Depressive Syndrome and Osteoarthritis: A Predictive Factors Analysis in Outpatient at the University of North Sumatra Hospital

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Abstract

Background: An individual with chronic osteoarthritis (OA) is known to experience depressive symptoms frequently. Furthermore, OA is one of the most common conditions that cause disability, particularly in the elderly. Around 10% of individuals above 55 years old with knee OA experience severe disability. Therefore, this study aimed to analyze the contributing factors to depressive syndrome in individuals with knee OA.

Methods: A cross-sectional predictive linear regression multivariate design was employed, and sampling was conducted consecutively for 120 subjects with knee OA who participated in this study. Meanwhile, the severity of depressive syndrome was assessed using the Beck Depression Inventory-II (BDI-II).

Results: The majority of the samples were female (n=64, 53%), with a median age of 61 (40 - 68), an average Body Mass Index (BMI) of 24.39+4.16, 70.83% (n=85) were married, and 49.17% (n=59) were employed. The median degree of knee OA in the sample was grade 3, the median level of experienced pain was 5 (3-7), and the BDI score was 21.23+7.16 (mild to moderate). The results of the multivariate linear regression analysis showed that income level ($\beta = -4.127$, $p = <0.001$), gender ($\beta = 4.670$, $p = 0.003$), BMI ($\beta = 3.920$, $p = 0.02$), degree of OA ($\beta = 7.341$, $p = <0.001$), and pain level ($\beta = 6.528$, $p = <0.001$) were associated with the severity of depressive syndrome (adjusted R2 = 74.7%).

Conclusion: This study indicated that there were several factors associated with the severity of depressive syndrome in individuals with knee OA. Income level acted as a protective factor, while gender, BMI, degree of OA, and pain level were aggravating factors for the severity of depressive syndrome.

Keywords: Depression, Syndrome, Osteoarthritis, Outpatient, BDI-II

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Introduction

Individuals with chronic osteoarthritis (OA) commonly experience depressive symptoms [1]. OA is a prevalent condition that often leads to disability, particularly in the elderly [2]. Chronic pain affects approximately 25% of individuals over 55 with knee OA, with 10% experiencing severe disability [3]. In addition, joint pain, stiffness, and limited mobility increase the risk of disability, thereby contributing to financial burdens [4]. Nazarinasab et al. showed that 58.5% of OA patients experience mental disorders, with depression being the most prevalent [5]. Shams et al. indicated that engaging in physical activities could lead to lower levels of depression in the elderly [6]. A recent study found that females are more likely to experience incident depression within 24 months after a knee OA diagnosis [7].

The experience of chronic pain often leads to the development of depression, and patients who simultaneously suffer from both conditions tend to have a worse prognosis. Studies have identified shared brain regions involved in processing bodily pain and regulating mood, such as the insular cortex, prefrontal cortex, anterior cingulate, thalamus, hippocampus, and amygdala. These regions provide the histological basis for the coexistence of chronic pain and depression [8,9]. Meanwhile, chronic pain resulting from lesions or diseases affecting the somatosensory system, or chronic joint inflammation, for example, is associated with decreased serotonin in the prefrontal cortex and increased norepinephrine from the Locus Coeruleus (LC) nucleus, which has been linked to nociception and emotion [10,11].

Depressive syndrome in individuals with OA is an aggravating factor that often leads to social withdrawal and avoidance of activities, ultimately worsening depression, increasing the risk of obesity, muscle weakness, and exacerbating pain experience [12,13]. Therefore, healthcare providers need to understand factors associated with depression in OA patients to provide early prevention and detection.

Method

Sample

The subjects were obtained through consecutive sampling. These were knee OA patients who sought treatment at the outpatient orthopaedic clinic of the University of North Sumatra Hospital from May to November 2022. The subjects were aged 30-80 years, had been diagnosed with OA by an orthopaedic specialist, and were willing to participate. In addition, patients with a history of mental disorders or currently taking psychotropic medications and those with a history of psychoactive substance use (except nicotine and caffeine) were excluded. The sample size was determined by setting the type one error at 5%, type two error at 20%, and a coefficient of determination of 0.25, resulting in 56 subjects. However, the study also considered the sample size based on the bivariate relationships of each independent variable [14] to obtain a final sample size of 120 subjects.

Procedure

The screening was conducted on OA patients who visited the orthopaedic outpatient clinic of the University of North Sumatra Hospital to exclude the presence of mental disorders using the MINI-ICD10 Indonesian version. Subsequently, the subjects were provided with explanations about their participation in the study, and only those who gave consent were included. Interviews were then conducted to obtain demographic data from the sample. The Visual Analogue Scale (VAS) and BDI-II instruments were given to patients to assess their pain levels and the severity of depressive syndrome experienced. Furthermore, the OA degree was determined based on radiological expertise.

