

ASSOCIATION OF AGE, GENDER, AND OCCUPATION WITH KELLGREN-LAWRANCE SEVERITY IN KNEE OSTEOARTHRITIS PATIENTS AT PANDEGA PANGANDARAN GENERAL HOSPITAL

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Abstract: Association of Age, Gender, and Occupation with Kellgren-Lawrance Severity in Knee Osteoarthritis Patients at Pandega Pangandaran General Hospital. A person's quality of life can be greatly diminished by osteoarthritis (OA), a degenerative joint disease that gradually impacts every part of the joint. It predominantly affects weight-bearing joints, particularly the hip and knee. The prevalence of disability attributable to OA rose by 114% between 1990 and 2019. Age, female gender, and physical activity are among the risk factors for OA. This study aims aimed to evaluate the association between age, gender, and occupation with Kellgren-Lawrance Severity in Knee Osteoarthritis Patients at Pandega Pangandaran General Hospital. A descriptive-analytical strategy was utilized inside a cross-sectional method in this study. The study data consisted of secondary data from knee OA patients above 40 years old registered in the medical records of Pandega Pangandaran General Hospital from January 2022 to December 2024 who had undergone radiographic examination. Data were collected through total sampling and subsequently analyzed using SPSS version 27. Correlation tests were selected to assess the association between demographic variables and ordinal Kellgren-Lawrance severity grades. Potential confounding variables, including body mass index, history of trauma, comorbidities, and physical activity level, were not controlled due to limitations of secondary data. There was a statistically significant association between age and knee OA severity ($p < 0.001$, $r = 0.335$), indicating a weak positive correlation, and between occupation and knee OA severity ($p = 0.002$, $r = 0.279$), also indicating a weak positive correlation. Gender was significantly associated with knee OA severity ($p = 0.043$, $r = 0.217$), also indicating a weak positive correlation. Multivariate analysis showed that occupation remained the strongest independent factor associated with severe knee OA ($p = 0.015$; adjusted OR 4.364; 95% CI 1.330–14.320), followed by age ($p = 0.003$; adjusted OR 3.958; 95% CI 1.583–9.897). Gender was not independently associated with OA severity after adjustment ($p = 0.295$). In conclusion, age, gender, and occupation were significantly associated with the severity of knee OA; however, the observed correlation strengths were weak.
Keywords : Age, Association, Gender, Knee osteoarthritis, Occupation

Abstrak: Hubungan Usia, Jenis Kelamin, dan Pekerjaan dengan Derajat Keparahan Kellgren-Lawrence pada Pasien Osteoarthritis Lutut di RSUD Pandega Pangandaran. Kualitas hidup seseorang dapat sangat menurun akibat osteoarthritis (OA), yaitu penyakit sendi degeneratif yang secara bertahap memengaruhi seluruh bagian sendi. Penyakit ini terutama menyerang sendi penopang berat badan, khususnya pinggul dan lutut. Prevalensi disabilitas akibat OA meningkat sebesar 114% antara tahun 1990 dan 2019. Usia, jenis kelamin perempuan, dan aktivitas fisik termasuk di antara berbagai faktor risiko OA. Penelitian ini bertujuan untuk mengevaluasi hubungan antara usia, jenis kelamin, dan pekerjaan dengan tingkat keparahan (derajat) Kellgren-Lawrence pada pasien osteoarthritis lutut di RSUD Pandega Pangandaran. Strategi deskriptif-analitik dengan metode potong lintang (*cross-sectional*) digunakan dalam penelitian ini. Data penelitian ini merupakan data sekunder dari pasien OA lutut berusia di atas 40 tahun

