

Literature Review: The Impact of Obesity on the Incidence of Osteoarthritis

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Abstract

Osteoarthritis is a chronic degenerative joint disease that is one of the main causes of pain, activity limitations, and disability in adults and the elderly. Obesity is known to be an important risk factor that plays a role in the occurrence and progression of osteoarthritis through biomechanical and inflammatory mechanisms. The increasing prevalence of obesity in various countries makes the relationship between obesity and osteoarthritis a health problem that requires attention. The purpose of this study was to determine the relationship between obesity and the incidence of osteoarthritis based on the results of published studies. This study used a literature review method by examining scientific articles obtained from the PubMed, Google Scholar, ScienceDirect, SpringerLink, ProQuest, and ResearchGate databases. The selected articles were published between 2016–2026, available in Indonesian or English, and discussed the relationship between obesity and osteoarthritis. Analysis was conducted using a narrative approach and the PICOS framework on 10 articles that met the inclusion criteria. The results showed that all articles analyzed showed a relationship between obesity and osteoarthritis, especially knee osteoarthritis. Individuals with obesity have a higher risk of developing osteoarthritis than individuals of normal weight. The risk increases with increasing body mass index (BMI). In addition to increasing the mechanical load on joints, obesity also triggers chronic inflammation through the production of adipokines and proinflammatory cytokines that accelerate cartilage damage. Obesity is associated with increased pain, decreased physical function, decreased quality of life, and an increased risk of sarcopenia in osteoarthritis patients. Weight loss, physical exercise, and bariatric surgery have been shown to significantly improve symptoms and joint function. Obesity is an important risk factor associated with the occurrence and progression of osteoarthritis through biomechanical and inflammatory mechanisms. Weight control through a healthy lifestyle, regular physical activity, and weight loss interventions is an important strategy in the prevention and management of osteoarthritis

Introduction

Osteoarthritis (OA) is a degenerative joint disease characterized by articular cartilage damage, subchondral bone changes, osteophyte formation, and decreased joint function which can cause pain, stiffness, and disability (Coaccioli et al., 2022; Puntillo et al., 2024; Zhao et al., 2024). OA is one of the musculoskeletal diseases most frequently found in the elderly population and is the main cause of limited physical activity throughout the world. Risk factors for OA include age, gender, genetics, joint injury, physical activity, and obesity (Wardhani et al., 2022; Nugraha et al., 2015).

Obesity is a condition of excessive accumulation of body fat due to an imbalance between energy intake and energy expenditure. Based on Asia-Pacific recommendations, obesity is

defined as a body mass index (BMI) ≥ 25 kg/m². Apart from using BMI, obesity can also be assessed through waist circumference to identify central obesity which is closely related to the risk of metabolic and cardiovascular disease (Ossai, 2024; Salsabila et al., 2024).

In the last few decades, the prevalence of obesity has continued to increase and has become a major public health problem (Williams et al., 2015; Blüher, 2019; Agha & Agha, 2017). Apart from increasing the risk of cardiovascular disease, type 2 diabetes mellitus, and hypertension, obesity also plays an important role in the occurrence of osteoarthritis. Various studies show that individuals with obesity have a higher risk of developing osteoarthritis, especially in the knee, hip and ankle joints compared to individuals with normal weight (Nugraha et al., 2015; Ossai, 2024; Salsabila et al., 2024; Reyes et al., 2016).

The relationship between obesity and osteoarthritis is not only caused by increased mechanical load on weight-bearing joints, but also involves complex inflammatory mechanisms (Thijssen et al., 2015; Shumnalieva et al., 2023; Chen et al., 2017). Increased body weight causes excess pressure on the articular cartilage and subchondral bone, thereby accelerating the degenerative process of the joint. In addition, adipose tissue produces various inflammatory mediators such as leptin, adiponectin, resistin, tumor necrosis factor-alpha (TNF- α), and interleukin-6 (IL-6) which play a role in cartilage degradation and osteoarthritis progression (Wardhani et al., 2022; Long et al., 2019).

Research by Reyes et al. showed that overweight and obesity increase the risk of osteoarthritis in various joint locations, especially knee osteoarthritis. Individuals with grade II obesity have up to a 4.7 times higher risk of developing knee osteoarthritis compared to individuals with a normal BMI.²⁹ Similar results were also reported by Nugraha et al., Sofyan and Rizal, and Syah et al. which found a significant relationship between obesity and the incidence of knee osteoarthritis in adult and elderly populations (Nugraha et al., 2015; Rizal, 2020; Syah et al., 2021). Considering the high prevalence of obesity and its impact on the incidence and progression of osteoarthritis, a comprehensive study of the relationship between these two conditions is needed. Therefore, this study aims to examine various scientific evidence regarding the influence of obesity on the incidence of osteoarthritis through a literature review method.

