The Effectiveness of Blood Flow Restriction Exercise on Quadriceps Muscle Strength in Osteoarthritis Patients: A Literature Review

Efektifitas Latihan Blood Flow Restriction Terhadap Kekuatan Otot Quadriceps Pada Penderita Osteoatritis : Tinjauan Pustaka

Review Article

Tisar Ibnu Mansyar* Universitas Negeri Yogyakarta, INDONESIA

Panggung Sutapa Universitas Negeri Yogyakarta, INDONESIA

Bernadeta Suhartini Universitas Negeri Yogyakarta, INDONESIA

Abstract.

Background Osteoarthritis is a disorder caused by degeneration of the body, particularly in old age. Osteoarthritis is usually characterized by structural damage to the joints and decreased physical function. Exerciseblood flow restrictionbe an alternative step to provide an effect on muscle adaptation. Providing exerciseblood flow restrictioncan provide physiological adaptation to muscle strength and mass, so that physical function will improve along with increases in muscle strength and mass.

Objectives This literature review aims to examine in more detail the effects of training usingblood flow restrictionon quadriceps muscle strength in osteoarthritis sufferers

Methods This research uses the methodsystematic literature review The database used to search for literature is data found on the website.scopus, google scholars And pubmed The research results are presented by examining the quality of the documents in detail and according to the scope of the research.

Results The results of the study showed an increase in muscle strength.quadricepsusing trainingblood flow restrictionin osteoarthritis sufferers.

Conclusion The conclusion of this study is that there is effectiveness in quadriceps muscle strength in osteoarthritis sufferers with training using.blood flow resrtricion However, the load must be adjusted to achieve satisfactory results and avoid further injury.

Keywords: blood flow restriction, quadriceps muscle strength, osteoarthritis.

Received: March 28, 2026. Accepted: April 10, 2026

*Correspondence: tisaribnumansyar@gmail.com
Tisar Ibnu Mansyar
Magister Program of Sport Science, Faculty of Sport and Health Science, Universitas Negeri Yogyakarta, Indonesia

INTRODUCTION

Osteoarthritis is the most common type of arthritis, particularly among the elderly, and is therefore classified as a degenerative disease. Degenerative diseases are caused by the deterioration of organ function over time [1]. Osteoarthritis is chronic and typically progresses slowly, causing mild inflammation and often no inflammation. It can affect various joints, but is most commonly seen in the weight-bearing joints, namely the knees [2].

Knee osteoarthritis (KOA) has become a major public health problem worldwide. The primary symptom of KOA is pain that worsens as the disease progresses, affecting knee joint function and ultimately disrupting daily activities [3]. Therefore, effective conservative treatment is essential to effectively manage and reduce the burden caused by osteoarthritis.

Exercise therapy can be an alternative to reduce the symptoms of knee osteoarthritis (KOA). Quadriceps weakness is considered a significant risk factor for KOA and is also a major determinant of physical function in patients [4]. Elderly arthritis patients have a higher risk of falls due to deficits in muscle strength and knee proprioception [5]. Decreased muscle mass is associated with the presence and severity of age-related knee osteoarthritis. Low muscle mass in the lower limbs is independently associated with knee osteoarthritis (KOA) [4].

Many new exercise therapy modalities are being researched to address this problem, one of which is exercise usingblood flow restrictionThis exercise is performed by partially restricting the arterial blood flow entering the muscle and completely restricting the venous blood flow leaving the working muscle during exercise [6]. The mechanism that can explain the increase in muscle strength in exerciseblood flow restrictionThis is the accumulation of metabolic waste around the trained muscles as a form of adaptive response to local hypoxide due to restricted blood flow in the trained area [7]. The accumulation of these waste causes stress on the muscle tissue and its surroundings so that the muscle

tissue will try to adapt to respond to the existing stressor, so that muscle protein synthesis experiences an increase in signals that support the process of forming new muscle protein [6].

Various studies have shown changes and developments in muscle strength trained in OA sufferers aged 50-70 years with low intensity loads of 20%-40% of 1 RM for 4 weeks usingblood flow restriction[8]. Another study conducted on people aged 55 – 68 compared quadriceps muscle strength before and after the study usingblood flow restrictionwith a training intensity of 3x a week over a period of 4 weeks, it shows an increase in muscle strength.quadricepswith an initial average value of 18.93 ± 2.35 kg after the intervention to 23.71 ± 2.03 kg [6]. Meanwhile, research conducted on a 50-year-old age group with muscle volume measurements showed a significant change in value after usingblood flow restriction. The initial value of muscle volume from 43.00 cm increased to 43.40 cm [4].

The exercises provided not only increase muscle strength in osteoarthritis sufferers, but also prevent cartilage degeneration and inhibit inflammation.blood flow restrictionperformed to restore muscle strength in patients. Strengthening exercises are useful for relieving pain, reducing stiffness, improving physical function, and increasing the ability of lower extremity muscles to absorb shock when walking [4].

