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ORIGINAL ARTICLE

An analysis of differences in kellgren-lawrence scores between patients with knee osteoarthritis and class II obesity versus those without obesity

Fransiska Ambarukmi[1*], Djoni Kusumah[2], Herfani H Dewi[3]

1) Department of Anatomy, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia.
2) Department of Anesthesiology, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia.
3) Medicine Study Program, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia

*Corresponding author. E-mail: ambarukmifransiska@gmail.com

ABSTRACT

Individuals with overweight or obesity are at a higher risk of developing knee osteoarthritis (OA) compared to those with a normal body mass index (BMI). This increased risk is attributed to metabolic effects and the excessive mechanical load on the joint, which escalates with weight gain. Previous studies have established a correlation between the higher BMI and increased severity of joint damage in patients with knee OA. This analytic, comparative study utilized cross-sectional design to investigate the difference in Kellgren-Lawrence (KL) Score between patients with and without obesity who have knee osteoarthritis (OA) The analysis was conducted using secondary data from medical records and knee X-rays at Cianjur General District Hospital during 2020. A total of 50 patients were included, with 25 patients in each group (OA with obesity and OA without obesity). The majority of participants were female (80%), aged 56-65 years old (52%), and had a BMI classified as class II obesity (50%). KL Score ranged from grade 1 to 3. Data analysis using the non-parametric Mann- Whitney U test revealed a statistically significant difference in KL Score between the two groups (p-value=0.000). The increased mechanical stress associated with obesity is hypothesized to be a causative agent that aggravates joint damage, as evidenced by the more severe degree of the Kellgren- Lawrence Score in the obese population. In conclusion, a significant difference in the severity of OA Genu degree, based on the Kellgren-Lawrence scoring system, was found between obese and non-obese patients.

Keyword: knee OA, overweight, obesity, Kellgren-Lawrence Score, X-rays

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INTRODUCTION

Osteoarthritis (OA) is a clinical syndrome characterized by joint pain accompanied by varying degrees of functional limitation and a reduced quality of life. Pathologically, it is marked by localized degradation of articular cartilage, subchondral bone remodeling, osteophyte formation, and synovial inflammation. These pathological changes result in the cardinal manifestations of pain, stiffness, swelling, and impaired joint function.[1,2] These limitations interfere with the performance of essential daily activities, such as walking and lifting.[3] As the most common form of arthritis, OA is one of the most prevalent chronic diseases worldwide. It affects approximately 32.5 million adults in the United States, with global estimates reaching 302 million individuals. This high prevalence establishes OA as a leading cause of disability, particularly among elderly populations. Osteoarthritis (OA) predominantly affects appendicular joints, including the knees, hips, and hands. The knee joint (genu) is the most frequently affected site, with a global prevalence higher in women (4.8%) than in men (2.8%).[3] Data from 2007 Indonesian National Basic Health Research (Riskesdas) indicated that 15.5% of men and 12.7% of women aged 40–60 years were diagnosed with knee OA based on radiological evidence. These epidemiological patterns suggest that gender is a significant factore in OA development, with a higher prevalnce observed in women. This disparity is primarily due to hormonal factors, particularly the decline of estrogen levels during menopause, which is associated with reduced bone density and compromised joint integrity.[4] Furthermore, previous studies suggest that aging is associated with increased oxidative stress, which plays a central role in disrupting the balance between catabolic and anabolic signaling pathways, thereby contributing to progressive cartilage matrix degradation.[5] Supporting these findings, a study conducted at the Rheumatology Clinic of Hasan Sadikin Hospital in 2007 and 2010 reported that 74.48% of patients sought treatment for OA. Among these patients, 69% were women, and the majority (87%) were diagnosed with knee OA.[6]

