# Relationship between Body Mass Index and Knee Osteoarthritis at UKI General Hospital in 2017

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*Open Access Full Text Article*                                                                                      Research Article

# Relationship between Body Mass Index and Knee Osteoarthritis at UKI General Hospital in 2017

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**Article Info:**

**Abstract**

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Knee osteoarthritis is a degenerative joint disease usually suffered by elderly patients, contributing to the high risk of disability. The risk factors that affect the severity of knee osteoarthritis are obesity, age, sex, occupation, patient's history of the disease, trauma, and other factors. Excessive body weight is a factor that exacerbates the disease of osteoarthritis. Generally, this research is aimed to examine the correlation between Body Mass Index (BMI) and knee osteoarthritis at UKI General Hospital. The researcher used a descriptive-analytic study with a cross-sectional approach. In this study, the researcher used 30 samples. The result of chi-square analysis by using Fisher's Exact Test shows that p-value = 0.045 indicates that the p-value of BMI is under the significance level of α = 0,05. Therefore, the researcher concluded that there is a correlation between BMI and knee osteoarthritis, in which a high BMI value (>24.9) may affect the occurrence of joint space narrowing among the patients. The mean BMI value among the osteoarthritis patients UKI General Hospital is 25.6, which highly indicates that most osteoarthritis patients are preobese/overweight.

**Keywords:** Knee osteoarthritis, Body Mass Index (BMI), joint space narrowing

## Introduction

Osteoarthritis (OA) is a degenerative joint disease associated with joint cartilage damage. Vertebrae, pelvis, knees, and ankles are most commonly affected by OA [1]. Osteoarthritis is the most common articular disease in developed countries and the leading cause of chronic disability, as the most common consequence of knee OA and hips OA. The prevalence of symptomatic knee OA increases with each decade of life, with the highest annual incidence of knee OA between 55 and 64 years [2]. In Indonesia, the prevalence of knee OA is relatively high, namely 15.5% in men and 12.7% in women [3]. Based on medical record data at UKI General Hospital in 2017, 162 patients experienced joint inflammation, of which 106 patients were kneed OA sufferers.

Joints between bones will work harder when carrying heavy loads and are thought to contribute to OA [4]. Excess body weight is associated with an increased risk of developing OA in both women and men. Excessive body weight is a factor that will aggravate OA disease [5]. Based on the description above, the author wants to research the relationship between Body Mass Index (BMI) and Knee Osteoarthritis at UKI General Hospital. This research is expected to be input for medical workers in seeing the effect of body weight on knee osteoarthritis in patients at UKI General Hospital in 2017. This research is also expected to be input for health workers in educating patients with knee osteoarthritis at UKI General Hospital better so that patients can maintain their weight better and carry out daily activities better because the knee joint is one of the joints most often used in carrying out daily activities.

The formulation of the problem answered in this study is "how is the relationship between Body Mass Index (BMI) in knee osteoarthritis patients at UKI General Hospital in 2017?" the purpose of the study namely to determine the relationship between Body Mass Index (BMI) and Knee Osteoarthritis at UKI General Hospital in 2017.

## Literature Review

Osteoarthritis is a degenerative disease in the joints caused by several factors, and this disease is characteristic of damage to the cartilage (joint cartilage). Cartilage is a complex, slippery tissue surrounding the ends of hard bones in joints. This tissue is a smooth movement between bones and a shock absorber when the joint performs an activity or movement [1]. Osteoarthritis (OA) is a degenerative joint disease associated with joint cartilage damage. Vertebrae, pelvis, knees, and ankles are most commonly affected by OA [2]. Osteoarthritis is a degenerative disease due to chronic joint failure and attacks the joints, especially the joint cartilage. The joints affected have a predilection for weight-bearing joints: neck joints, lumbosacral vertebrae, hips, knees, ankles, and first metatarsal phalangeal joints, as well as the CMC (Carpometacarpal), PIP (Proximal Interphalangeal) and DIP (Distal Interphalangeal) joints [3].