yang terdaftar di rekam medis RSUD Pandega Pangandaran dari bulan Januari 2022 hingga Desember 2024 dan telah menjalani pemeriksaan radiografi. Data dikumpulkan melalui total sampling dan selanjutnya dianalisis menggunakan SPSS versi 27. Uji korelasi dipilih untuk menilai hubungan antara variabel demografi dengan tingkat keparahan ordinal Kellgren-Lawrence. Variabel perancu potensial, termasuk indeks massa tubuh, riwayat trauma, penyakit penyerta (komorbiditas), dan tingkat aktivitas fisik, tidak dikontrol karena keterbatasan data sekunder. Hasil analisis menunjukkan terdapat hubungan yang signifikan secara statistik antara usia dan tingkat keparahan OA lutut ($p < 0.001$, $r = 0.335$), yang mengindikasikan korelasi positif lemah, serta antara pekerjaan dan tingkat keparahan OA lutut ($p = 0.002$, $r = 0.279$), yang juga mengindikasikan korelasi positif lemah. Jenis kelamin juga berhubungan signifikan dengan tingkat keparahan OA lutut ($p = 0.043$, $r = 0.217$), dengan korelasi positif lemah. Analisis multivariat menunjukkan bahwa pekerjaan tetap menjadi faktor independen terkuat yang terkait dengan OA lutut berat ($p = 0.015$; *adjusted OR* 4.364; 95% CI 1.330–14.320), disusul oleh usia ($p = 0.003$; *adjusted OR* 3.958; 95% CI 1.583–9.897). Jenis kelamin tidak lagi memiliki hubungan independen dengan keparahan OA setelah penyesuaian variabel ($p = 0.295$). Kesimpulannya, usia, jenis kelamin, dan pekerjaan memiliki hubungan yang signifikan dengan tingkat keparahan OA lutut; namun, kekuatan korelasi yang teramati tergolong lemah.

Kata Kunci : Hubungan, Jenis kelamin, Osteoarthritis lutut, Pekerjaan, Usia

INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease characterized by progressive structural damage involving the articular cartilage, subchondral bone, synovium, ligaments, and periarticular muscles, which may significantly reduce quality of life (Primorac et al., 2020). Knee OA is one of the most common forms of OA because the knee functions as a major weight-bearing joint exposed to repetitive mechanical loading during daily activities (Kloppenborg & Berenbaum, 2020). Globally, the burden of OA continues to increase, with approximately 595 million individuals affected in 2020, representing a 132.2% increase since 1990 (Steinmetz et al., 2023). In Indonesia, based on the 2018 Riset Kesehatan Dasar (Riskesdas), the prevalence of joint disease reached 7.3%, while West Java Province reported a prevalence of 8.86%, and Pangandaran District showed an even higher prevalence of 11.69% (Kementerian Kesehatan Republik Indonesia, 2019). These data indicate that OA remains a significant musculoskeletal health problem, particularly in populations with high physical workload exposure.

The development and progression of knee OA are multifactorial, involving increasing age, female sex, obesity, previous joint injury, and occupational physical activity (Bala et al., 2020). Among these, biomechanical loading plays a central role in disease pathogenesis. Excessive and repetitive mechanical stress on the knee joint increases compressive and shear forces across the articular cartilage, leading to disruption of the collagen network, loss of proteoglycan content, and reduced shock-absorbing capacity (Hunter & Bierma-Zeinstra, 2019; Primorac et al., 2020). Sustained abnormal loading further contributes to subchondral bone remodeling, osteophyte formation, synovial inflammation, and joint space narrowing, which collectively worsen radiographic severity based on Kellgren-Lawrence grading (Kloppenborg & Berenbaum, 2020).

Occupational exposure contributes to knee OA progression through both biomechanical and biological mechanisms. Activities such as squatting, kneeling, stair climbing, prolonged standing, lifting heavy loads, and repetitive walking impose cumulative mechanical stress on the knee joint. When this loading exceeds the adaptive

capacity of cartilage, mechanotransduction pathways in chondrocytes are activated, leading to increased expression of matrix-degrading enzymes such as matrix metalloproteinases (MMPs) and aggrecanases (ADAMTS), resulting in accelerated extracellular matrix breakdown. Repetitive microtrauma also induces subchondral bone sclerosis and microfractures, which alter joint biomechanics and further increase stress transmission to cartilage (Kloppenborg & Berenbaum, 2020).