Method

Research Sources and Methods

This literature review aims to determine the relationship between obesity and the incidence of osteoarthritis. The literature search was conducted through several electronic databases, namely PubMed, Google Scholar, ScienceDirect, SpringerLink, ProQuest, and ResearchGate. The literature used was limited to publications from 2016 to 2026, and articles available in both Indonesian and English. The literature search was conducted using keywords. The article selection process was carried out systematically through identification based on titles and keywords, abstract review, full-text review, and final selection according to predetermined inclusion and exclusion criteria. Data analysis was conducted using a narrative approach with the PICOS (Population, Intervention, Comparative, Outcome, Study Design) method to identify, evaluate, and synthesize relevant research findings regarding the effect of obesity on the incidence of osteoarthritis.

Keywords

Obesity, osteoarthritis, body mass index, joint pain, nutritional status.

Research Article Selection

Search results were limited to research articles published between 2016 and 2026 and available in both Indonesian and English.

Inclusion Criteria

The exclusion criteria for this study were as follows: (1) Articles/journals discussing the effect of obesity on the incidence of osteoarthritis. (2) Studies published in the last 10 years (2016–2026). (3) Articles in Indonesian or English.

Exclusion Criteria

The exclusion criteria for this study were as follows: (1) Articles not available in full version, (2) Articles irrelevant to the topic focus.

Data Extraction and Management

The obtained articles were selected in stages. First, title screening was performed to eliminate articles that did not meet the inclusion criteria. Second, abstract review was conducted to determine their relevance to the research topic and eliminate articles that did not meet the inclusion criteria. Third, a comprehensive review was conducted to ensure the suitability of the articles for analysis. Data extracted from each article covered the following aspects: (1) Population; (2) Intervention; (3) Comparative; (4) Outcome; (5) Study Design. This study uses a literature review method, with literature sources obtained from PubMed, Google Scholar, ScienceDirect, SpringerLink, ProQuest, and ResearchGate. The selected articles were articles published in 2016–2026 and articles that are accessible, and discuss the relationship between obesity and the incidence of osteoarthritis.

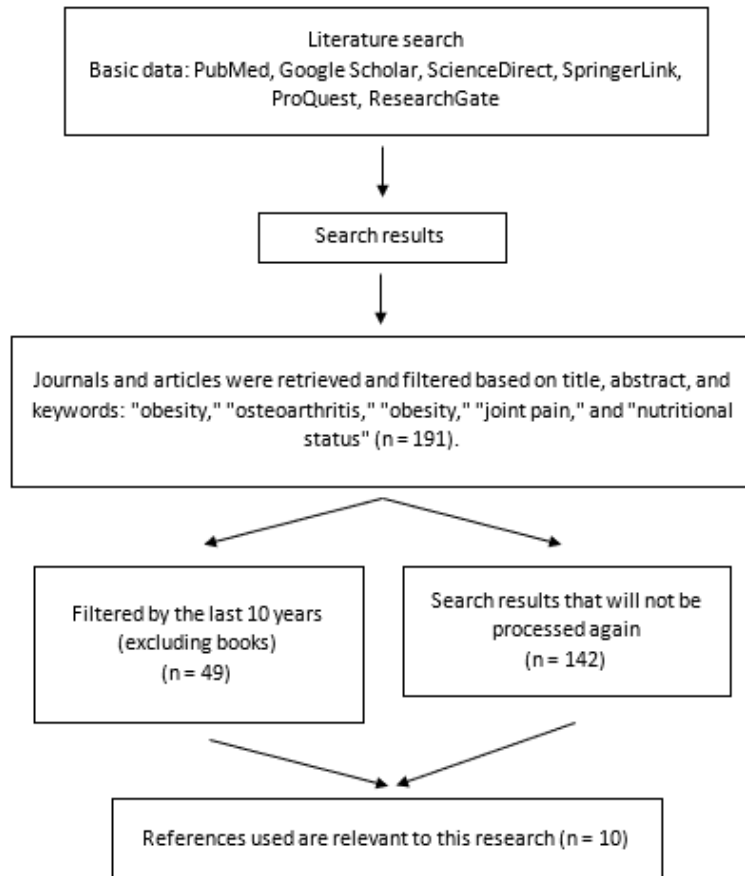


Figure 1. Identification of Literature Review

Result and Discussion

As shown in the flowchart (Figure 1), approximately 191 articles were initially identified using specific keywords. After several stages of screening based on inclusion and exclusion criteria, the articles eligible for review and summary are presented in Table 1.