Knee osteoarthritis (OA) is thought to be predisposed by the metabolic effects of excess body weight, which imposes greater mechanical stress on weight-bearing joints such as the hips and knees. This biomechanical burden increases further in individuals with overweight or obesity, thereby elevating their risk of developing OA[3] In 2016, over 1.9 billion adults aged 18 years and older were classified as overweight, of whom more than 650 million were obese. According to the World Health Organization (WHO), 13% of the global adult population was obese, with nearly equal prevalence rates among both women (40%) and men (39%). The global prevalence of obesity has nearly tripled between 1975 and 2016.[9] Obesity is a significant public health concern that increase the risk of numerous comorbidities, including type 2 diabetes, cardiovascular disease, liver disorders, and osteoarthritis.[8] Consequently, multiple cross-sectional and longitudinal studies have consistently identified a strong association between obesity typically measured by body mass index (BMI) and both the prevalence and incidence of knee OA. As a result, obesity is recognized as one of the most significant modifiable risk factors for the disease.[1] A meta-analysis by Zheng & Cheng (2015) found that individuals who are overweight or obese have a 2.5 to 4.6 times higher likelihood of developing knee OA compared to those with a normal body weight. Furthermore, the risk of knee OA increases by approximately 35% for every 5 kg/m^2 increment in BMI.[10] Raud et al. (2020) reported a positive correlation between the degree of obesity and the clinical severity of knee OA. Participants with a higher BMI reported more intense pain, greater functional disability, and higher incidences of depression and anxiety.[11]

Supporting the correlation between obesity and structural joint damage, a study by Hardiyanti et al. (2020) also identified a significant association between BMI and the severity of joint damage severity assessed by the Kellgren-Lawrence (KL) classification system. The study found that the majority of obese knee OA patients (30.9%) were classified as KL grade 3.[12]

The diagnosis of OA is established through clinical assessment and confirmed by radiographic imaging. The gold standard for radiological grading of knee OA severity is the Kellgren-Lawrence (KL) classification system.[13] This system is specifically applied using anterior-posterior (AP) projection radiographs of the knee joint and grades OA severity from 0 to 4, where grade 0 indicates no radiological features of OA and grade 4 indicatessevere OA.[14] Previous studies on gthe relationship between obesity and KL grade have reported conflicting results. A study by Mutiwara et al. (2016) in Padang found that 88.9% of obese patients had more severe knee OA compared to those with normal body weight, demonstrating a significant relationship between BMI and joint damage severity based on radiological assessment.[15] Similarly, Hardiyanti et al. (2020) reported a significant correlation between BMI and Kellgren-Lawrence grades among knee OA patients in Kupang, with higher grades observed in obese individuals.[16] In contrast Widhiyanto et al. (2017) at Dr. Soetomo Regional Hospital in Surabaya found no significant relationship between BMI and the severity of knee OA, suggesting that other risk factors may play a more prominent role in disease progression.[17] Likewise, Khaidar (2017) reported no statistically significant effect of BMI on knee OA severity among elderly patients.[18] These discrepancies highlight inconsistencies in the current literature regarding the association between obesity and radiographic severity of knee OA, highlighting a need for further research. OA is a common disease in Indonesia, and obesity is a major modifiable risk factor. However, studies on this relationship remain limited in West Java. This gap in the literature has prompted the present study, which aims to analyze differences in Kellgren-Lawrence scores between obese and non-obese patients with knee OA. RSUD Sayang Cianjur was selected as the research site, as it serves as a representative regional hospitals for studying OA epidemiology in West Java Province.

METHODS AND SUBJECT

This study employed a comparative analytical design with a cross-sectional approach. Comparative analytical research aims to evaluate differences in one or more variables between two or more distinct groups. A cross-sectional design involves data collection at a single point in time.[19] The primary objective of this study was to determine the differences in Kellgren-Lawrence scores between patinets with knee osteoarthritis who were obese and those who were non-obese at at RSUD Sayang Cianjur during the 2020 period. This study utilized secondary data, which were obtained from patient medical records and corresponding knee joint radiographs (X-rays) archived at RSUD Sayang Cianjur for the 2020 period.

Sample Size

Data for this study were retrieved from medical records and radiograph archives at the Radiology Department of RSUD Sayang Cianjur. A purposive sampling technique was employed, wherein subjects were selected based on specific characteristics and predefined criteria aligned with the study objectives. The minimum required sample was calculated using a formula for hypothesis testing of the difference between two proportions.[20] Based on this calculation, a minimum of 50 subjects was determined. The final sample comprised 25 patients with knee osteoarthritis (OA genu) without obesity and 25 patients with knee osteoarthritis and Class II obesity.