Osteoarthritis (OA) is the most common articular disease in developed countries and a leading cause of chronic disability, mainly due to knee OA and hip OA. The prevalence of OA increases with age, up to 80 percent in people over 65 in high-income countries. As the world's population ages, it is estimated that degenerative joint disorders such as OA will affect at least 130 million people worldwide by 2050. At least 15 percent of all adults over 60 are believed to have this disorder, with women having a higher prevalence of osteoarthritis than men. It is estimated that 9.6 percent of men and 18.0 percent of women over 60 have OA worldwide. Osteoarthritis is considered the most common of all musculoskeletal diseases, affecting about 10 percent of the world's population over 60. Osteoarthritis ranks fifth among all forms of disability worldwide [4].

Hip and knee osteoarthritis is the leading cause of disability worldwide and is responsible for approximately 17 million years of living with disability worldwide [6]. The prevalence of symptomatic knee OA increases with each decade of life, with the highest annual incidence of knee OA between 55 and 64 years of age [7]. The prevalence of symptomatic knee OA has increased over the past few decades in the United States, along with an aging population and a growing obesity epidemic. There are 14 million individuals in the United States who have symptomatic knee OA. In 2010, the prevalence of symptomatic knee osteoarthritis in patients aged 45 and older was estimated to be between 5.9 and 13.5 percent in men and 7.2 and 18.7 percent in women, respectively. Approximately 10 million adults have symptomatic knee OA. Osteoarthritis of the knee is often accompanied by comorbidities that contribute to decreased quality of life, are obesity or overweight (90 percent), hypertension (40 percent), depression (30 percent), and diabetes (15 percent) [4].

Based on the Basic Health Research in 2007, the national prevalence of joint disease was 30.3%, and the prevalence based on the diagnosis of health workers was 14% . By province, the highest prevalence of joint disease was found in West Papua Province (28.8%) and the lowest in West Sulawesi (7.5%). The coverage of joint disease diagnosis by health personnel in each province is generally around 50% of all cases. The prevalence of the joint disease by gender in Indonesia tends to be higher in women. The prevalence of knee osteoarthritis in Indonesia reaches 5% at age <40 years, 30% at age 40-60 years, and 65% at age>61 years. In Indonesia, the prevalence of genu osteoarthritis is relatively high, namely 15.5% in men and 12.7% in women [5]. Based on patient data at UKI General Hospital in 2017, 162 patients experienced joint inflammation. Of the 162 patients, 106 were knee OA patients who came for examination and treatment at UKI General Hospital.

Risk factors for osteoarthritis include age, obesity and metabolic disease, gender, joint injury, occupation, sports, genetics, ethnicity, joint infection, occupational trauma, growth disorders, history of joint inflammation, neuromuscular disorders, and other factors [8]. Based on the pathogenesis, OA is divided into two, namely primary OA and secondary OA. Primary Osteoart [10] is also known as idiopathic OA, which is OA whose cause is unknown and has nothing to do with systemic disease or local changes in the collaborative process [9]. Secondary OA is based on endocrine, inflammatory, metabolic, growth, hereditary disorders, micro and macro injury, and prolonged immobilization. Primary Osteoarthritis is more common than secondary OA [10]. The development of osteoarthritis is divided into three phases, namely a) in the first phase, there is a proteolytic breakdown of the cartilage matrix; b) in the second phase, fibrillation and erosion of the cartilage surface occur, accompanied by the release of proteoglycans and collagen fragments into the

synovial fluid; and c) the third phase, the breakdown of cartilage products that induces an inflammatory response in the synovial. The clinical presentation of osteoarthritis depends on the extent to which the impact of osteoarthritis causes cartilage destruction. Osteoarthritis symptoms are progressive, where complaints occur slowly and gradually get worse [5].