Table 1 Journal Studies of the Relationship Between Obesity and the Incidence of Osteoarthritis

No	Title	Population	Intervention	Comparative	Outcome	Study Design
1	Association between Overweight and Obesity and Risk of Clinically Diagnosed Knee, Hip, and	1,764,061 residents of Catalonia, Spain aged ≥ 40 years without a diagnosis of osteoarthritis at the start of the study and with BMI data. Individuals with patellofemoral pain (PFP) and	Exposure is in the form of body weight status based on WHO BMI categories: normal	Group with normal BMI (< 25 kg/m ²).	Risk of osteoarthritis of the knee, hip, and hand. Results show that overweight and obesity increase the risk of OA at all joint sites, especially knee OA. Grade II obesity	Population-Based Cohort Study (Retrospective Cohort)

No	Title	Population	Intervention	Comparative	Outcome	Study Design
	Hand Osteoarthritis: A Population-Based Cohort Study (Reyes et al., 2016)	patellofemoral osteoarthritis (PFOA) from 52 studies (adolescents and adults)	(<25 kg/m ²), overweight (25–29.9 kg/m ²), grade I obesity (30–34.9 kg/m ²), and grade II obesity (≥35 kg/m ²). Higher Body Mass Index (BMI) (overweight/obese)		increases the risk of knee OA by up to 4.7 times compared to the normal BMI group. There is a dose-response relationship between increasing BMI and increased OA risk.	
2	Is Body Mass Index Associated with Patellofemoral Pain and Patellofemoral Osteoarthritis? A Systematic Review and Meta-Regression Analysis (Hart et al., 2016)	Patients treated at the Surgery, Neurology, and Internal Medicine Clinics of Teungku Peukan General Hospital, Southwest Aceh, aged >16 years (n=70)	Obesity based on Body Mass Index (BMI)	Healthy controls or lower BMI	Higher BMI was found in adults with PFP and PFOA compared to healthy controls. No significant association was found in adolescents with PFP. There was a trend for higher BMI to increase the risk of developing PFP in adults.	Systematic Review dan Meta-Regression Analysis

No	Title	Population	Intervention	Comparative	Outcome	Study Design
3	The Relationship between Obesity and the Incidence of Knee Osteoarthritis at Teungku Peukan General Hospital, Southwest Aceh (Rizal, 2020)	67 elderly people in the Batu Aji Community Health Center (Puskesmas) working area in Batam City in 2020	Obesity (BMI $\geq$ obesity)	Obesity group compared with non-obesity group	There was a significant association between obesity and the incidence/severity of knee osteoarthritis ($p=0.000$). 88.6% of obese patients had severe OA compared to 42.3% in the non-obese group.	Observational analysis with a cross-sectional approach
4	The Relationship between Obesity and the Incidence of Knee Osteoarthritis in the Elderly in the Batu Aji Community Health Center Work Area, Batam City, 2020 (Syah et al., 2021)	1,105 adult patients with knee osteoarthritis and obesity (average BMI 33.6–36.4 kg/m ²)	Weight loss program through nutrition education, behavioral therapy, low-calorie diet, meal replacement, and a combination of diet and exercise	Non-obese elderly	Obese elderly people are more likely to experience knee osteoarthritis (76.7%) than non-obese elderly people (37.5%). There is a significant association between obesity and knee osteoarthritis ($p = 0.001$).	Observational analysis with a cross-sectional approach

No	Title	Population	Intervention	Comparative	Outcome	Study Design
5	Effects of Meaningful Weight Loss Beyond Symptomatic Relief in Adults with Knee Osteoarthritis and Obesity: A Systematic Review and Meta-Analysis (Chu, Lim, & Ng, 2018)	Individuals with knee, hip, and hand osteoarthritis and a control group from various studies analyzed	Body composition measurement (fat mass, fat mass percentage, lean mass, lean mass percentage, and fat mass/lean mass ratio)	Control group, exercise only, or intervention with lower weight loss	Weight loss of 5–10% significantly improves pain (ES=0.33), disability (ES=0.42), and physical quality of life (ES=0.39) in obese knee OA patients.	Systematic Review and Meta-analysis of Randomized Controlled Trials (RCTs)
6	Association Between Body Composition and Osteoarthritis: A Systematic Review and Meta-Analysis (Long et al., 2019)	50 elderly people in Laweyan District, Surakarta, consisting of 25 obese and 25 non-obese elderly people	Obesity status measured using Body Mass Index (BMI)	Comparison between OA and non-OA subjects and various body composition categories	Fat mass and fat mass percentage are risk factors for knee, hip, and hand OA. Lean mass is positively associated with knee OA, but lean mass percentage is protective against OA. The fat/lean mass ratio is associated with an increased risk of structural OA.	Systematic Review dan Meta-analysis

