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The Relationship Between Body Mass Index and Pain Severity in Patients with Knee Osteoarthritis at Buleleng Regional General Hospital (RSUD Buleleng)

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ABSTRACT

Osteoarthritis (OA) is a prevalent joint disease marked by morning stiffness, crepitus, and pain during movement, and it represents a major cause of disability among older adults worldwide. Body mass index (BMI) has been identified as an important factor associated with pain severity in patients with knee osteoarthritis. This study aimed to examine the relationship between body mass index and pain intensity in individuals with knee osteoarthritis. A cross-sectional study design was employed involving 50 participants who fulfilled the inclusion and exclusion criteria, consisting of 22 men and 28 women. Body mass index was assessed using standardized measurements of body weight and height, while pain intensity was evaluated using the Numeric Rating Scale (NRS). The association between BMI and pain severity was analyzed using Spearman's rank correlation test. The findings demonstrated a statistically significant positive correlation between body mass index and pain intensity in patients with knee osteoarthritis, with a moderately strong correlation ($p < 0.001$; $r = 0.549$).

INTRODUCTION

Osteoarthritis (OA), commonly known in everyday terms as joint degeneration or "wear-and-tear arthritis," is a joint disorder and a leading cause of disability among the elderly population worldwide (Liew et al., 2023). Osteoarthritis can affect various joints, including the knee (knee OA), hand (hand OA), and hip (hip OA) (Warwick et al., 2022). However, knee osteoarthritis is the most common form and is characterized by morning joint stiffness, crepitation, and pain that occurs during physical activity (Wijaya, 2018). Knee osteoarthritis occurs most frequently because the knee joint bears body weight during daily activities (Washilah et al., 2021)

The World Health Organization (WHO) reported that in 2019, approximately 528 million individuals worldwide were affected by osteoarthritis (OA), reflecting a 113% increase since 1990. Data from the 2018 Indonesian Basic Health Research (RISKESDAS) indicated that osteoarthritis

accounted for 7.2% of all diagnosed joint-related conditions in Indonesia. Osteoarthritis represents a significant health burden among the elderly population, as pain associated with the condition often results in decreased engagement in daily activities and deterioration in overall quality of life (Ismunandar et al., 2019). Numerous risk factors have been identified for osteoarthritis, including advancing age, sex, genetic predisposition, obesity, levels of physical activity, and prior joint injury (Warwick et al., 2022).

Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory experience. In osteoarthritis, pain is usually felt in the affected joint, becomes more severe when the joint is moved or used to bear body weight, and decreases with rest. The pathomechanism underlying pain in patients with osteoarthritis has not been fully elucidatet however, pain in osteoarthritis originates from tissues surrounding the joint, such as the synovium, intra-articular fat pad, ligaments, joint capsule, and subchondral bone (Loscalzo et al., 2022). These tissues are richly innervated, so inflammation or damage to them can trigger the sensation of pain. One of the main risk factors for osteoarthritis that is associated with the severity of pain experienced by patients is body mass index (Christiana et al., 2025).

Older adults generally undergo an aging process characterized by a decrease in muscle mass, an increase in fat mass, and a rise in body mass index (BMI) (Loeser et al., 2016). A higher BMI increases the load on the knee joints as they support body weight (Puspita Arintika et al., 2022). During physical activity, obesity increases mechanical stress on the joints, which accelerates the progression of osteoarthritis and contributes to the development of pain (Chen et al., 2020). Moreover, individuals with elevated body mass index, particularly those with obesity, exhibit alterations in adipose tissue function that result in increased secretion of pro-inflammatory mediators, including leptin, tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-1β (IL-1β). These inflammatory factors contribute to the amplification of inflammatory responses and play a role in intensifying pain perception (Devi et al., 2024).

Previous studies have explored the association between body mass index (BMI) and pain severity in patients with knee osteoarthritis. Devi et al. (2024) demonstrated a significant relationship between BMI and pain intensity, whereas Maulani and Chondro (2025) reported opposing findings, indicating no significant association between BMI and pain severity in knee osteoarthritis patients. These inconsistencies in existing evidence, coupled with the high prevalence of osteoarthritis, highlight the need for further investigation. Therefore, this study was conducted to analyze the relationship between body mass index and pain severity among patients with knee osteoarthritis treated at Buleleng Regional General Hospital (RSUD Buleleng).