Measurement Instrument

Beck Depression Inventory-II (BDI-II)

BDI-II is one of the most widely used measures in study and clinical practice to assess depression. This measurement tool consists of 21 self-reported depression screening items, and each question is scored from 0 to 3, with higher scores indicating

higher depression levels. The survey involves respondents endorsing statements that reflect their feelings over the past two weeks, and the total score for all 21 items can range from 0 to 63. Based on the scoring system, scores between 0-13, 14-19, 20-28, and 29-63 indicate minimal, mild, moderate, and severe depression, respectively [15]. BDI-II has been validated in the Indonesian language, and its cutoff point was determined by Ginting et al. in 2012. In the study by Ginting et al., Cronbach's alpha value for the Indonesian version of BDI-II is reported to be 0.90 [16].

VAS
VAS is widely recognized as a reliable, valid, and responsive measure commonly employed to assess pain outcomes. It comprises a straight line measuring 10 cm long, with two endpoints labelled "no pain" and "worst pain." Patients are instructed to indicate their pain level by marking a vertical line on the scale [17]. VAS demonstrates excellent test-retest reliability, evidenced by its high Intraclass Correlation Coefficient (ICC) value of 0.9. Moreover, it exhibits minimal measurement error when assessing knee OA pain, with a value of 0.03, further highlighting its reliability[18].

The Mini International Neuropsychiatry Interview (MINI-ICD10 Version)
The MINI-ICD10 is a short structured diagnostic interview instrument developed collaboratively by psychiatrists and physicians in the United States and Europe for psychiatric disorders, with criteria based on the DSM-IV and ICD-10. It takes approximately 15 minutes to administer and is designed to fulfil the needs of a brief but accurate structured psychiatric interview [19].

Classification of OA Severity:
The first formal attempt to establish a radiographic classification scheme for OA was described by Kellgren and Lawrence (KL) in 1957. The KL classification was initially described using knee radiographs. Each radiograph was assigned a score ranging from 0 to 4, correlating with the increasing severity of OA [20].
(0) No joint space narrowing or reactive changes
(1) Doubtful joint space narrowing, possible osteophyte
(2) Definite osteophyte, possible joint space narrowing
(3) Moderate osteophyte, definite joint space narrowing, some sclerosis, possible bone end deformity
(4) Large osteophyte, marked joint space narrowing, severe sclerosis, definite bone end deformity

Ethics Approval and Consent to Participate

The study implementation followed the patterns and norms of scientific study as stated in the Helsinki Declaration. The interviewed respondents were asked for informed consent with the provision of information that their data and confidentiality would be ensured. This study was approved by the Medical Research Ethics Committee, Faculty of Medicine, University of North Sumatra, with reference number 475/KEPK/USU/2022 dated June 2, 2022.

Data Analysis
The categorical independent variables are gender, marital status, employment status, and OA severity. The numerical independent variables include age, income, Body Mass Index (BMI), and pain level, while the dependent variable is the BDI-II score. Linear regression analysis is performed on these variables using the Statistical Package for the Social Sciences (SPSS) software.

Requirements for Linear Regression Analysis
Linear regression analysis can only be used when specific requirements are fulfilled, namely, normal distribution of residuals (confirmed by histogram), mean residual = 0 (confirmed by descriptive statistics), no outliers (confirmed by case-wise diagnostics), constant variance (confirmed by a scatter plot of residuals against independent variables), independence (confirmed by Durbin-Watson test), no multicollinearity

(confirmed by Pearson's test and tolerance test) among independent variables, and a linear relationship between independent and dependent variables (confirmed by a scatter plot of independent variables against dependent variable) [14]. The normality of numerical data is determined by performing the Kolmogorov-Smirnov test. Pearson's test is conducted when the assumption of normality is fulfilled. Otherwise, Spearman's test is used. Bivariate analysis with the Mann-Whitney test is also used for categorical variables. However, when the correlation between independent variables has a p-value<0.25, the variables are included in the linear regression analysis [14, 21].

Results

Table 1 shows the characteristics of knee OA patients participating in this study. The majority were female (n=64, 53%), with a median age of 61 (40-68), an average BMI of 24.39±4.16, 70.83% (n=85) were married, and 49.17% (n=59) were employed. The median OA severity in the sample was grade 3, the median level of experienced pain was 5 (3-7), and the BDI score was 21.23±7.16 (mild to moderate).