Body Mass Index is a measure to indicate nutritional status in adults. It is defined as a person's weight in kilograms divided by the square of that person's height in meters (kg/m2) [12].

$$BMI\ (kg/m^2) = \frac{body\ weight\ (kilogram)}{(body\ height\ (meter))^2}$$

The following is the classification of BMI according to WHO.

| BMI | Status Nutrisi |
|---|---|
| <18.5 | Underweight |
| 18.5 – 24.9 | Normal |
| 25.0 – 29.9 | Are obese |
| 30.0 – 39.9 | Obesity class 1 |
| 40.0 – 49.9 | Obesity class 2 |
| > 40 | Obesity class 3 |

BMI ranges are based on the effect of excess body fat on disease and mortality and are moderately related to adiposity. BMI was developed as an indicator of disease risk; as BMI increases, so does the risk of some diseases. Common conditions associated with overweight and obesity include premature death, cardiovascular disease, high blood pressure, osteoarthritis, certain types of cancer, and diabetes.

The average BMI value is between 18.5-24.9, so if a BMI value is obtained outside of this range, it can be said that a person's BMI value is not average. Abnormal BMI values can be in the form of being underweight and overweight. Being overweight can increase the risk of infectious diseases while being overweight increases the risk of degenerative diseases [12]. Carrying heavier weights will make the joints work harder, allegedly contributing to osteoarthritis.1 Excess weight is significantly associated with an increased risk of developing OA in both women and men. Excessive body weight turns out to be a factor that will aggravate OA disease [2].

The physiological mechanisms responsible for obesity are not fully understood. However, there is now increasingly clear evidence of several signaling mechanisms in the small intestine, adipose tissue, brain, and possibly other tissues that can provide insight into nutrient intake flow, distribution, metabolism, and storage. All of these mechanisms are coordinated in the brain and lead to changes in diet, physical activity, and body metabolism so that energy reserves in the body can be maintained. The recent discovery of the hormone leptin, secreted by adipocytes in proportion to triglyceride stores and binds to receptors in the hypothalamus, provides an exciting picture of possible regulatory signal systems function to maintain energy balance [13]. However, there is still much to learn about the system [10].

Being overweight at 36-37 years is a risk factor for knee OA in the elderly. Under normal circumstances, the body's weight will pass through the medial knee joint and be balanced by the lateral thigh muscles so that the results will fall on the central part of the knee joint. However, in obesity, the resultant will shift so that the load received by the knee joint will be unbalanced [14]. It can cause cartilage wear due to shifting the body's fulcrum.

The obesity will cause changes in the structure and composition of joint cartilage. The process of cartilage damage will occur and cause abnormal joint cartilage formation and the activation of inflammatory mediators that will damage the knee joint enzymatically [15]. The obesity can increase the production of proinflammatory cytokines such as IL-6, IL-1, IL-8, and TNF-a, which are triggered by adipose tissue. Furthermore, adipose produces adipokines that can trigger synovial inflammation, cartilage degradation, and remodeling of bone matrix [16]. Adipose tissue also secretes leptin which is the critical link between obesity and osteoarthritis. Increased leptin levels will increase the synthesis of proinflammatory cytokines and cause accelerated cartilage degradation [17].

A relationship between obesity and the incidence of knee osteoarthritis. In obese BMI, patients with obese BMI have a 7.20 times risk of developing knee osteoarthritis compared to patients with normal BMI [5]. The higher the BMI measurement results, which indicates obesity, the higher the BMI measurement results, higher the BMI measurement results will be at higher risk of developing osteoarthritis, and from the results of the analysis also obtained someone who is classified as obese, has a 2.6 times risk of developing osteoarthritis than those who are not classified as obese [18]. There was a relationship between body mass index (BMI) and knee osteoarthritis. Overweight patients have a 2,5241 times greater chance of experiencing knee osteoarthritis than subjects with normal weight, and patients with average weight have a 0.462 times greater chance of experiencing knee osteoarthritis than subjects with lean body weight [19].

The patients with a high degree of knee osteoarthritis were more likely to suffer from obese people (88.9%). Meanwhile, patients with a low degree of osteoarthritis suffered more than regular people (83.3%) [20]. Statistical tests found a significant relationship between body mass index and joint damage in osteoarthritis patients. The OA patients with a BMI value above normal mostly had a more severe Kellgren-Lawrence degree, but the study stated that obesity could not be associated with the progression of knee osteoarthritis [21]. Meanwhile, another study conducted showed that obesity was associated with the progression of knee osteoarthritis [22].