No	Title	Population	Intervention	Comparative	Outcome	Study Design
7	The Relationship Between Obesity and the Incidence of Knee Osteoarthritis in the Elderly in Laweyan District, Surakarta (Nugraha AS, Widyatmoko S, Jatmiko SW., 2015)	Overweight or obese patients with knee osteoarthritis (410 participants; 217 in the intervention group and 193 in the control group)	Physical exercise program (aerobic exercise, resistance training, strength training, aquatic exercise, walking program, individualized exercise therapy) with a duration of 1–18 months	Obesity elderly compared with non-obesity elderly	There was a significant association between obesity and the incidence of knee osteoarthritis ($p = 0.001$). Fourteen of the 25 obese elderly individuals experienced osteoarthritis, while only three of the 25 non-obese elderly individuals experienced osteoarthritis. Obesity increases the mechanical load on the knee joint, accelerating cartilage damage and joint degeneration.	Observational Analysis with Cross-Sectional Approach
8	Effectiveness of Exercise in Patients with Overweight or Obesity Suffering from Knee Osteoarthritis: A Systematic Review	Adult patients with obesity and osteoarthritis (OA), total $\pm 12,000$ participants from 12 studies	Bariatric surgery (LSG, RYGB, LAGB, and other bariatric procedures)	Control group without exercise intervention or only receiving standard care/diet	Physical exercise reduced pain ($MD = 0.95$; $p < 0.001$), improved physical function based on the WOMAC ($MD = 3.74$; $p < 0.05$), and increased 6MWT distance by 38.18 meters ($p < 0.001$). The combination of diet and exercise provided better	Systematic Review dan Meta-Analysis terhadap 6 Randomized Controlled Trials (RCT)

No	Title	Population	Intervention	Comparative	Outcome	Study Design
	and Meta-Analysis (Jurado-Castro et al., 2022)				results than diet alone.	
9	Effect of Bariatric Surgery on Osteoarthritis-Related Pain and Function : A Systematic Review and Meta-Analysis (Alqahtani et al., 2026)	13,528 knee osteoarthritis (KOA) patients aged ≥ 50 years from 35 studies in various countries	Presence of risk factors for sarcopenia in patients with AOC (AOC severity, gender, diabetes mellitus, osteoporosis, smoking, alcohol consumption, and irregular physical activity)	Preoperative versus postoperative conditions	A 79% reduction in the odds of an OA diagnosis (OR=0.21; 95% CI 0.11–0.41); significant improvement in WOMAC (pain, stiffness, physical function) scores at 6 and 12 months postoperatively	Systematic Review and Meta-analysis of 12 prospective and retrospective cohort studies
10	High Prevalence and Multifactorial Risks of Sarcopenia in Knee Osteoarthritis: A Systematic Review and Meta-	1,764,061 residents of Catalonia, Spain aged ≥ 40 years without a diagnosis of osteoarthritis at the start of the study and with BMI data. Individuals with patellofemoral pain (PFP) and patellofemoral osteoarthritis (PFOA) from	Exposure is in the form of body weight status based on WHO BMI categories: normal (<25 kg/m ²), overwei	OA patients without specific risk factors (e.g., no diabetes, no osteoporosis, no smoking, regular physical activity, lower	The prevalence of sarcopenia was 25.07%; the prevalence of sarcopenic obesity was 12.06%; the prevalence increased in more severe AKI, women, Asian populations, diabetes, osteoporosis, smokers, alcohol	Systematic Review dan Meta-analysis

No	Title	Population	Intervention	Comparative	Outcome	Study Design
	analysis (Chen et al., 2025)	52 studies (adolescents and adults)	ght (25–29.9 kg/m ²), grade I obesity (30–34.9 kg/m ²), and grade II obesity (≥35 kg/m ²). Higher Body Mass Index (BMI) (overweight/obese)	grade of OA)	drinkers, and irregular physical activity.	