Table 1. Characteristics of Knee OA Patients

Characteristics	Mean+SD/Median (min-max)/n%
Gender	
- Female	64 (53%)
- Male	56 (47%)
Age (years)	61 (40 – 68)
Marital Status	
- Married	85 (70,83%)
- Single	35 (29,17%)
Employment Status	
- Yes	59 (49,17%)
- No	61 (50,83%)
Income Level (IDR million/month)	4 (2-6)
BMI	24,39±4,16
OA Severity	3 (1 – 4)
Pain Level	5 (3 – 7)
BDI-II Score	21,23±7,16

Bivariate analysis was conducted on the above characteristics variables and BDI score to determine which variables met the requirements for linear regression analysis. Table 2 showed that age, marital status, and employment status were not associated with the BDI-II score with a p-value>0.25. Therefore, they were not included in the linear regression analysis. Gender, income level, BMI, OA severity, and pain level were included in the linear regression analysis, as shown in Table 3**.**

Table 2. Bivariate Analysis Results of Characteristics Variables with BDI-II Score

Variable	p-value
Gender	0,187***
Age (years)	0,261*
Marital Status	0,257**
Employment Status	0,637**
Income Level (IDR million/month)	0,001*
BMI	0,17*
OA Severity	0,001*
Pain Level	0,004*

*Pearson's test **Mann-Whitney test ***independent t-test

Table 3. Multivariate Linear Regression Analysis Results

Variable	Correlation Coefficient (r)	Multivariate Linear Regression Value (β)	p-value
Gender	0,537	4,670	0,003
Income Level	-0,582	-4,127	<0,001
BMI	0,624	3,920	0,02
OA Severity	0,619	7,341	<0,001
Pain Level	0,328	6,528	<0,001

Adjusted R^2 = 74,7%

The multivariate linear regression analysis showed that income level (β = -4.127, p<0.001), gender (β = 4.670, p = 0.003), BMI (β = 3.920, p = 0.02), OA severity (β = 7.341, p<0.001), and pain level (β = 6.528, p<0.001) were associated with the severity of depressive syndrome (adjusted R^2 = 74.7%). Females with higher BMI, OA severity, and pain level were correlated with more severe depressive symptoms. Conversely, higher income level was associated with a decrease in the severity of depressive syndrome.

Discussion

Several factors have been linked to depression, such as gender. The study indicates a higher prevalence of depression among females [21], and the results align with other studies that have consistently reported a greater likelihood among knee OA patients, particularly in females with higher BMI and more severe symptoms [22]. It has been observed that females may be more susceptible to depression due to variations in coping mechanisms. They tend to exhibit internalization mechanisms and have a stronger sensitivity to interpersonal relationships than males, who are generally more goal-directed [23,24]. Furthermore, females experience hormonal fluctuations throughout their lives, and most preclinical studies suggest that intact ovarian hormone function is a protective factor against depression. This is mediated by a decrease in hippocampal volume accompanied by a reduction in serotonin 1A receptors [25]. This study also indicates that depression tends to be experienced by knee OA patients with lower monthly incomes. Chronic diseases affect the cost of living and primary healthcare for families. Insufficient family income can significantly impact a person's ability to meet medical expenses, affecting their physical and mental well-being [26].

A cross-sectional study reported that higher BMI is correlated with increased OA pain severity and decreased physical activity capacity, ultimately leading to increased severity of the experienced depressive syndrome [27]. This is consistent with this study, where higher BMI and pain levels are associated with higher depression scores. In addition, obesity is a risk factor for OA through its impact on biomechanical capacity, inflammatory function, and metabolism. This condition can underlie depression through increased systemic inflammatory responses resulting in hyperstimulation of the hypothalamic-pituitary-adrenal axis [28]. On the other hand, obesity can lead to low self-esteem and social isolation, which are known risk factors for depression [29]. Pain level and OA severity are also known to be associated with depression [30-32], consistent with the findings of this study. This is related to limited mobility, which worsens with increasing pain and OA severity. The condition becomes a psychological burden, especially for the elderly, who may become isolated due to difficulty moving [33].

Based on a psychosocial perspective, individuals with OA are exposed to various stress stimuli, such as pain, mobility limitations, self-image decline, and social isolation, contributing to the development of depression. It is common for OA patients to unconsciously amplify pain and exhibit a greater fear rather than sensation [34]. Furthermore, common medical conditions can occur concomitantly with psychological disorders. By identifying factors associated with depression in knee OA patients, clinicians can provide early support to vulnerable individuals. This is

expected to alleviate symptoms and prevent the development of depressive syndrome into disorders.

Conclusions

In conclusion, this study shows that several factors are associated with the severity of depressive syndrome in individuals with knee OA. Income level is a protective factor, while gender, BMI, OA severity, and experienced pain worsen depressive syndrome severity.

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Transparency Declaration

The authors declare no competing interests.

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