The statistical testing concluded that there was no significant relationship between BMI and knee osteoarthritis [23]. Another study also showed no significant relationship between BMI and the degree of bilateral knee osteoarthritis, according to Kellgren and Lawrence [24]. It is said that many other risk factors also work together in determining the degree of knee osteoarthritis.

## Research Method

The research design used in this study is a descriptive analysis study with a cross-sectional or cross-sectional approach. This research was conducted at UKI General Hospital. This research was conducted from November 2017 to January 2018 by taking medical records of Osteoarthritis patients in 2017. The population in this study were all medical records of patients with knee osteoarthritis at UKI General Hospital. The samples used in this study were all patients who met the inclusion criteria, namely those diagnosed with knee osteoarthritis based on clinical and radiological examinations and who had complete medical records. So the samples taken for the study were as many as 30 samples. The BMI value was obtained using the formula for a weight divided by the square of height. After that, the BMI values obtained were classified according to the distribution of BMI according to WHO. In this study, the research instrument used was medical records of patients with knee osteoarthritis at UKI General Hospital. The method used in this study was to collect secondary data by researchers by using medical records of knee osteoarthritis patients and then taking data in the form of height and weight and calculating the BMI value. After that, the researchers looked at the results of the radiological examination of the knee Osteoarthritis patient and saw the interpretation of the patient's joint space picture. The data obtained from the results of this study will be processed using the SPSS program to analyze the relationship (correlation) between BMI and knee osteoarthritis.

## Result and Discussion

Based on research on knee osteoarthritis patients who came to UKI General Hospital in 2017, underwent treatment, and performed radiological examinations, a sample of 30 patients was taken.

**Table 1: Number of patients with knee osteoarthritis by age**

| Age | Frequency | % |
|---|---|---|
| Elderly (75-90) | 4 | 13.3 |
| Old age (60-74) | 15 | 50.0 |
| Middle age (45-59) | 11 | 36.7 |
| **Total** | 30 | 100.0 |

In this study, all patients with knee osteoarthritis who were sampled were elderly patients. Based on the WHO classification, the criteria for the elderly can be divided into middle age (45 – 59 years), old age (60 – 74 years), old age (75 – 90 years), and very old age (> 90 years). This study used no knee osteoarthritis patients as very old samples (>90 years).

Based on table 4.1, there are 11 samples of middle age (45 – 59 years) or 36.7%, 15 samples (60 – 74 years old) or 50.0%, and four samples or 13.3% old elderly (75 – 90 years).

**Table 2: Number of patients with knee osteoarthritis by joint gap and age**

| | | Age | | | Total |
|---|---|---|---|---|---|
| | | middle age | Elderly | old elderly | |
| **Joint Gap** | Narrowing | 8 | 11 | 3 | 22 |
| | % | 36.4 | 50.0 | 13.6 | 100.0 |
| | Not narrow | 3 | 4 | 1 | 8 |
| | % | 37.5 | 50.0 | 12.5 | 100.0 |
| | **Total** | 11 | 15 | 4 | 30 |
| | **%** | 36.7 | 50.0 | 13.3 | 100.0 |

Based on table 2, there are 8 (36.4%) patients with knee osteoarthritis with narrowed joint gaps in the middle-aged, the elderly, as many as 11 (50%) samples, and the very old elderly as many as 3 (13.6%) samples. Patients with knee osteoarthritis with non-narrowed joint space were three samples or 37.5% of middle-aged elderly, four samples or 50% of elderly people, and 1 sample or 13.3% of very old elderly. This study found that the age of all patients with knee osteoarthritis sampled was more than 40 years old, most of whom were the elderly (60-74 years). Patients with knee osteoarthritis with narrowed joint gaps are primarily in the elderly (60-74 years), and the least are in the elderly (75-90 years). Patients with knee osteoarthritis with non-narrowed joint gaps are primarily in the elderly (60-74 years), and the least are in the elderly (75-90 years).