METHOD

Search Strategy

This study uses SLR study orsystematic literature reviewto collect, assess, and synthesize all relevant studies systematically and transparently. The database used to search for literature is data found on the website scopus, google scholars And pubmed with the criteria for 2021-2025. Prosedur Preferred Reporting Items for Systematic Reviews and Meta-Analyses(PRISMA) is used to ensure complete reporting with research results presented to see the quality of the documents in detail and according to the scope of the research. The main focus of this review is the academic literature on the influence ofblood flow restrictionon muscle strengthquadricepsin osteoarthritis sufferers.

Exclusion Criteria

The exclusion criteria for this study are as follows: (1) articles in the form of literature reviews, (2) articles published less than 5 years ago, (3) articles that do not discuss BFR in osteoarthritis sufferers.

Search Procedure

The search began by reviewing numerous databases discussing the use of blood flow restriction. Four articles were found that addressed the effects of blood flow restriction on osteoarthritis sufferers.

RESULTS AND DISCUSSION

Author & Year	Research Methods & Types	Head	Research & Objectives	Research result
[8]	A clinical experimental study with a randomized controlled trial. The study involved 6 weeks of twice-weekly high-intensity exercise with an interval of 48–120 hours between sessions.	The effect of 6 weeks of training with 2x training per week on the isokinetic strength of the quadriceps muscle in osteoarthritis patients with an average age of 50 to 65 years.	To determine the results of training using BFR on quadriceps muscle strength in OA sufferers.	In this study, there was a significant increase in peak isokinetic torque of the quadriceps muscle in knee OA patients with an addition of 50 mmHg to low-intensity weight training (30% 1-RM), 2 sessions per week for 6 weeks without side effects.

[3]	This study was conducted as a multicenter randomized controlled trial. This is the first study to assess the effects of a 12-week BFR training program on pain, muscle strength, and physical function in individuals with acute otitis media (KOA) complicated by MASLD.	The effects of 12 weeks of exercise and Kellgren and Lawrence scoring system scores were collected. Pain, range of motion (ROM), maximal isotonic strength (10RM), self-reported function (KOOS), and the 30-second sit-to-stand test from a chair were assessed at weeks 1, 4, and 12.	This study aims to compare the effects of exercise without and using BFR for 12 weeks in OA patients.	This study demonstrated that BFR training improved knee strength better than WB training alone. This resulted in greater pain reduction and overall improvements in functional outcomes of daily living, sports, and recreation for patients with KOA.
[6]	This study used a two-group pre- and post-test method. Group 1 BFR andlow load resistance training, group 2 only useslow load resistanceThe intervention was carried out for 4 weeks with an exercise intensity of 3x in 1 week.	Testing the effect of BFR & low load resistance training for 4 weeks on quadriceps muscle strength was carried out by predicting the 1-RM value using the formulaapple	To determine the effect of BFR and low load resistance training on quadriceps muscle strength in OA patients.	In this study, there were results of quadriceps muscle strength values in group I before the intervention, namely 14.90-21.50 kg (average: 18.93 ± 2.35 kg) and after the intervention 19.85-25.81 kg (average: 23.71 ± 2.03). While in group II before the intervention 16.55-25.81 kg (average: 19.47 ± 3.50) and after the intervention, namely 18.20-27.95 kg (average: 22.26 ± 3.23 kg).
[4]	This study was a prospective, single-group, pre-post study. The study was administered to individuals aged 50 years and older who were diagnosed with OA late.	This study evaluated the short-term effects and safety of LIRE with BFR, focusing on clinical symptoms, physical status, and function. It involved 15 OA patients aged 50 years and over.	To determine the short-term effects of BFR training carried out for 2 weeks with 3x training per week.	This study has confirmed that short-term LIRE training using BFR has an immediate positive effect on lower extremity muscle strength.

Research Methods and Results

The articles included in this literature review summarize and analyze four studies that generally discuss using a quantitative experimental approach [8][3][6][3]. The four articles that constitute the literature can be divided into two categories. Three articles used a randomized controlled trial approach [8][3][6]. One article used a quasi-experimental design [4].

Contents

People with osteoarthritis often experience difficulty performing activities. This is due to pain. This pain causes reluctance and difficulty moving [9]. This reluctance to move causes muscles to be rarely used, leading to weakness and reduced muscle mass [10]. It is estimated that approximately 80% of OA patients will experience limited mobility, and another 20% will experience a reduced quality of life [11].

The quadriceps muscle is a component of the knee's movement. When this muscle becomes weak, it can lead to decreased function. Exercising the quadriceps muscle increases actin and myosin activity, increasing the number of muscle fibers. This increased number of muscle fibers will increase quadriceps muscle strength [12].