In addition, occupational mechanical stress promotes low-grade chronic inflammation within the joint. Mechanical overload stimulates synovial cells and chondrocytes to release pro-inflammatory cytokines such as interleukin-1 β (IL-1 β) and tumor necrosis factor- α (TNF- α), which amplify cartilage catabolism and suppress repair mechanisms. This creates a self-perpetuating cycle in which structural damage leads to abnormal biomechanics, which in turn exacerbates inflammatory signaling and accelerates OA progression (Primorac et al., 2020). Consequently, occupations involving sustained repetitive knee loading, such as housewives, farmers, and manual laborers, are associated not only with increased risk of OA but also with greater disease severity (Palmer, 2012; Gates et al., 2022).

Although previous studies have identified risk factors associated with the incidence of knee OA, evidence examining the association between demographic and occupational factors with radiographic severity of knee OA remains limited, particularly in regional hospital-based populations in Indonesia. Understanding these associations is important for identifying high-risk groups for more severe disease progression and functional impairment. Therefore, this study aimed to analyze the association between age, gender, and occupation with Kellgren–Lawrence severity in knee OA patients at Pandega Pangandaran General Hospital.

METHODS

This study employed a retrospective cross-sectional design using secondary data derived from medical records of patients with knee osteoarthritis (OA) who were treated at the Orthopaedic Clinic of Pandega Pangandaran General Hospital from January 2022 to December 2024. The study was conducted to evaluate the association between demographic factors and radiographic severity of knee OA based on the Kellgren–Lawrence classification. Ethical clearance for this study was obtained from the Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta (No. 843/KEPK-FIK/I/2025). All procedures were conducted in accordance with institutional ethical standards for retrospective studies using anonymized secondary data.

The independent variables included age, gender, and occupation. The dependent variable was the knee OA severity, assessed using the Kellgren–Lawrence (K–L) grading system. The K–L classification stratifies knee OA into five grades (0–4), ranging from normal joint appearance to severe disease characterized by marked joint space narrowing, osteophyte formation, subchondral sclerosis, and bony deformity (Jang et al., 2021; Dieppe et al., 2018). Radiographic evaluation of knee OA severity was performed using standard knee X-ray imaging interpreted by a radiologist as part of routine clinical care at the hospital. The classification followed the Kellgren–Lawrence criteria. However, information regarding the number of radiologists involved, blinding procedures, and interobserver reliability testing was not available due to the retrospective nature of the study, and this is acknowledged as a methodological limitation.

The study population consisted of all patients diagnosed with knee OA recorded in the hospital medical records during the study period. A total sampling technique was applied, in which all eligible patients who met the inclusion criteria were included. This approach was

used to minimize selection bias and ensure that all accessible cases within the defined period were analyzed. A total of 133 patients fulfilled the inclusion criteria and were included in the final analysis. Inclusion criteria were: (1) patients diagnosed with knee OA recorded in the hospital medical records between January 2022 and December 2024; (2) patients who underwent knee radiographic examination; and (3) patients aged >40 years. Patients under 40 years were excluded due to the higher likelihood of secondary OA etiology in younger populations. Exclusion criteria included: (1) incomplete medical records; (2) absence of radiographic evaluation; and (3) missing key demographic or clinical data required for analysis.

Several potential confounding variables known to influence OA severity such as body mass index (BMI), history of knee trauma, physical activity level, comorbidities (e.g., diabetes mellitus), menopausal status, and genetic predisposition were not available in the medical records and therefore could not be included in the analysis. This limitation may introduce residual confounding and has been considered in the interpretation of results. Occupation was categorized based on medical record documentation into housewife, farmer, laborer, and employee. However, this occupational classification was relatively broad and did not adequately capture detailed biomechanical exposures such as repetitive joint loading, squatting frequency, kneeling activities, ergonomic stress, lifting intensity, duration of occupational exposure, or overall physical workload. Therefore, interpretation of occupational risk should be approached cautiously.