Discussion

Based on a literature review of 10 selected articles, obesity was found to be a significant risk factor associated with osteoarthritis, particularly knee osteoarthritis. All studies indicate that obese individuals have a higher risk of developing osteoarthritis than individuals of normal weight, and this risk increases with increasing body mass index (BMI). These findings suggest that obesity plays a role in the development and progression of osteoarthritis by increasing the load on the supporting joints, particularly the knee and hip joints (Nugraha et al., 2015; Reyes et al., 2016; Rizal, 2020; Syah et al., 2021). In addition to increasing the mechanical load on joints, obesity also causes chronic low-grade inflammation through the production of adipokines and proinflammatory cytokines such as leptin, TNF- α , and IL-6, which contribute to joint cartilage damage. This condition can accelerate joint degeneration, increase pain, reduce physical function, and worsen the quality of life of people with osteoarthritis (Wojcieszek et al., 2022; Geng et al., 2023). Several studies have also shown that weight loss through dietary adjustments and physical activity can improve symptoms, joint function, and quality of life in osteoarthritis patients, making weight control an important strategy in the prevention and management of osteoarthritis (Chu et al., 2018; Long et al., 2019; Jurado-Castro et al., 2022).

Obesity Increases the Risk of Knee Osteoarthritis

Obesity plays a significant role as a risk factor for knee osteoarthritis. Individuals who are overweight or obese are known to be more likely to develop osteoarthritis than those with a normal BMI. This risk increases with increasing BMI, indicating a dose-response relationship between obesity and the incidence of osteoarthritis. A study by Reyes et al. reported that individuals with stage II obesity had up to a 4.7-fold higher risk of developing knee osteoarthritis compared to those with a normal weight group (Reyes et al., 2016). These results

align with studies conducted by Nugraha et al., Sofyan and Rizal, and Syah et al., which found a significant association between obesity and the incidence of knee osteoarthritis in various population groups, including the elderly and hospital patients. These findings indicate that weight gain is a contributing factor to the development of knee osteoarthritis (Nugraha et al., 2015; Rizal, 2020; Syah et al., 2021).

Obesity Increases Mechanical Load on the Knee Joint

The relationship between obesity and knee osteoarthritis is primarily explained by increased mechanical load on the joint (Sampath et al., 2023; Adouni et al., 2024; Duclos, 2016). As the body's primary support joint, the knee experiences a significant portion of stress during daily activities. In obese individuals, excess weight causes increased stress on various joint structures, including cartilage, menisci, ligaments, and subchondral bone, accelerating joint damage (Rizal, 2020). Biomechanically, each additional 1 kg of body weight can increase the load on the knee joint by 3–4 times during walking. This sustained, long-term pressure can cause progressive cartilage damage, reduce joint elasticity, and trigger the degenerative changes characteristic of osteoarthritis. Furthermore, increased mechanical stress also contributes to osteophyte formation, joint space narrowing, and changes in the subchondral bone, further accelerating disease progression (Syah et al., 2021).

Obesity Causes Chronic Inflammation That Accelerates Joint Destruction

In addition to increased mechanical loading on joints, the link between obesity and osteoarthritis also involves inflammatory mechanisms. Obesity is now considered a chronic low-grade inflammatory condition because adipose tissue acts as an active endocrine organ that produces various pro-inflammatory mediators (Long et al., 2019). According to Long et al. (2022), increased body fat mass is associated with an increased risk of osteoarthritis in various joints. Adipose tissue produces adipokines, such as leptin, adiponectin, resistin, TNF- α , and IL-6, which contribute to systemic inflammation and cartilage matrix damage. As a result, joint degeneration can progress more rapidly in obese individuals compared to those of normal weight. This mechanism also explains why osteoarthritis can occur in joints that do not directly bear weight, such as the joints of the hands.

Obesity Is Associated with Increased Knee Pain

Pain is the most common clinical symptom experienced by people with osteoarthritis. A systematic review conducted by Hart et al. (2017) showed that individuals with a higher body mass index (BMI) tend to experience more severe patellofemoral pain and patellofemoral osteoarthritis than individuals of normal weight. The higher levels of pain in obese individuals are thought to be caused by a combination of biomechanical and inflammatory factors (Paley & Johnson, 2016; Francisco et al., 2018). Increased joint load causes greater intra-articular pressure and irritation of surrounding tissues, while inflammatory mediators produced by adipose tissue can increase the sensitivity of pain receptors. This condition leads to more severe and prolonged pain, which can ultimately reduce mobility, limit daily activities, and increase the patient's dependence on others for assistance.

