ORIGINAL RESEARCH

IMPACT OF BODY MASS INDEX ON PAIN SEVERITY IN LUMBAR FACET ARTHROPATHY: AN OBSERVATIONAL STUDY

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Abstract

Background: Lumbar facet arthropathy is a common cause of chronic low back pain (LBP), with increasing evidence suggesting a link between obesity and pain severity. However, the relationship between body mass index (BMI) and pain intensity in facet-mediated LBP remains underexplored.

Methods: A cross-sectional study was conducted on 50 patients aged 40–70 with clinically diagnosed lumbar facet arthropathy at Siloam General Hospital Lippo Village between February and June 2022. BMI was calculated and categorised per the WHO Asia-Pacific criteria. Pain severity was measured using the Numerical Rating Scale (NRS). Associations between BMI and pain severity were analysed using Chi-square or Fisher's exact tests.

Results: Most patients were female (52%) and aged 51–60 years (42%). Obesity was prevalent (46%), and 54% of participants experienced severe pain. A significant association was found between higher BMI and pain severity ($p = 0.004$), with overweight or obese patients having 8.73 times higher odds (95% CI: 2.04–37.30) of reporting severe pain compared to those with normal or underweight BMI.

Discussion: These findings suggest a strong relationship between elevated BMI and increased pain severity in lumbar facet arthropathy. Potential mechanisms include increased mechanical loading and systemic inflammation mediated by adipokines.

Conclusion: Higher BMI is significantly associated with greater pain severity in patients with lumbar facet arthropathy.

Keywords: Lumbar facet arthropathy, low back pain, BMI, obesity, pain severity, facet joint degeneration, numeric rating scale.

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Introduction

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders globally, with epidemiological studies indicating that approximately 80% of individuals will experience at least one episode of LBP during their lifetime. [1,2]. It stands as a leading cause of disability worldwide and imposes a substantial

socioeconomic burden due to increased healthcare utilisation, work absenteeism, and decreased productivity[3–5].

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Facet joint arthropathy accounts for approximately 15% to 41% of chronic low back pain cases [6]. Lumbar facet joints, also known as zygapophysial joints, are paired synovial articulations between one vertebra's inferior articular process and the vertebra's superior articular process below. These joints are critical in maintaining segmental spinal stability, limiting excessive motion, and supporting controlled flexion, extension, and axial rotation. Facet-mediated pain arises when the facet joints undergo degenerative changes or inflammation, a condition clinically termed lumbar facet arthropathy [7,8]. Structural deterioration typically begins with cartilage degradation and progresses to joint space narrowing, subchondral bone sclerosis, osteophyte formation, and synovial hypertrophy [9]. Clinically, lumbar facet arthropathy presents as localised paraspinal pain typically worsened by lumbar extension and rotation, but usually occurs without significant neurological deficits. Radiological findings may support diagnosis through evidence of joint degeneration, although confirmation is optimally achieved via intra-articular injections [10,11].

Obesity, commonly assessed using body mass index (BMI), is a well-established risk factor for various musculoskeletal disorders, including osteoarthritis, intervertebral disc disease, sacroiliac joint dysfunction, piriformis syndrome, and other forms of non-specific low back pain[12–17]. BMI, a commonly used proxy for body fat composition, is classified by the World Health Organization (WHO) into underweight, normal, overweight, and obese[18]. Numerous studies have established a correlation between elevated BMI and increased mechanical loading on spinal structures, contributing to accelerated wear of the facet joints[19]. Additionally, adipose tissue functions as an active endocrine organ, producing pro-inflammatory cytokines such as interleukin-6 (IL-6), tumour necrosis factor-alpha (TNF-α), and leptin, which may further exacerbate joint inflammation and pain sensitivity [20,21].

While previous studies have shown a positive correlation between elevated BMI and low back pain severity [22,23], the specific link between BMI and pain intensity in patients with lumbar facet arthropathy remains insufficiently explored. Although low back pain is a multifactorial condition influenced by various factors, including physical activity, metabolic status, and fat distribution, this study focuses explicitly on BMI for several reasons. First, BMI remains the most widely used and accessible anthropometric indicator in clinical and epidemiological settings, offering a simple, reproducible, and cost-effective measure of obesity[24]. Second, while factors such as

visceral fat or metabolic conditions (e.g., insulin resistance) are known to influence systemic inflammation and pain modulation [25–27], these factors require advanced imaging techniques or laboratory evaluations, which are not routinely available in observational studies or resource-limited settings. Given the pathophysiological plausibility and increasing prevalence of obesity, understanding this relationship is critical for optimising clinical management and informing preventive strategies.