The research of Anggraini et al. showed that more patients with positive knee osteoarthritis were aged >55 years, while patients who were not favorable for knee osteoarthritis were more at the age 25-55 years. Most occur in people aged over 50 years.21 Likewise, in another study stated that most knee osteoarthritis sufferers were above 50 years of age [24].

**Table 3: Number of patients with knee osteoarthritis by gender**

| Gender | Frequency | % |
|--------|-----------|-----|
| Man | 3 | 10.0 |
| Woman | 27 | 90.0 |
| **Total** | 30 | 100.0 |

Table 3 shows three samples of male knee osteoarthritis or 10%, and 27 samples of women or 90%.

**Table 4: Number of patients with knee osteoarthritis by joint gap and gender**

| | | Gender | | Total |
|--|--|--------|--|-------|
| | | **Male** | **Female** | |
| **Joint Gap** | Narrowing | 3 | 19 | 22 |
| | % | 13.6 | 86.4 | 100.0 |
| | Not Narrowing | 0 | 8 | 8 |
| | % | 0 | 100.0 | 100.0 |
| | **Total** | 3 | 27 | 30 |
| | **%** | 10.0 | 90.0 | 100.0 |

Based on table 4, there are knee osteoarthritis sufferers with narrowed joint space with three samples of the male sex 13.6% and 19 samples of female 86.4%. Patients with knee osteoarthritis with non-narrowed joint space with no sample of male gender and eight samples of female or 100%.

In this study, it was found that women suffered from knee osteoarthritis the most than men. Patients with knee osteoarthritis with narrowed joint gaps are the most common in women. Knee osteoarthritis with non-narrowed joint space is the most common in women.

**Table 5: Number of patients with knee osteoarthritis by accompanying disease**

| Variable | Category | Frequency |
|----------|----------|-----------|
| Disease | Diabetes mellitus | 14 |
| | Hypertension | 16 |
| | Heart | 11 |
| | There is no | 6 |

Based on table 5, from 30 patients with knee osteoarthritis who suffered from diabetes mellitus as many as 14 (46.7%) samples, hypertension as many as 16 (53.3%) samples, heart disease as many as 11 (36.7%) samples, and who did not suffer namely six (20%) samples.

**Table 6: Number of patients with knee osteoarthritis based on joint gaps and past medical history**

| | | Disease | | | |
|---|---|---|---|---|---|
| | | **Diabetes Mellitus** | **Hypertension** | **Heart** | **There is no** |
| **Joint Gap** | Narrowing | 11 | 13 | 2 | 3 |
| | % | 50.0 | 59.1 | 9.1 | 13.6 |
| | Not Narrowing % | 3 | 3 | 0 | 3 |
| | | 37.5 | 37.5 | 0 | 37.5 |
| **Total** | | 14 | 16 | 11 | 6 |
| **%** | | 46.7 | 53.3 | 36.7 | 20.0 |

Based on table 6, of 22 patients with knee osteoarthritis with narrow joint space who suffer from diabetes mellitus, namely 11 samples or 50%, hypertension as many as 13 samples or 59.1%, heart disease as many as two samples or 9.1%, and no disease as many as three samples or 13.6 %. Of the 22 patients with knee osteoarthritis with non-narrowed joint space, three samples or 37.5% diabetes mellitus, three samples or 37.5% hypertension, no heart disease, and three samples or 37.5% no disease.

In this study, it was found that hypertension was the most suffered by patients with osteoarthritis. Knee osteoarthritis sufferers with narrowed joint space are most common in knee osteoarthritis patients with a history of hypertension, and the least are knee osteoarthritis patients with a history of heart disease. Patients with knee osteoarthritis with non-narrowed joint gaps who have a history of diabetes mellitus, hypertension, and no disease are the same, at least in patients with knee osteoarthritis who have a history of heart disease.