Information regarding whether OA involvement was unilateral or bilateral was also unavailable in the medical records. This limitation may affect interpretation of OA severity and functional impairment because bilateral OA may be associated with greater disability and different biomechanical

loading patterns compared to unilateral disease.

This observational cross-sectional study employed SPSS version 27 for descriptive and inferential analyses. Ordinal variables, such as age and occupation against the Kellgren-Lawrence grade, were evaluated using Kendall's tau. Meanwhile, the Chi-square test determined the association between gender and osteoarthritis severity (significance set at $p < 0.05$). Bivariate and multivariate methods were applied to assess simple and complex variable interactions.

To strengthen the analysis and account for potential interactions among variables, additional bivariate and multivariate analyses were performed. Binary logistic regression analysis was conducted by categorizing OA severity into non-severe OA (KL grade II) and severe OA (KL grades III-IV). Variables with $p < 0.25$ in bivariate analysis were included in the multivariate logistic regression model to identify independent factors associated with severe knee OA and to control for confounding between age, gender, and occupation. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported.

RESULTS

The characteristics of age, gender, and occupation regarding the Kellgren-Lawrence classification in knee OA patients are presented in Table 1. Based on age groups, knee joint OA is most commonly found in the 60-69 age group (39.8%). In this age group, the Kellgren-Lawrence classification predominantly consists of 3rd degree (50.7%) and 4th degree (41.2%). The 50-59 age group represents the second most prevalent category, comprising 31.6% of the sample. The age group least affected by knee OA is the >80-years-old group (5.3%). knee OA is more frequently observed in females (74.4%) compared to males (25.6%). The Kellgren-Lawrence degrees in this study are entirely dominated by females. The occupation most affected by knee OA is housewives (44.3%), predominantly

classified as Kellgren-Lawrence 2nd (43.3%). Meanwhile, 4th degree knee OA degree (71.9%) and 3rd degree is most common among farmers (50%).

Table 1. Characteristics of knee OA patients.

	Kellgren-Lawrence classification							
	II (n=32)		III (n=67)		IV (n=34)		Total (n=133)	
	n	%	n	%	n	%	n	%
Age (years old)								
40-49	11	34	2	3	1	2.9	14	10.5
50-59	11	34	24	35.8	7	20.6	42	31.6
60-69	5	16	34	50.7	14	41.2	53	39.8
70-79	5	16	4	6	8	23.5	17	12.8
≥80	-	-	3	4.5	4	11.8	7	5.3
Gender								
Male	3	9.4	22	32.8	9	26.5	34	25.6
Female	29	90.6	45	67.2	25	73.5	99	74.4
Occupation								
Housewife	23	71.9	29	43.3	7	20.6	59	44.3
Labor	3	9.3	11	16.5	5	14.7	19	14.3
Farmer	2	6.2	15	22.4	17	50	34	25.6
Employee	4	12.4	12	18	5	14.7	21	15.8

n = number of subjects

Correlation between each independent variable and the dependent variable is provided in Table 2. There was a statistically significant association between age and knee OA severity ($p < 0.001$, $r = 0.335$), indicating a weak positive correlation, and between

occupation and knee OA severity ($p = 0.002$, $r = 0.279$), also indicating a weak positive correlation. Gender was significantly associated with knee OA severity ($p = 0.043$, $r = 0.217$), also indicating a weak positive correlation.

Table 2. Bivariate analysis.

Variable	PR	95% CI	p-value	r
Age	1.43	1.14-1.80	<0.001	0.335
Gender	0.78	0.66-0.91	0.043	0.217
Occupation	1.34	1.11-1.60	0.002	0.279

r = correlation coefficient

To provide additional measures of association, binary logistic regression analysis was performed by categorizing OA severity into non-severe OA (KL grade II) and severe OA (KL grades III-IV). In bivariate analysis, older age was associated with higher prevalences of severe OA (PR 1.43; 95% CI 1.14-1.80). Occupations involving heavier physical activity also demonstrated increased prevalences of severe OA (PR 1.34; 95% CI 1.11-1.60). Female gender showed a

higher prevalence of OA overall, although its association with OA severity was weaker after adjustment. Multivariate analysis showed that occupation remained the strongest independent factor associated with severe knee OA ($p = 0.015$; adjusted OR 4.364; 95% CI 1.330-14.320), followed by age ($p = 0.003$; adjusted OR 3.958; 95% CI 1.583-9.897). Gender was not independently associated with OA severity after adjustment ($p = 0.295$).