Obesity Reduces Physical Function and Quality of Life

In addition to increasing pain, obesity also contributes to decreased physical function in osteoarthritis patients. Persistent pain and progressive joint damage can limit the patient's ability to perform various activities, such as walking, standing for long periods, climbing stairs, and performing other daily activities. This condition leads to decreased mobility and functional ability, impacting the patient's quality of life. Jurado-Castro et al. (2022) reported that

overweight and obese patients with knee osteoarthritis have lower walking ability than individuals of normal weight. This decline in physical function can impact productivity, independence, and quality of life. If not optimally managed, activity limitations can lead to reduced energy expenditure, worsen obesity, and create a mutually reinforcing cycle between obesity and osteoarthritis.

Body Composition Plays a Role in the Development of Osteoarthritis

The results of research by Long et al. (2022) indicate that the incidence of osteoarthritis is not only related to overall body weight but is also influenced by body composition. Increased fat mass and body fat percentage are known to be associated with a higher risk of osteoarthritis in the knee, hip, and hand joints. Conversely, a higher percentage of muscle mass has a protective effect against the development of osteoarthritis. These findings indicate that the risk of osteoarthritis may vary in individuals of the same body weight, depending on the proportion of fat mass and muscle mass. Adequate muscle mass plays a role in supporting and stabilizing joints, thereby reducing excessive pressure on joint structures and helping maintain optimal joint function.

Obesity Associated with Sarcopenia in Osteoarthritis Patients

Research by Chen et al. (2025) reported that the prevalence of sarcopenia in patients with knee osteoarthritis reached 25.07%, while the prevalence of sarcopenic obesity was 12.06%. Sarcopenic obesity is characterized by increased body fat mass accompanied by decreased muscle mass and strength, making it a common problem in patients with knee osteoarthritis. The combination of obesity and sarcopenia can worsen physical function decline compared to obesity alone. Reduced muscle mass and strength, particularly the quadriceps, leads to decreased knee joint stability, increasing the risk of impaired mobility, falls, and limitations in daily activities. Consequently, this condition can have a greater impact on the quality of life of patients with knee osteoarthritis.

Weight Loss Can Reduce Osteoarthritis Symptoms

Chu et al. (2018) showed that a 5–10% weight loss significantly improved pain, physical function, and quality of life in obese patients with knee osteoarthritis. These benefits occurred due to reduced mechanical load on the joints and decreased inflammatory activity triggered by adipose tissue. The greater the weight loss achieved, the greater the improvement in symptoms experienced by patients. Therefore, weight control through dietary modification and increased physical activity is an important component in the prevention and management of knee osteoarthritis in obese individuals.

Physical Exercise and Bariatric Surgery Provide Significant Clinical Improvements

Jurado-Castro et al. (2022) reported that various forms of physical exercise, such as aerobic exercise, resistance training, aquatic exercise, and walking programs, are effective in reducing pain and improving physical function in overweight and obese osteoarthritis patients. In addition to helping control weight, physical exercise also plays a role in increasing the strength of the knee-supporting muscles and improving joint stability, thereby reducing functional limitations in patients. In individuals with severe obesity, bariatric surgery can be a treatment option with significant clinical benefits. A systematic review showed that this procedure can reduce the risk of osteoarthritis diagnosis by up to 79% and improve pain, joint stiffness, and physical function. These findings confirm that weight loss is a major factor in improving the clinical condition and quality of life of patients with knee osteoarthritis.

Conclusion

Based on the literature review of the various studies reviewed, it can be concluded that the characteristics of the study respondents varied by age, gender, and nutritional status, with the majority of respondents being in the elderly group at higher risk of developing osteoarthritis. Osteoarthritis is still quite common in the study population, especially in the older age group. Furthermore, the distribution of obesity indicates that some respondents had obese nutritional status, which is an important risk factor for osteoarthritis, particularly knee osteoarthritis. Reviews of various studies consistently show a significant association between obesity and osteoarthritis, with obese individuals having a higher risk of developing osteoarthritis than individuals of normal weight. This risk increases with increasing body mass index and is influenced by mechanisms such as increased mechanical load on joints and inflammatory processes that accelerate cartilage damage and joint degeneration. Based on these findings, the public is advised to pay more attention to weight management through a healthy diet and regular physical activity to reduce the risk of osteoarthritis, particularly in the knee joint. Healthcare professionals are expected to increase education, health promotion, and early detection efforts in high-risk groups, such as the elderly and obese individuals. Furthermore, healthcare facilities need to support the implementation of sustainable prevention and control programs for degenerative diseases. Further research is also needed to strengthen the scientific evidence regarding the relationship between obesity and osteoarthritis and explore other factors that may influence the incidence and progression of the disease.