**Table 7: Number of patients with unilateral and bilateral knee osteoarthritis**

| | Frequency | % |
|---|---|---|
| Unilateral | 18 | 60.0 |
| Bilateral | 12 | 40.0 |
| **Total** | 30 | 100.0 |

Table 7 shows 12 samples of osteoarthritis in both knees or bilateral or 40%, and 18 samples or 60% who had osteoarthritis in only one knee or unilateral.

**Table 8: Number of patients with right and left knee osteoarthritis**

| | Frequency | % |
|---|---|---|
| Sinistra and dextra | 12 | 40.0 |
| Dextra | 12 | 40.0 |
| Sinistra | 6 | 20.0 |
| **Total** | 30 | 100.0 |

Table 4.8 shows patients with knee osteoarthritis on the right and left sides, namely 12 samples or 40%, on the right side, namely 12 samples or 40%, and on the left side with as many as six samples or 20%. This study found that knee osteoarthritis was most commonly affected on one side only or unilaterally. The side most affected is the right side.

**Table 9: Number of patients with knee osteoarthritis by occupation**

| Work | Frequency | % |
|---|---|---|
| Housewife | 20 | 66.7 |
| Civil Servants | 4 | 13.3 |
| Private | 2 | 6.7 |
| Pension | 4 | 13.3 |
| **Total** | 30 | 100.0 |

Table 9 shows knee osteoarthritis sufferers who work as housewives are 20 samples or 66.7%, civil servants are four samples or 13.3%, private are two samples or 6.7%, and those who are not working or retired are four samples or 13.3%.

**Table 10: Number of patients with knee osteoarthritis by joint gap and occupation**

|  |  | Work |  |  |  | Total |
|---|---|---|---|---|---|---|
|  |  | Housewife | Civil Servants | Private | Pension |  |
| Joint Gap | Narrowing | 13 | 3 | 2 | 4 | 22 |
|  | % | 59.1 | 13.6 | 9.1 | 18.2 | 100.0 |
|  | Not Narrowing | 7 | 1 | 0 | 0 | 8 |
|  | % | 87.5 | 12.5 | 0 | 0 | 100.0 |
|  | Total | 20 | 4 | 2 | 4 | 30 |
|  | % | 66.7 | 13.3 | 6.7 | 13.3 | 100.0 |

Based on table 10, there are 13 samples of knee osteoarthritis with narrow joint gaps who work as housewives 59.1%, three samples of civil servants 13.6%, two samples in the private sector 9.1%, and four samples not working or retiring sample or 18.2%. Patients with knee osteoarthritis with non-narrowed joint gaps who work as housewives are seven samples or 87.5%, and civil servants are 1 sample or 12.5%, no private sector and no work or retirement.

In this study, it was found that most knee osteoarthritis sufferers worked as housewives. Patients with knee osteoarthritis with narrowed joint gaps mostly work as housewives, and the least are those who do not work or retire.

Knee osteoarthritis sufferers with joint gaps that are not narrowed mostly work as housewives, and those who work in the private sector and do not work with those whose joint gaps are not narrowed.

**Table 11: Number of patients with knee osteoarthritis based on average or abnormal BMI values**

| BMI | N | % |
|---|---|---|
| Normal | 13 | 43.3 |
| Abnormal | 17 | 56.7 |
| Total | 30 | 100.0 |

In this study, the sample was divided into two categories, with normal and abnormal BMI values (underweight, preobese, obesity class 1, and obesity class 2), to be analyzed using the chi-square method. Table 11 shows 13 samples of normal BMI or 43.3%, and 17 samples of abnormal or 56.7%.

**Table 12: Number of patients with knee osteoarthritis by BMI**

| BMI | N | % |
|---|---|---|
| Underweight | 1 | 3.3 |
| Normal | 13 | 43.3 |
| Preobese | 12 | 40 |
| Obesity class 1 | 3 | 10 |
| Obesity class 2 | 1 | 3.3 |
| Total | 30 | 100.0 |

Based on table 12, knee osteoarthritis sufferers who have a BMI underweight, namely 1 sample or 3.3%, normal, namely 13 samples or 43.3%, preobese as many as 12 samples or 40%, obesity class 1 as many as three samples or 10%, and obesity class 2 as much as 1 sample or 3.3%.