Materials and Methods

Fifty patients from the outpatient department at Siloam General Hospital Lippo Village were enrolled in this cross-sectional study between February and June 2022. The sample recruitment was done using a non-probability purposive sampling technique. All participants were aged between 40 and 70 years and were clinically diagnosed with lumbar facet arthropathy based on history, physical examination, and clinical judgment by a neurologist. The diagnostic criteria required the presence of at least three out of four clinical features suggestive of facet-mediated pain: (1) localized pain over the lumbar vertebral region, (2) tenderness upon palpation, (3) referred pain to the thigh or lower extremity, and (4) pain exacerbated by lumbar extension and rotation but relieved by flexion. We excluded patients with a history of spinal trauma, spinal deformities, or those who did not consent to participate in the study.

After obtaining informed consent, participants were asked to complete a structured form, which included demographic information such as age, sex, height, weight, and BMI calculation. Pain severity, as the primary dependent variable, was measured using the Numerical Rating Scale (NRS), with pain levels categorised as mild (1–3), moderate (4–6), and severe (7–10)[28,29]. The independent variable in this study was BMI derived from self-reported height and weight, and classified based on the World Health Organization (WHO) Asia-Pacific guidelines, with the following cutoffs: underweight (<18.5 kg/m²), normal (18.5–22.9 kg/m²), overweight (23.0–24.9 kg/m²), obese I (25.0–29.9 kg/m²), and obese II (≥30.0 kg/m²)[18].

The collected data were entered and tabulated using Microsoft Excel 2013 and analysed with IBM SPSS Statistics version 24. The association between pain severity and BMI was examined using Chi-square or Fisher's exact test, depending on the distribution of expected values. Statistical significance was considered at $p < 0.05$. Descriptive statistics were used to summarise the demographic data.

This study adhered to established ethical principles and received approval from the Faculty of Medicine Ethics Committee, Pelita Harapan University. All participants were fully informed about the study's objectives, procedures, and potential benefits prior to enrollment. Written informed consent was obtained from each participant, confirming their voluntary agreement to participate in the study.

Results

This study included 50 participants with lumbar facet atrophy, most of whom were female (Table 1). The majority of

patients (42%) were in the 51–60 age group, followed by the 61–70 age group (32%) and the 40–50 age group (26%). The highest proportion of participants was categorised as obese (46%), while 24% were overweight, 28% had normal BMI, and only one patient (2%) was underweight. Pain severity was dominated by the severe category, with 27 patients (54%) experiencing severe pain, while 20 patients (40%) reported moderate pain, and only three patients (6%) had mild pain.

A strong association was observed between BMI and pain severity. Among patients with severe pain, the majority (89%) were overweight or obese, while only 11% had a normal or underweight BMI. Conversely, in the mild to moderate pain group, 52% had normal or underweight BMI, and 48% were overweight or obese. This association was statistically significant (p = 0.004), with overweight or obese patients having 8.73 times higher odds (95% CI: 2.04–37.30) of experiencing severe pain compared to those with normal or underweight BMI (Table 2).

Discussion

This study aimed to examine the association between BMI and pain severity in patients diagnosed with lumbar facet arthropathy. Among 50 patients, the majority were in the 51–60 age group (42%) with a near-equal gender distribution. Most notably, 46% of patients were classified as obese, and 54% experienced severe pain. A significant association was found between higher BMI (overweight/obese) and severe pain (p = 0.004), with an odds ratio of 8.73 (95% CI: 2.04–37.30), indicating that individuals with elevated BMI were over eight times more likely to report severe pain than those with normal or underweight BMI. These findings are consistent with prior research demonstrating that obesity and elevated BMI are strongly associated with increased prevalence and severity of low back pain, including facet-mediated pain[15,19,23,30].