The variables analyzed in this study included: primary diagnosis of knee osteoarthritis, the severity of OA genu (as assessed by the Kellgren-Lawrence grading system), body mass index (BMI) category (normal vs. Class II obesity), age, and sex.

Research Procedure

The initial step in preparing for this research involved conducting a comprehensive literature review on knee osteoarthritis (OA genu) and its association with obesity. Prior to data collection, ethical clearance was obtained following a review by the ethics Committee of the Faculty of Medicine, Universitas Jenderal Achmad Yani. Subsequently, a formal research permit was secured from the administration of RSUD Sayang Cianjur.

Data collection was conducted within the medical records department of RSUD Sayang Cianjur. Subject selection was performed using a purposive sampling method based on the predetermined inclusion and exclusion criteria. The analyzed data consisted of secondary information, including patient medical records for those diagnosed with knee osteoarthritis; comparing those with Class II obesity to those diagnosed with a normal BMI, along with data on age and sex. Corresponding radiographic data were retrieved from the hospital's Radiology Department archives.

Once collected, the data were processed to calculate frequency distribution and percentages for each variable. The results are presented descriptively in narrative form and summarized in tables. Following compilation, and analysis, the findings were incorporated into a final research report.

Data Analysis

The collected data were processed and analyzed using IBM SPSS Statistics software. The primary research objective was to analyze the difference in Kellgren-Lawrence scores between patients with knee osteoarthritis who were obese and those who were non-obese. As the KL score data were determined to be not normally distributed, the non-parametric Mann-Whitney U test was selected as the appropriate statistical method for analysis.

Research Setting and Timeframe

This study was conducted at RSUD Sayang Cianjur. The secondary data were obtained from patient medical records with documentation dates within the 2020 calendar year. The research activities, including data collection and analysis, were carried out between June to July 2021.

Ethical Considerations

This study utilized secondary data in the form of medical records of patients diagnosed with knee osteoarthritis who met the predefined inclusion criteria. To ensure ethical compliance, formal approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Jenderal Achmad Yani, under protocol number M1.2107.021 and approval letter number **032/UM1.07/2021**. Furthermore, official permission to access and utilize patient data was granted by the administration of RSUD Sayang Cianjur, as formally documented in letter number **073/1439/Datin and Litbang**.

RESULTS AND DISCUSSION

A total of 263 medical records and corresponding knee x-ray images from patients with knee osteoarthritis (OA genu) were identified from 2020 period. Following the application of inclusion and exclusion criteria, 50 subjects were selected for analysis. The final sample consisted of 25 patients with Class II obesity and 25 non-obese patients, all diagnosed with knee osteoarthritis (OA genu). As illustrated in Table 1, the majority of patients with OA Genu in this study were female (73.01%).

The distribution was consistent across both groups: the majority of patients with Class II obesity group were female (..%), as were the majority of non-obese group (60.98%), compared to 39.02% male. These findings are consistent with Endang's research conducted in Padang. It wasreported that 75% of OA genu patients were female.[15] Likewise, Hardiyanti et al. (2020) found that 71.1% of OA genu patients were female.[13]

Although the exact pathophysiological mechanisms remain unclear, female sex is recognized as a significant risk factor for the development of knee osteoarthritis. OA is generally more prevalent among males at younger ages; however, after the age of 50, the incidence and prevalence in females increase substantially. This epidemiological shift is strongly associated with a decreased estrogen production following menopause, which contributes to cartilage degeneration.[7] The predominance of females observed in this studyboth in the obese and non-obese OA groups can also be attributed to the fact that all participants were aged ≥55 years. Additionally, studies indicate that the rate of cartilage degradation in the knee, particularly in the patellofemoral compartment, can be up to three times faster in women, which may further explain the higher incidence of knee OA among female patients.[17]

Table 1. Characteristics of Knee Osteoarthritis Patients by Sex

Sex	Obese (n)	Obese (%)	Non-Obese (n)	Non-Obese (%)	Total (n)	Total (%)
Male	39	21.54	32	39.02	71	26.99
Female	142	78.46	50	60.98	192	73.01
Total	**181**	**100**	**82**	**100**	**263**	**100**