**Table 13: Number of patients with knee osteoarthritis by joint gap**

| Joint Gap | N | % |
|---|---|---|
| Narrowing | 22 | 73.3 |
| Not Narrowing | 8 | 26.7 |
| Total | 30 | 100.0 |

Based on the Kellgren-Lawrence classification, joint space narrowing has not occurred in grade 1 or grade 2, grade 3, and grade 4 knee osteoarthritis patients in grade 3, grade 4, and the joint gap are not narrowed (grade 1) so that it can be analyzed using the chi-square method. Based on table 13, patients with knee osteoarthritis with narrowed joint space were 22 samples or 73.3%, and eight were not narrowed or 26.7%.

**Table 14: Number of patients with knee osteoarthritis based on the Kellgren-Lawrence classification**

| Kellgren-Lawrence | N | % |
|---|---|---|
| Grade 1 | 9 | 30.0 |
| Grade 2 | 20 | 66.7 |
| Grade 3 | 1 | 3.3 |
| **Total** | 30 | 100.0 |

Table 14 shows knee osteoarthritis patients with grade 1 were nine samples or 30%, grade 2 were 20 samples or 66.7%, grade 3 was 1 sample or 3.3%, and grade 4 was absent.

**Table 15: Number of patients with knee osteoarthritis based on joint gaps and normal and abnormal BMI values**

| | | BMI | | |
|---|---|---|---|---|
| | | **Abnormal** | **Normal** | **Total** |
| | Narrowing | 15 | 7 | 22 |
| | % | 68.2 | 31.8 | 100.0 |
| **Joint Gap** | Not Narrowing | 2 | 6 | 8 |
| | % | 25.0 | 75.0 | 100.0 |
| | **Total** | 17 | 13 | 30 |
| | **%** | 56.7 | 43.3 | 100.0 |

Based on table 15, patients with knee osteoarthritis with narrowed joint space and abnormal BMI were 15 samples or 68.2%, narrowed joint space, and normal BMI were seven samples or 31.8%, joint space was not narrowed, and abnormal BMI was two samples or 25.0%, joint space was not narrowed, and BMI was normal for six samples or 75.0%. Based on the results of this study, it was found that more knee osteoarthritis patients with abnormal BMI values had a narrowed joint space picture and more knee osteoarthritis patients with average BMI values had a non-narrowed joint space picture.

**Table 16: Number of patients with knee osteoarthritis based on the Kellgren-Lawrence classification and BMI**

| | | BMI | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | *Underweight* | *Normal* | *Pre Obese* | *Obesity Class 1* | *Obesity Class 2* | |
| | Grade 3 | 0 | 1 | 0 | 0 | 0 | 1 |
| | % | 0 | 100.0 | 0 | 0 | 0 | 100.0 |
| **Kellgren Lawrence** | Grade 2 | 1 | 5 | 10 | 3 | 1 | 20 |
| | % | 5.0 | 25.0 | 50.0 | 15.0 | 5.0 | 100.0 |
| | Grade 1 | 0 | 7 | 2 | 0 | 0 | 9 |
| | % | 0 | 77.8 | 22.2 | 0 | 0 | 100.0 |
| Total | | 1 | 13 | 12 | 3 | 1 | 30 |
| | | 3.3 | 43.3 | 40.0 | 10.0 | 3.3 | 100.0 |

Based on table 16, there is only 1 sample of knee osteoarthritis grade 3 or 100% with normal BMI values. Grade 2 with an underweight BMI value of 1 sample or 5%, normal five samples or 25%, preobese ten samples or 10%, obesity class 1 3 samples or 15%, and obesity class 2 1 sample or 5%. Grade 1 with an underweight BMI value has no sample, seven samples or 77.8% normal, two samples or 22.2% preobese, obesity class 1 and obesity class 2 have no samples.

In this study, it was found that knee osteoarthritis patients who had abnormal BMI values were more than normal BMI values. The most abnormal BMI values are preobese, and the least are underweight and obesity class 2. Osteoarthritis knee sufferers with narrowed joint space more than those with non-narrowed joint space. Based on the Kellgren-Lawrence classification, the highest number of knee osteoarthritis sufferers is in grade 2, and the least is in grade 3.