Table 3. Multivariate analysis.

Variable	Adjusted OR	95% CI	p-Value
Age	3.958	1.583-9.897	0.003
Gender	0.481	0.122-1.894	0.295
Occupation	4.364	1.330-14.320	0.015

DISCUSSION

This research indicates that knee OA is most prevalent in the 60-69 age group (39.8%). Similar findings were reported by Claudia et al.'s (2020) study at Sanglah Hospital Denpasar from January to June 2018, which showed a high incidence of knee OA in patients aged 60-69 years (41.7%), and Hermansyah et al.'s (2022) study at Dr. Soebandi Hospital Jember from January 2019 to December 2020, which found that knee OA was predominantly seen in patients over 60 years old (40%). The correlation coefficient value was 0.335, suggesting a weak link ($p = 0.000$), although the study did find a favorable association between age and knee OA severity level according to the Kellgren-Lawrence classification at Pandega Pangandaran General Hospital. These findings are in agreement with those of the Surabaya PHC Hospital study by Khudrati et al. (2019), which also discovered a positive association ($r = 0.35$) between age and the degree of pain of knee OA as classified by Kellgren-Lawrence. One of the primary factors causing knee OA is age, which can increase with age (He et al., 2020). Aging leads to articular cartilage thinning and a decrease in muscle strength that maintains knee stability. Radiographic images of patients with knee OA show joint space narrowing caused by articular cartilage damage or loss (Dieppe et al., 2018). Aging is associated with decreased chondrocyte regenerative capacity, extracellular matrix degradation, oxidative stress, and accumulation of advanced glycation end products (AGEs), which contribute to cartilage stiffness and degeneration. Furthermore, aging-related sarcopenia and reduced periarticular muscle strength may increase joint instability

and mechanical stress on the knee joint. (Yunus et al., 2020).

Females (74.4%) are more prevalent than males (25.6%). These findings align with those of Sibarani et al.'s (2021) study at Dr. Hasan Sadikin Hospital Bandung in 2019-2020, which found that knee OA was more common in females (71.6%) than males (28.4%) and Liena et al.'s (2021) study at Royal Prima Hospital Medan, which showed a greater proportion of knee OA cases were observed in females (70%) relative to males (30%). Female patients predominated in this study. Although gender showed a significant association with OA severity in bivariate analysis, the association was no longer significant after multivariate adjustment, indicating possible confounding effects from other variables. Previous study by Nugraha et al., (2023) at Dr. H. Abdul Moeloek Hospital in Lampung Province in December 2022 also found a weak correlation between gender and the knee OA severity ($p = 0.027$; $r = 0.217$). Increased estrogen levels can protect against OA changes by maintaining the health of subchondral bone and articular cartilage. Animal studies suggest that estrogen helps maintain joint health by preserving subchondral bone and articular cartilage (Hussain et al., 2018). Estrogen deficiency after menopause has been associated with increased inflammatory cytokine production, altered cartilage metabolism, subchondral bone remodeling, and accelerated cartilage degeneration. Experimental studies also suggest that estrogen has protective effects on chondrocyte survival and extracellular matrix maintenance. Reduced estrogen levels in postmenopausal women may therefore contribute to OA progression and symptom severity (Pang et al., 2023).