Table 1. Demographic Characteristics of Patients with Lumbar Facet Arthropathy

Subject characteristics	N (50 patients)
Age Group (years)	
40-50	13 (26 %)
51-60	21 (42 %)
61-70	16 (32 %)
Gender	
Male	24 (48 %)
Female	26 (52 %)
BMI Category	
Underweight	1 (2 %)
Normal	14 (28 %)
Overweight	12 (24 %)
Obese	23 (46 %)
Pain Severity	
Mild (NRS 1-3)	3 (6 %)
Moderate (NRS 4-6)	20 (40 %)
Severe (NRS 7-10)	27 (54 %)

Table 2. Association Between BMI Categories and Pain Severity in Patients with Lumbar Facet Arthropathy

Subject characteristics	Pain Severity		p-value	OR [95 % CI]
	Mild/ Moderate (n=23)	Severe (n=27)		
BMI Category				
Under-weight/ Normal	12 (52%)	3 (11%)	0.004	8.73 [2.04 - 37.30]
Overweight/ Obese	11 (48%)	24 (89%)		

Supporting this, a study by Suri et al. showed that higher BMI is significantly associated with a greater risk of developing

moderate facet joint osteoarthritis, particularly among individuals classified as overweight or obese.

Moreover, Suri et al. also reported that each 1-unit increase in BMI (kg/m²) was associated with an 8% increase in the risk of moderate facet joint osteoarthritis, suggesting that even small BMI increments can meaningfully contribute to progressive facet joint degeneration[31]. A prior study conducted by Kalichman et al. demonstrated that among 187 randomly selected individuals, those classified as obese based on BMI had a significantly higher prevalence of facet joint arthritis (odds ratio 2.8 [1.1–7.2])[32]. A similar finding was reported by Higgins et al., who analysed data from 1,759,338 individuals with musculoskeletal disorders and found that higher BMI (particularly >27 kg/m²) was significantly associated with increased odds of musculoskeletal pain severity, including low back pain cases[33].

The pathophysiological mechanisms underlying this association are multifactorial. From a biomechanical perspective, excess body weight imposes greater axial loading on the lumbar spine, particularly on the facet joints, accelerating joint degeneration through repetitive stress and microtrauma[7,19,31]. Over time, this stress induces cartilage wear, osteophyte formation, and joint space narrowing, all contributing to pain generation. Beyond mechanical loading, obesity is also associated with systemic inflammation due to the increased secretion of pro-inflammatory cytokines such as TNF-α and IL-6 from adipose tissue [20,21]. These cytokines not only exacerbate local inflammation within the facet joints but also promote central and peripheral sensitisation, which amplifies pain perception and lowers the pain threshold.

These findings highlight the importance of incorporating weight management into the treatment paradigm for lumbar facet arthropathy. Interventions targeting BMI reduction may result in pain reduction, particularly when combined with other conservative or interventional treatments. Addressing obesity targets the mechanical load on the facet joints and may also reduce systemic inflammation that contributes to pain sensitisation.

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes the ability to establish causal relationships between BMI and pain severity; longitudinal studies are needed to clarify this temporal association. Second, the study was conducted during the COVID-19 pandemic, limiting in-person data collection opportunities. Consequently, some patient information had to be obtained indirectly through clinicians, potentially introducing reporting bias and reducing the accuracy of clinical assessments. Third, this study did not analyse the relationship between pain severity and potential confounding variables such as psychosocial stressors, physical activity levels, or comorbid conditions like diabetes or depression, all of which may influence pain perception or interact with BMI. Future research with larger sample sizes should incorporate these variables into multivariate models to better adjust for potential confounding factors.

Conclusion

This study demonstrates a significant association between elevated body mass index and increased pain severity in patients with lumbar facet arthropathy. Individuals classified as overweight or obese were over eight times more likely to report severe pain compared to those with normal or low BMI, reinforcing the role of excess weight in exacerbating facet joint pathology. The underlying mechanisms likely involve biomechanical stress on spinal structures and systemic inflammation mediated by adipose-derived cytokines. These findings highlight the clinical relevance of incorporating weight management strategies into the multidisciplinary care of patients with lumbar facet arthropathy.

Conflict of Interest

The authors declared no conflict of interest.

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