSA found a significant correlation in both the groups ($P<0.01$). The LSAs were assessed against the BMI scores. The lumbosacral angle (LSA), lumbar lordosis angle (LLA), Sacral inclination angle (SIA) and the Lumbo-sacral disc angle (LSDA) were significantly higher in the test group as compared to the control group. The higher LSA and LLAs in obese and overweight subjects were attributed to the increased mechanical loading of the lumbar spine that led to the subsequent exaggeration of LSA and the LLA. This change in the LSA appears to be similar to the postural changes observed in pregnant women.[27]

This lumbar loading during pregnancy or as a result of the abdominal obesity, leads to "biomechanical changes that produce higher compressive force and increase the shear stress on the lumbar spine, resulting in an increased incidence of mechanical LBP in individuals with raised BMI and truncal obesity as indicated by a high WHR. Several studies have similarly reported positive associations between increased lumbar lordosis and LBP.[31-32] These biomechanical effects of increased BMI and WHR on LLA increase the incidence of LBP among overweight and obese individuals." In the present study, there was no significant variation in the mean lordosis angles between the males and females. However, some of the studies have reported greater lordotic angles in women.[27-29] This might have been attributed to the ethnic and racial differences in the study populations. It was also observed that the overweight and obese subjects had significantly higher SIA than the controls.

In the present study, there is positive and statically significant association between BMI and LSA, LLA, SIA and LSDA in males and females. Similar findings have been reported by Fernand and Fox,[27] Caglayan et al,[29] and Evcik and Yucel.33 However, some of the studies have reported a significant correlation between BMI, and LSA and LSDA in males and with SIA and other parameters in females. The LSAs were significantly higher in those with BMI >25 in both the groups in males as well as females. It was reported by Caglayan et al,[29] that SIA and BMI were higher in female patients with LBP which is similar to the findings of

the present study. This might be related to the position of the sacrum in the pelvic girdle of the females and has a bearing on the pelvic inlet and outlet diameters. Therefore, the sacral inclination that seems to be more in females, creation of a larger pelvic outlet diameter for females, which serves as an major parameter during delivery. This explains the naturally higher SIA in females as a biological variation. In obsess individuals, there is axial loading of the sacral vertebrae that leads to increased sacral inclination. Some studies have reported a positive correlation between raised value of SIA and LBP.[28-32]

Similarly, Evcik and Yucel33 has reported that large SIA was found in patients with chronic LBP. On the other hand, increased SIA has been proved to be associated with spondylolisthesis and isthmic pathologies.[29,33] "This may further contribute to facet joint problems and spinal stenosis which results in increased incidence of LBP among individuals with high BMI. The present study also showed a significant correlation between BMI and LSDA. This can be explained by the increased sacral inclination in the test group. The higher values of the LSDA are directly proportional to the sacral inclination, thereby directly affecting the LSDA. It was also reported by some of the studies that an increase in LSDA is positively corelated with an increased incidence of facet syndrome particularly in patients with chronic LBP.[34,35] A minimal increase in the LSDA only to an extent of 1.5° has been reported to increase the compressive and shearing forces exerted at L5 /S1 facet joint. These facet joints in the lumbar vertebral column are not adapted for weight bearing but are functioning as a shock absorber that helps to prevent spinal injuries due to excessive rotation. Therefore, even minor biomechanical changes at the lumbosacral segments result in exaggerated shearing and compressive forces at the lumbosacral facet joints, giving rise to mechanical LBP.[48]

CONCLUSION

Based on observations of the present study it can be concluded that an increase in Body mass Index leads to increase in various angles of Lumbo-sacral spine like Lumbo-sacral angle, Lumbar lordosis angle, Sacral inclination angle and Lumbo-sacral disc angle. This increase is propositional to the BMI irrespective of gender. Obesity causes biomechanical alterations in the lumbosacral spine, which may cause to a rise in the prevalence of LBP. Therefore, the present study establishes that overweight and obesity are potential risk factors for LBP.