Knee OA is most prevalent among housewives (44.3%). These findings align with those of Hidayati et al.'s (2023) study at Ibnu Sina Hospital Makassar from 2018 to 2021, which found that knee OA was more common in housewives (45.2%) and Nugraha et al.'s (2023) study at Dr. H. Abdul Moeloek Hospital in Lampung Province in December 2022, which found that knee OA was most common among housewives (39.4%). Occupation was identified as the strongest independent factor associated with severe knee OA. Although the correlation coefficient was weak ($r=0.279$), logistic regression analysis demonstrated that occupation increased the odds of severe OA by more than four times. This finding suggests that occupational mechanical loading may contribute substantially to OA progression. Previous research by Dhaifullah et al. (2023) at Sanglah Hospital Denpasar from January 2019 to December 2020 also showed a positive correlation between occupation and the knee OA severity with a correlation coefficient value of 0.417, denoting fairly strong correlation ($p = 0.001$). Some studies have revealed that certain physical activities related to occupation can increase the risk of OA. The lower muscle mass in females compared to males can also impact functional limitations with aging, leading to a high incidence of knee discomfort among housewives, but further research is needed (Shamsi et al., 2021). Routine activities among housewives, including climbing stairs, squatting, lifting, and similar physical movements, involve repetitive or weight-bearing motions that can heighten the likelihood of knee OA (Schram et al., 2020). Knee OA in housewife can be influenced by ongoing mechanical processes resulting from daily household activities (Quicke et al., 2022). Daily occupational activities such as prolonged squatting, kneeling, stair climbing, lifting heavy objects, repetitive bending, and prolonged standing can substantially increase mechanical loading on the knee joint. Repeated squatting and kneeling positions may elevate

tibiofemoral and patellofemoral contact pressure, resulting in progressive cartilage degeneration and meniscal stress. In addition, repetitive loading over long periods may contribute to microtrauma within the articular cartilage and subchondral bone (Seidler et al., 2008). Biomechanically, excessive joint loading can disrupt normal force distribution across the knee joint, increasing compressive and shear stress on cartilage surfaces. Continuous mechanical stress may stimulate inflammatory pathways, synovial irritation, extracellular matrix degradation, and chondrocyte apoptosis, ultimately accelerating OA progression. Kneeling and deep flexion postures have also been shown to increase tibiofemoral contact pressure and alter knee kinematics, which may further increase the risk of cartilage damage and meniscal injury (Hofer et al., 2011).

Interestingly, KL grade III represented the majority of cases in this study. This finding may indicate that most patients seek medical evaluation after moderate structural joint damage has already occurred but before end-stage destruction develops. Clinically, this has important implications because patients with grade III OA may still benefit from conservative interventions aimed at slowing disease progression and improving quality of life.

Several limitations should be considered in this study. First, this was a single-center retrospective study using secondary medical record data, which may increase the risk of incomplete records and information bias. Second, important confounding variables such as body mass index (BMI), obesity status, physical activity level, comorbidities, and duration of symptoms were unavailable. Obesity contributes not only through increased mechanical loading but also through metabolic inflammation mediated by adipokines such as leptin and adiponectin. Obesity is one of a major risk factor for knee OA and may interact with age, gender, and occupational loading. Therefore, the absence of BMI data may limit

interpretation of the independent effects of the analyzed variables. Third, the unequal distribution of KL grades, particularly the predominance of grade III OA, may affect statistical balance between severity groups. Finally, although multivariate logistic regression was performed, future studies with larger multicenter populations and more comprehensive biomechanical and metabolic variables are needed to better clarify the determinants of knee OA severity.

CONCLUSION

Age, gender, and occupation were associated with the severity of knee osteoarthritis based on the Kellgren-Lawrence classification among patients at the Orthopedic Clinic of Pandega Pangandaran Regional Hospital. Increasing age and occupational mechanical loading were associated with higher OA severity, while occupation emerged as the strongest independent factor after multivariate adjustment. Although the observed correlations were weak, these findings support the multifactorial nature of knee OA involving demographic and biomechanical factors. Further multicenter prospective studies incorporating obesity, BMI, physical activity, and metabolic factors are needed to better clarify the determinants of knee OA severity and progression.

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