Patients with knee osteoarthritis with narrowed joint gaps had the most abnormal BMI values. Patients with knee osteoarthritis with non-narrowed joint space had the most normal BMI values. In the Kellgren-Lawrence classification, grade 1 is the most experienced by patients with a normal BMI, and grade 2 is the most experienced by patients with knee osteoarthritis with a preobese BMI. Grade 3 only has knee osteoarthritis among patients with a normal BMI. Joint space narrowing has not occurred in grades 1, and joint space narrowing has occurred in grades 2 and 3. So joint space narrowing is most common in patients with preobese BMI or BMI values between 25.0-29.9.

In this study, 30 patients with knee osteoarthritis were used as samples. The average BMI value of the 30 samples was 25.6. It means that, on average, patients with knee osteoarthritis at UKI General Hospital are overweight or preobese. In this

study, H0 is a BMI value above normal that cannot affect knee osteoarthritis in patients at UKI General Hospital in 2017, and Ha, which is a BMI value above normal, can affect knee osteoarthritis in patients at UKI General Hospital in 2017. The results of the chi-square analysis using Fisher's Exact Test show that the p-value = 0.045, which indicates that the BMI variable has a p-value of less than the significance level = 0.05. It can be concluded that there is a relationship between BMI and knee osteoarthritis where a BMI value above normal can affect knee osteoarthritis, so H0 can be rejected. In the abnormal BMI value, the odds ratio (OR) value is 6.429, which means that patients with abnormal BMI values have a risk of 6,429 times greater risk of joint space narrowing than patients with normal BMI values.

Based on the results of previous studies reporting BMI affects the severity of knee osteoarthritis, there are also those who get the results that BMI is not proven to affect the severity of knee osteoarthritis. So, it can be concluded that other risk factors can affect the severity of knee osteoarthritides, such as age, gender, occupation, patient history, trauma, and other factors that may increase the risk of knee osteoarthritis severity. However, it is undeniable that excess body weight can worsen knee osteoarthritis because it increases the burden that the knee of knee osteoarthritis sufferers must bear. In addition, with the thinning of the cartilage layer and over time, if excess weight lasts for a long time, the joint space will narrow and worsen knee osteoarthritis. As a result, the patient will have difficulty walking and experience pain in the knee affected by osteoarthritis, impacting the patient's quality of life. Therefore, it is advisable for patients over 40 with a BMI value above normal to keep their weight within normal limits.

The statistical test analysis showed a relationship between BMI and the incidence of knee osteoarthritis, where patients with abnormal BMI values had more images of joint space narrowing. The results of this study indicate that a BMI value above normal (more than 24.9) can affect the occurrence of joint space narrowing in Knee Osteoarthritis patients. It can be seen from the results of the data obtained that more patients with BMI values above normal (more than 24.9) experienced joint space narrowing than patients with normal BMI values.

## Conclusion

Based on research conducted on 30 patients with knee osteoarthritis at UKI General Hospital in 2017, the results showed a relationship between BMI and the incidence of knee osteoarthritis. The results of this study indicate that BMI values above average (more than 24.9) can affect the occurrence of joint space narrowing in patients. Those with abnormal BMI had a risk of 6,429 times the risk of joint space narrowing compared to patients with normal BMI. The average BMI value of patients with knee osteoarthritis at UKI General Hospital is 25.6. It means that, on average, patients with knee osteoarthritis at UKI General Hospital are overweight or preobese. Therefore, people are expected to maintain ideal body weight to avoid obesity. Ways that can be done such as exercising regularly, having a balanced diet to maintain a healthy diet, and immediately taking treatment if the initial symptoms of knee osteoarthritis occur to avoid getting the disease worse, especially for people who are elderly and overweight to reduce physique activity that uses the knee joint.

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# Relationship between Body Mass Index and Knee Osteoarthritis at UKI General Hospital in 2017