References

- Adouni, M., Aydelik, H., Faisal, T. R., & Hajji, R. (2024). The effect of body weight on the knee joint biomechanics based on subject-specific finite element-musculoskeletal approach. *Scientific Reports*, 14(1), 13777. <https://doi.org/10.1038/s41598-024-63745-x>
- Agha, M., & Agha, R. (2017). The rising prevalence of obesity: part A: impact on public health. *International journal of surgery. Oncology*, 2(7), e17. <https://doi.org/10.1097/IJ9.000000000000017>
- Alqahtani, M. M. M., Raposo, A., Alshalaan, A. M. S., Asiri, S. M. S., Alfaifi, J. S. Y., Alqahtani, S. M. S., ... & Alshahrani, N. Z. (2026). Effect of Bariatric Surgery on Osteoarthritis-Related Pain and Function: A Systematic Review and Meta-Analysis. *World Journal of Surgery*, 50(3), 513-522. <https://doi.org/10.1002/wjs.70236>
- Blüher, M. (2019). Obesity: global epidemiology and pathogenesis. *Nature reviews endocrinology*, 15(5), 288-298. <https://doi.org/10.1038/s41574-019-0176-8>
- Chen, D. I., Shen, J., Zhao, W., Wang, T., Han, L., Hamilton, J. L., & Im, H. J. (2017). Osteoarthritis: toward a comprehensive understanding of pathological mechanism. *Bone research*, 5(1), 16044. <https://doi.org/10.1038/boneres.2016.44>
- Chen, T. X., Yang, T. J., Cheng, S., Zhang, Z. L., & Liu, T. (2025). High prevalence and multifactorial risks of sarcopenia in knee osteoarthritis: a systematic review and meta-analysis. *Journal of Orthopaedic Surgery and Research*, 20(1), 987. <https://doi.org/10.1186/s13018-025-06391-x>
- Chu, I. J. H., Lim, A. Y. T., & Ng, C. L. W. (2018). Effects of meaningful weight loss beyond symptomatic relief in adults with knee osteoarthritis and obesity: a systematic review and meta-analysis. *Obesity Reviews*, 19(11), 1597-1607. <https://doi.org/10.1111/obr.12726>

- Coaccioli, S., Sarzi-Puttini, P., Zis, P., Rinonapoli, G., & Varrassi, G. (2022). Osteoarthritis: new insight on its pathophysiology. *Journal of clinical medicine*, 11(20), 6013. <https://doi.org/10.3390/jcm11206013>
- Duclos, M. (2016). Osteoarthritis, obesity and type 2 diabetes: the weight of waist circumference. *Annals of physical and rehabilitation medicine*, 59(3), 157-160.
- Francisco, V., Pérez, T., Pino, J., López, V., Franco, E., Alonso, A., ... & Gualillo, O. (2018). Biomechanics, obesity, and osteoarthritis. The role of adipokines: When the levee breaks. *Journal of Orthopaedic Research®*, 36(2), 594-604. <https://doi.org/10.1002/jor.23788>
- Geng, R., Li, J., Yu, C., Zhang, C., Chen, F., Chen, J., ... & Jin, T. (2023). Knee osteoarthritis: Current status and research progress in treatment. *Experimental and therapeutic medicine*, 26(4), 481. <https://doi.org/10.3892/etm.2023.12180>
- Hart, H. F., Barton, C. J., Khan, K. M., Riel, H., & Crossley, K. M. (2017). Is body mass index associated with patellofemoral pain and patellofemoral osteoarthritis? A systematic review and meta-regression and analysis. *British journal of sports medicine*, 51(10), 781-790. <https://doi.org/10.1136/bjsports-2016-096768>
- Jurado-Castro, J. M., Munoz-Lopez, M., Ledesma, A. S. T., & Ranchal-Sanchez, A. (2022). Effectiveness of exercise in patients with overweight or obesity suffering from knee osteoarthritis: a systematic review and meta-analysis. *International journal of environmental research and public health*, 19(17), 10510. <https://doi.org/10.3390/ijerph191710510>
- Long, H., Xie, D., Zeng, C., Wei, J., Wang, Y., Yang, T., ... & Lei, G. (2019). Association between body composition and osteoarthritis: A systematic review and meta-analysis. *International Journal of Rheumatic Diseases*, 22(12), 2108-2118. <https://doi.org/10.1111/1756-185X.13719>
- Nugraha, A. S., Widyatmoko, S., PD, S., & Jatmiko, S. W. (2015). *Hubungan obesitas dengan terjadinya osteoarthritis lutut pada lansia kecamatan laweyan surakarta* (Doctoral dissertation, Universitas Muhammadiyah Surakarta).
- Ossai, O. V. (2024). Impact of nutrition on mental health and wellbeing of primary school children in a rural suburb of Enugu State, Nigeria.
- Paley, C. A., & Johnson, M. I. (2016). Physical activity to reduce systemic inflammation associated with chronic pain and obesity: a narrative review. *The Clinical journal of pain*, 32(4), 365-370.
- Puntillo, F., Giglio, M., Corriero, A., Coaccioli, S., Fornasari, D. M. M., Iolascon, G., ... & Finco, G. (2024). Unraveling the joints: a narrative review of osteoarthritis. *European Review for Medical and Pharmacological Sciences*, 28(15), 4080-4104.
- Reyes, C., Leyland, K. M., Peat, G., Cooper, C., Arden, N. K., & Prieto-Alhambra, D. (2016). Association between overweight and obesity and risk of clinically diagnosed knee, hip, and hand osteoarthritis: a population-based cohort study. *Arthritis & Rheumatology*, 68(8), 1869-1875. <https://doi.org/10.1002/art.39707>
- Rizal, F. (2020). Hubungan Antara Obesitas Dengan Kejadian Osteoarthritis Sendi Lututdi Rsu Teungku Peukan Aceh Barat Daya. *Jurnal Ilmu Kedokteran dan Kesehatan*, 7(4). <https://doi.org/10.33024/jikk.v7i4.3230>