The age distribution of the study population is presented in Table 2. The majority of patients with Class II obesity (66,25%) were in the elderly group (60–65 years), while the remainder were in the older elderly group (>65 years). In contrast, among nonobese patients, the majority (n=52, 52.00%) were in older elderly group, with 48.00% in the elderly category. These findings are consistent with previous studies. Hardiyanti et al. (2020) reported that knee osteoarthritis (OA genu) was most frequently in the 60–69 age group, accounting for 30.9% of cases.[12] Studies conducted in Surabaya and Padang similarly found that 90% and 91.7% of OA genu patients, respectively, were aged 50 years or older.[15,17] Furthermore, a prospective cohort study by Reyes et al. (2016) demonstrated that the incidence of both knee and hip OA begins to increase after the age of 40, with marked surges observed in the 55–60 and 70–75 age ranges.[21]

Table 2. Characteristics of Knee Osteoarthritis Patients by Age

Age Group	Obese (n)	Obese (%)	Non-Obese (n)	Non-Obese (%)	Total (n)	Total (%)
Elderly (60–65 years)	108	66.25	48	48.00	156	59.31
Older elderly (>65 y)	55	33.75	52	52.00	107	40.69
Total	**163**	**100**	**100**	**100**	**263**	**100**

The results of this study indicate no significant difference in the prevalence of knee osteoarthritis between the elderly (60-65 years) and older elderly (>65 years) age groups, regardless of obesity status. This finding aligns with the established understanding that osteoarthritis is a degenerative condition whose incidence and prevalence increase with age, particularly after the fifth decade of life. Aging contributes to joint vulnerability through several mechanisms, including thinning of cartilage due to a diminished chondrocyte synthesis response, increased susceptibility to shear stress, failure of joint protective mechanisms due to age-related muscle weakness (sarcopenia), and slowed sensory nerve input, which impairs mechanoreceptor feedback. Additionally, aging-related ligament laxity reduces the ability to absorb mechanical impulses, thereby increasing the risk of joint damage.[7]

Characteristics of Kellgren-Lawrence Grading in Patients with Knee Osteoarthritis, with and without Class II Obesity, at RSUD Sayang Cianjur

The severity of joint damage, assessed by the Kellgren-Lawrence (KL) grading system, in patients with knee osteoarthritis (OA genu) is presented in Table 3, comparing those with Class II obesity to non-obese patients.

A significant difference in disease severity was observed between the two groups. Among patients with Class II obesity, the vast majority (96%) were classified with moderate to severe OA (KL grades 3-4). Specifically, 52.00% were categorized as KL grade 3, and 44.00% were classified as grade 4. A small minority (4.00%) presented with grade 2 OA. No patients in the obese cohort had grade 0 or 1 OA. In contrast, within the non-obese group, the majority of patients (96%) were in the early stages of the disease (KL grades 1-2), with 52.00% classified as KL grade 1 and 44.00% as grade 2. Only 4.00% presented with grade 3 OA, and no patients were classified as having severe (grade 4) OA.

Table 3. Distribution of Kellgren-Lawrence Scores among Patients with Knee Osteoarthritis with and without Grade 2 Obesity at RSUD Sayang Cianjur

Kellgren-Lawrence Grade	Obese (n)	Obese (%)	Non-Obese (n)	Non-Obese (%)	Total (n)	Total (%)
Grade 0	0	0.00	0	0.00	0	0.00
Grade 1	0	0.00	13	52.00	13	26.00
Grade 2	1	4.00	11	44.00	12	24.00
Grade 3	13	52.00	1	4.00	14	28.00
Grade 4	11	44.00	0	0.00	11	22.00
Total	**25**	**100.00**	**25**	**100.00**	**50**	**100.00**

These findings suggest that 96% of obese patients in this study had moderate to severe knee OA (KL grades 3 and 4), while only 4% had mild disease (grade 2). This distribution aligns with the findings of Hardiyanti et al. (2020), who reported that higher KL grades (3 and 4) were more prevalent among obese patients, accounting for 30.9% and 18.6% of cases, respectively, compared to lower grades (2.1% for grade 1 and 11.3%12 for grade 2).