METHODS

This research employed an analytic observational design with a cross-sectional approach to examine the relationship between the variables of interest. The study was carried out at the Orthopedic Outpatient Clinic of Buleleng Regional General Hospital (RSUD Buleleng) between July and December 2025. The study population comprised all patients diagnosed with osteoarthritis who were registered at the clinic during the study period. A total of 50 participants were included in the analysis, selected in accordance with predetermined inclusion and exclusion criteria. The sampling technique employed was consecutive sampling, in which osteoarthritis patients visiting the outpatient clinic were recruited consecutively until the minimum required sample size was achieved. The inclusion criteria were patients diagnosed with osteoarthritis aged 40 years or older. The exclusion criteria included patients who refused to participate, patients who were unable to stand independently, and patients with a history of anterior cruciate ligament (ACL) injury. The independent variable in this study was body mass index (BMI), obtained from primary data through direct measurement of body weight using a digital scale (GEA) with a precision of 0.1 kg and height using a stadiometer (Onemed) with a precision of 0.1 cm. The dependent variable was pain severity, measured using the Numeric Rating Scale (NRS) ranging from 1 to 10. Data analysis was performed using the Spearman rank correlation test.

RESULTS

A total of 50 respondents were included in this study, of whom 56% (28 individuals) were female and 44% (22 individuals) were male. The respondents were predominantly in the older age group, with a mean age of 55.96 ± 9.370 years. The mean body weight of the respondents was 64.6 ± 10.2 kg, while the mean height was 1.57 ± 0.071 m. The respondents' body mass index (BMI) fell within the overweight category, with a mean BMI of 26.40 ± 4.561 kg/m². Pain intensity assessed using the Numeric Rating Scale (NRS) showed a median value of 6, with a minimum–maximum range of 2–10, indicating moderate pain among the study population (Table 1).

Table 1. Characteristics of the Study Sample

Variable	Mean	Standard Deviation	Min-max	Median
Age	55,96	9,37	42-76	52,5
Body Weight (kg)	64,60	10,248	40-99	65
Height (m)	1,57	0,0711	1,40-1,70	1,55
Body Mass Index (kg/m²)	26,40	4,561	17.09-39.66	25,91
Numeric Rating Scale (NRS)	5,86	1,75	2-10	6

Table 2. Results of the Variable Normality Test

Variable	Shapiro–Wilk	Notes
Body Mass Index (kg/m²)	0,481	Normally Distributed
Numeric Rating Scale (NRS)	0,038	Not Normally Distributed

Based on the results of the normality test using the Shapiro–Wilk test, the body mass index (BMI) data showed a p-value of 0.481, which is greater than 0.05, indicating a normal distribution. Meanwhile, pain severity data measured using the Numeric Rating Scale (NRS) had a p-value of 0.038, which is less than 0.05, indicating a non-normal distribution. Therefore, data analysis was performed using the Spearman rank correlation test..

Table 3. Results of the Spearman Correlation Test

	Correlation Coefficient	Direction of Correlation	Category	p-value
Relationship Between Body Mass Index and Pain Severity in Patients with Knee Osteoarthritis at RSUD Buleleng	0,549**	Positive	Moderately Strong	<0,001

Based on the results of the bivariate analysis using the Spearman rank correlation test, a p-value of < 0.001 was obtained, indicating that the null hypothesis (H_0) was rejected and the alternative hypothesis (H_a) was accepted. The correlation coefficient value of r = 0.549 indicates a significant positive correlation with a moderately strong strength between the variables (Table 3).