REFERENCES

1. Global Burden of Disease Study 2013 Collaborators: Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet, 2015, 386: 743–800.
2. Srivastava N, Goel S. A study of patient satisfaction level in inpatient spine department of a tertiary care multispecialty hospital. J Med Res Innov. 2019; 3: e000147.
3. Cailliet R. Low Back Pain Syndrome FA Davis: Philadelphia, PA; 1988.
4. Koes, B. W., van Tulder, M. W., & Thomas, S. Diagnosis and treatment of low back pain. BMJ (Clinical research ed.) 2006; 332(7555): 1430–1434.
5. Van Tulder MW, Koes BW. Low back pain: acute. Clinical Evidence. London: BMJ Publishing Group, 2006.
6. Pengel LHM, Herbert RD, Maher CG, Refshauge KM. Acute low back pain: a systematic review of its prognosis. BMJ 2003; 327: 323-5.
7. Van den Hoogen HJ, Koes BW, van Eijk JT, Bouter LM, Deville W. On the course of low back pain in general practice: a one year follow up study. Ann Rheum Dis 1998;57: 13-9.
8. Guo, H. R., Tanaka, S., Halperin, W. E., & Cameron, L. L. Back pain prevalence in US industry and estimates of lost workdays. American journal of public health 1999; 89(7): 1029–1035.
9. Leigh JP, Sheetz RM. Prevalence of back pain among fulltime United States workers. Br J Ind Med. 1989 Sep;46(9):651–657.
10. Cunningham LS, Kelsey JL. Epidemiology of musculoskeletal impairments and associated disability. Am J Public Health. 1984 Jun;74(6):574–579.
11. Lalich NR, Sestito JP. Occupational health surveillance: contributions from the National Health Interview Survey. Am J Ind Med. 1997 Jan;31(1):1–3.
12. Deyo RA, Tsui-Wu YJ. Descriptive epidemiology of low-back pain and its related medical care in the United States. Spine (Phila Pa 1976) 1987 Apr;12(3):264–268.
13. Saladin K. Anatomy and Physiology: The Unity of Foam and Function1st ed: New York; 1998.
14. Kripa, S., Kaur, H. Identifying relations between posture and pain in lower back pain patients: a narrative review. Bull Fac Phys Ther 2021; 26: 34.
15. Nourbakhsh MR, Arab AM. Relationship between mechanical factors and incidence of low back pain. J Orthop Sports Phys Ther. 2002;32(9):447–60.
16. Pope MH, Bevins T, Wilder DG, Frymoyer JW. The relationship between anthropometric, postural, muscular, and mobility characteristics of males ages 18-55. Spine (Phila Pa 1976). 1985;10(7):644–8.
17. Dieck GS, Kelsey JL, Goel VK, Panjabi MM, Walter SD, Laprade MH. An epidemiologic study of the relationship between postural asymmetry in the teen years and subsequent back and neck pain. Spine (Phila Pa 1976). 1985;10(10):872–7.
18. Lederman E. The fall of the postural–structural–biomechanical model in manual and physical therapies: exemplified by lower back pain; 2010; 1–14.
19. Sullivan PO, Dip G, Ther M, Physio D, Nolan D. "Sit up straight": time to re-evaluate. Spine-Lippincott. 2019;49(8):562–4.
20. Nilsen TIL, Holtermann A, Mork PJ. Physical exercise, body mass index and risk of chronic pain in the low back and neck/shoulders: longitudinal data from the NordTrondelag Health Study. Am J Epidemiol. 2011; 174:267–273.
21. Blagojevic M, Jinks C, Jeffery A, Jordan KP. Risk factors for onset of osteoarthritis of the knee in older adults: a systematic review and meta-analysis. Osteoarthritis Cartilage. 2010; 18:24–33.
22. Viester L, Verhagen E, Hengel KM, Koppes L, Van der Beek A, Bonger P. The relation between body mass index and musculoskeletal symptoms in the working population. BMC Musculoskelet Disord. 2013; 14:238.
23. Mellin G, Harkappa K, Vanharanta H, Hupli M, Heinonen R, Jarvikoski A. Outcome of a multimodal treatment including intensive physical training of patients with chronic low back pain. Spine. 1993;18(7):825–829.

24. Leboeuf-Yde C. Body weight and low back pain: a systematic literature review of 56 journal articles reporting on 65 epidemiologic studies. Spine. 2000; 25:226–237.
25. Shiri R, Karppinen J. The association between obesity and low back pain: A metaanalysis. Am J Epidemiol. 2010; 171: 135-54.
26. Lord MJ, Small JM, Dinsay JM, Watkins RG. Lumbar lordosis. Effects of sitting and standing. Spine. 1997; 22:2571–2574.
27. Fernand R, Fox DE. Evaluation of Lumbar lordosis: a prospective and retrospective study. Spine. 1985; 10:799–803.
28. Sarikaya S, Ozdolap S, Gumustas S, Koc U. Low back pain and lumbar angles in Turkish coal miners. Am J Ind Med. 2007; 50:92–96.
29. Caglayan M, Tacar O, Demirant A, et al. Effects of lumbosacral angles on development of low back pain. J Musculoskelet Pain. 2014; 12(3):251–255.
30. Gelb DE, Lanke LG, Bridwell KH, Blanke K, McEnery KW. An analysis of sagittal spine alignment in 100 asymptomatic middle aged and older volunteers. Spine. 1995; 20:1351– 1358.
31. Korovessis PG, Stamatakis MV, Baikousis AG. Reciprocal angulation of vertebral bodies in the sagittal plane in an asymptomatic Greek population. Spine. 1998;23(6):700–705.
32. Murrie VL, Dixon AK, Holingworth W, Wilson H, Doyle TA. Lumbar lordosis: study of patients with and without low back pain. Clin Anat. 2003; 16(2):144–147.
33. Evcik D, Yucel A. Lumbar lordosis in acute and chronic low back pain patients. Rheumatol Int. 2003; 23:163–165.
34. Cox JM. Low Back Pain: Mechanisms, Diagnosis and Treatment. 6th ed. Baltimore: Williams and Wilkins; 1999:480–512.
35. Yochum TR, Rowe LJ. Essentials of Skeletal Radiology. Vol 1. 3rd ed. Philadelphia: Williams and Wilkins; 2005:53–70.