Similarly, a study by Widhiyanto et al. (2019) conducted at Dr. Soetomo General Hospital in Surabaya found that a majority of obese patients were classified with advanced OA, specifically KL grades 3 and 4, with proportions of 26.6% and 10%, respectively22. These findings are also supported by a prospective cohort study conducted by Reyes et al. (2016), which demonstrated that individuals with obesity have a significantly higher risk of developing OA, particularly in the knee joint. This risk increases proportionally with body mass index (BMI). Thes study found that the patients with Class II obesity (BMI >35 kg/m²) were 4.7 times more likely to be diagnosed with knee OA compared to individuals with a normal BMI (<25 kg/m²).

Differences in Kellgren-Lawrence Scores Between Pateinets with Knee Osteoarthritis and Class II Obesity Versus Non-Obese Patients at RSUD Sayang Cianjur

The differences in Kellgren-Lawrence (KL) scores between patients with knee osteoarthritis (OA genu), with and without Class II obesity, at RSUD Sayang Cianjur for the 2020 period is shown in Table 4.

The mean Kellgren-Lawrence score was significantly higher in the obese group (37.28) compared to the non-obese group (13.52). This finding indicates that the severity of knee osteoarthritis is greater in patients with Class II obesity, underscoring the practical implications of managing obesity in the comprehensive care of osteoarthritis patients.

Table 4. Differences in Kellgren-Lawrence Scores Among Patients with and without Grade 2 Obesity

Group	N	Mean Rank	Sum of Ranks	p-value	Remark
Obesity 2	25	37.28	937.00	0.000	Significant
Non-Obesity	25	13.52	338.00		

The Mann-Whitney U test yielded a p-value of 0.000, which is lower than the significance level $\alpha = 0.05$. Therefore, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. The result leads to a conclusion that there is a statistically significant difference in Kellgren-Lawrence scores between patients with knee OA who have Class II obesity and those who are non-obese.[15] These results are consistent with previous research by Mutiwara et al. (2016), which also demonstrated a significant association between body mass index (BMI) and the severity of joint damage in knee OA patients. In that study, 88.9% of obese patients were classified with more advanced OA grades on the Kellgren-Lawrence scale. Similarly, Hardiyanti et al. (2020) reported a moderate positive correlation between BMI and the severity of radiographic joint damage, reinforcing the impact of obesity on OA progression. This relationship is further supported by a meta-analysis by Zheng and Cheng (2015), which indicated that individuals with overweight or obesity have a 2.5 to 4.6 times higher risk of knee OA compared to those with a normal BMI. Furthermore, the risk of knee OA increases by approximately 35% with every 5 kg/m² increment in BMI.[10]

The pathogenesis of OA is multifactorial, involving a combination of mechanical, humoral, metabolic, and genetic factors. In obese individuals, excess body weight increases mechanical load on weight-bearing joints, accelerating structural damage. This excessive stress can surpass the articular cartilage‘s physiological adaptive capacity, resulting in progressive degenerative changes over time. Biochemical studies support this relationship; gait analysis has demonstrated that weight reduction can significantly reduce knee joint loading. It is estimated that every 0.5 kg of weight loss can result in a two- to three-fold reduction in knee joint loading per step. This is supported by a meta-analysis conducted by Chu et al. (2018), which found that weight loss of 5% to 10% produced modest improvements in pain, physical function, and quality of life among adults with an average BMI of 33.6–36.4 kg/m² and mild-to-moderate knee OA.[23]

CONCLUSION

The demographic distribution of knee osteoarthritis (OA genu) patients at RSUD Sayang Cianjur in 2020 showed that the majority (59.31%, n=156) were aged between 60 and 65 years, with 40.69% (n=107) over 65 years of age. In terms of gender distribution, 71 patients (26.99%) were male and 192 patients (73.01%) were female.

Regarding the Kellgren-Lawrence score distribution among patients with Class II obesity, 4% (n-=1) had grade 2 OA, 52% (n=13) had grade 3, and 44% (n=11) had grade 4. In contrast, the distribution among non-obese patients was skewed toward milder disease: 52% (n=13) had grade 1 OA, 44% (n=11)had grade 2, and 4% (n= 1)had grade 3. These data indicate a significant difference in Kellgren-Lawrence scores between the two groups, suggesting that higher body mass, specifically Class II obesity, is associated with more severe joint degeneration in patients with knee osteoarthritis.

CONFLICT OF INTEREST

The authors declare no conflict of interest concerning the research, authorship and/or publication of this scientific article.

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