DISCUSSION

The results of this study indicate a significant relationship between body mass index (BMI) and pain severity in patients with osteoarthritis at RSUD Buleleng. These findings are consistent with the

study by Devi et al. (2024), which involved 101 participants and demonstrated a significant association between BMI and pain severity in patients with osteoarthritis ($p < 0.001$). Similarly, Gupta (2017) reported comparable results, showing that among 109 osteoarthritis patients, there was a significant relationship between BMI and the degree of pain experienced by patients ($p < 0.001$; $r = 0.67$).

Osteoarthritis is a degenerative disease that leads to decreased joint function and reduced quality of life (Kanamoto et al., 2020). Anatomically, aging is associated with structural and physiological changes, including cartilage degradation, reduced bone remodeling, and osteophyte formation, which result in clinical symptoms such as pain, joint stiffness, swelling, and decreased range of motion (Swandari et al., 2022). In general, the underlying pathophysiology of osteoarthritis involves degradation of the cartilage matrix due to mechanical loading that exceeds the joint's capacity for remodeling through proteoglycan synthesis. Proinflammatory cytokines released by chondrocytes and synovial cells during this process diffuse into the joint environment, leading to a state of chronic low-grade inflammation. These conditions ultimately result in chondrocyte loss and severe degradation of the cartilage matrix (Kumar et al., 2018).

Body mass index (BMI) is one of the main risk factors for the development of knee osteoarthritis and is associated with two primary mechanisms: biomechanical and biochemical (Christiana et al., 2025). From a biomechanical perspective, a high BMI (obesity) accelerates the progression of cartilage damage and increases joint loading during walking. This excessive mechanical stress compresses nerve endings around the joint and triggers pain in affected patients (Nascimento et al., 2023). From a biochemical perspective, obesity is associated with alterations in the intrapatellar fat pad (IFP). Changes in IFP function can disrupt adipogenesis and increase the production of pro-inflammatory cytokines such as tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-1β (IL-1β). These inflammatory mediators promote joint inflammation and contribute to the development and intensification of pain in patients with osteoarthritis (Devi et al., 2024).

CONCLUSION

The results of this study revealed that most participants were female, with the mean body mass index classified as obesity class I, and the majority of patients experiencing moderate pain intensity. Statistical analysis using Spearman's rank correlation test showed a significant positive association between body mass index and pain severity, with a moderately strong correlation. These findings suggest that increased body mass index is related to higher levels of pain in patients with knee osteoarthritis treated at RSUD Buleleng.

RECOMMENDATIONS

The findings of this study underscore the importance of a comprehensive and collaborative approach to osteoarthritis prevention and management. At the policy level, governments are encouraged to strengthen preventive programs for high-risk populations, particularly older adults, through education on balanced nutrition, promotion of regular physical activity, and optimization of community-based services such as routine BMI screening at local health posts. At the clinical level, RSUD Buleleng is expected to implement more personalized management strategies for knee osteoarthritis by integrating appropriate dietary guidance and structured rehabilitation programs, thereby improving patients' quality of life and reducing reliance on analgesic medications. From a community perspective, individuals are advised to maintain healthy eating habits and remain physically active through light exercises such as walking, while ensuring adequate rest when pain increases after activity. Finally, future research is recommended to employ more comprehensive assessment tools, such as the WOMAC score, to better evaluate pain, joint stiffness, and physical function, and to consider additional confounding variables such as bone mineral density, given the potential coexistence of osteoarthritis and osteoporosis.

LIMITATIONS

This study has several limitations that should be taken into consideration. The variables examined were limited to body mass index and pain severity, while other factors that may influence the condition of patients with osteoarthritis—such as joint stiffness, joint function, and quality of life—were not evaluated. In addition, pain assessment was conducted solely using the Numeric Rating Scale (NRS) with a 1–10 scale, resulting in a relatively simple evaluation of pain. Other instruments, such as the Visual Analogue Scale (VAS) or the WOMAC Score, could provide a more comprehensive assessment by evaluating not only pain but also joint stiffness and physical function within the past 24 hours. Another limitation relates to the measurement of body mass index, as body weight and height were assessed using separate devices, which posed some difficulty for respondents during data collection. Therefore, the use of integrated devices for measuring body weight and height is recommended to improve the efficiency of data collection and enhance participant comfort.

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