- Salsabila, N. M., Hidayanty, H., Indriasari, R., Amalia, M., & Ibnu, I. F. (2024). The Relationship Between Common Mental Disorders And Emotional Eating And Nutritional Status Of Students In Hasanuddin University Student Dormitory, 2023: The Relationship Between Common Mental Disorders And Emotional Eating And Nutritional Status Of Students In Hasanuddin University Student Dormitory, 2023. *Jurnal Gizi Masyarakat Indonesia (The Journal of Indonesian Community Nutrition)*, 13(1). <https://doi.org/10.30597/jgmi.v13i1.32984>
- Sampath, S. J. P., Venkatesan, V., Ghosh, S., & Kotikalapudi, N. (2023). Obesity, metabolic syndrome, and osteoarthritis—an updated review. *Current obesity reports*, 12(3), 308-331. <https://doi.org/10.1007/s13679-023-00520-5>
- Shumnalieva, R., Kotov, G., Ermencheva, P., & Monov, S. (2023). Pathogenic mechanisms and therapeutic approaches in obesity-related knee osteoarthritis. *Biomedicines*, 12(1), 9. <https://doi.org/10.3390/biomedicines12010009>
- Syah, J., Alba, A. D., Wirakesuma, M. T., & Adha, K. (2021). Hubungan obesitas dengan kejadian osteoarthritis lutut pada lansia di wilayah kerja Puskesmas Batu Aji Kota Batam 2020. *Jurnal Rumpun Ilmu Kesehatan*, 1(2), 78-86. <https://doi.org/10.55606/jrik.v1i2.2349>
- Thijssen, E., Van Caam, A., & Van Der Kraan, P. M. (2015). Obesity and osteoarthritis, more than just wear and tear: pivotal roles for inflamed adipose tissue and dyslipidaemia in obesity-induced osteoarthritis. *Rheumatology*, 54(4), 588-600. <https://doi.org/10.1093/rheumatology/keu464>
- Wardhani, R. R., Riyanto, A., & Herwinda, N. (2022). Hubungan obesitas terhadap derajat Osteoarthritis Knee pada lansia: narrative review. *Journal Physical Therapy UNISA*, 2(1), 57-64.
- Wardhani, R. R., Riyanto, A., & Herwinda, N. (2022). Hubungan obesitas terhadap derajat Osteoarthritis Knee pada lansia: narrative review. *Journal Physical Therapy UNISA*, 2(1), 57-64.
- Williams, E. P., Mesidor, M., Winters, K., Dubbert, P. M., & Wyatt, S. B. (2015). Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *Current obesity reports*, 4(3), 363-370. <https://doi.org/10.1007/s13679-015-0169-4>
- Wojcieszek, A., Kurowska, A., Majda, A., Liszka, H., & Gądek, A. (2022). The impact of chronic pain, stiffness and difficulties in performing daily activities on the quality of life of older patients with knee osteoarthritis. *International journal of environmental research and public health*, 19(24), 16815. <https://doi.org/10.3390/ijerph192416815>
- Zhao, W., Long, Y., Wang, Y., & Chin, K. Y. (2024). Osteoarthritis: An integrative overview from pathogenesis to management. *The Malaysian Journal of Pathology*, 46(3), 369-378.