Physical exercise is recommended for managing osteoarthritis regardless of disease severity, pain, and functional status [7]. However, exercise for OA patients must be tailored. When this exercise is not tailored, there is a risk that OA patients will experience swelling, worsening pain, and cause inflammation [7]. Blood Flow RestricionAlso known as blood flow restriction training, BFR is a training method that can stimulate muscle growth without excessive resistance [4]. BFR is a method that can be performed with comparable hypertrophy. Training using BFR can induce muscle growth not only locally but also systematically. This systematic increase is associated with muscle growth.

Training blood flow restriction with the mechanism of blood flow restriction is a new strength training method that stimulates muscle growth and improves muscle function under proximal limb blood flow restriction or short-term and intermittent venous blood flow blockage during strength training performed with a small external load intensity. Training using BFR is significantly effective in increasing strength and hypertrophy in muscles [13].

Research Objectives and Results

Literature review [3][4][6][8] examined the effects of training usingblood flow restricition(BFR) on quadriceps muscle strength in osteoarthritis patients. Each of these studies showed the effect of BFR training on quadriceps muscle strength. [3] BFR training conducted for 12 weeks resulted in significant increases in muscle strength. BFR-induced neuromuscular adaptations that restrict blood flow create a hypoxic environment, thus inducing greater recruitment of type II fibers and increased concentrations of interleukin-6 and growth hormone. [4] Short-term BFR training also impacted muscle strength. Short-term BFR training conducted for 2 weeks resulted in positive changes in strength, muscle volume, and muscle thickness. Therefore, this study shows that short-term BFR training can help improve symptoms and function in osteoarthritis patients and is also effective in increasing overall muscle mass and strength. [6]

In theory, BFR training can increase muscle strength due to the accumulation of metabolic waste around the trained muscle as an adaptive response to local hypoxia. Muscle tissue attempts to respond by adapting, thus supporting the formation of new muscle protein. [8] Training using BFR is better at increasing quadriceps muscle strength than low-intensity weight training alone without BFR.

CONCLUSION

The studies listed in the table generally show changes in muscle strength after using blood flow restriction exercises in people with osteoarthritis. This muscle gain also generally indicates improved body function.

Training using blood flow restriction can improve overall muscle strength, not just strength, but volume, thickness, and functional quality. Significant improvements can be seen after four weeks of training, but short-term training can also have a noticeable effect on osteoarthritis sufferers.

In general, blood flow restriction (BFR) training is a strength training method that stimulates muscle growth and improves muscle function under conditions of blood flow restriction or blockage. BFR training involves partially restricting arterial blood flow into the muscle and completely restricting venous blood flow out of the working muscle during exercise. This restriction causes stress on the muscle, causing it to respond and adapt to the stressor. This adaptation process supports the formation of new muscle, resulting in muscle gains.

The results of this literature review can be concluded that training using blood flow restriction can increase strength in the quadriceps muscles in people with osteoarthritis.

ACKNOWLEDGMENT

Our deepest gratitude to the co-authors and supervisors who contributed to the creation of this manuscript.

AUTHOR CONTRIBUTION STATEMENT

The writing of this article involved roles in formulating, conceptualizing, reviewing, and analyzing relevant literature reviews. The author drafted the entire manuscript.

CONFLICT OF INTEREST AND FUNDING

There is no conflict of interest.

REFERENCES

[1] T. Setyawati*et al.*, "Understanding of Degenerative Diseases in the Community in Talise Village,"*J. Collaborative Science*, vol. 7, no. 8, pp. 3374–3383, 2024, doi: 10.56338/jks.v7i8.5928.

[2] M. Nugroho, A. Safitri, Zulfahamida, A. Jaya, and E. Rachman, "Characteristics of Genu Osteoarthritis in Elderly Patients Undergoing Medical Rehabilitation at Hajjah Andi Depu Regional Hospital,"*J. Mhs. Kedokt.*, vol. 2, no. 5, pp. 359–367, 2024.

[3] C. Hu*et al.*, "Effectiveness of blood flow restriction versus traditional weight-bearing training in rehabilitation of knee osteoarthritis patients with MASLD: a multicenter randomized controlled trial," *Front. Endocrinol. (Lausanne).*, vol. 14, no. December, pp. 1–9, 2023, doi: 10.3389/fendo.2023.1220758.

[4] K. H. Kim, S. H. Kang, N. Kim, J. Choi, and S. Kang, "Short-Term Impact of Low-Intensity Exercise with Blood Flow Restriction on Mild Knee Osteoarthritis in Older Adults: A Pilot Study," *Healthc.*, vol. 12, no. 3, 2024, doi: 10.3390/healthcare12030308.

[5] O. Bruyère, C. Cooper, N. M. Al-Daghri, E. M. Dennison, R. Rizzoli, and J. Y. Reginster, "Inappropriate claims from non-equivalent medications in osteoarthritis: a position paper endorsed by the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (ESCEO)," *Aging Clin. Exp. Res.*, vol. 30, no. 2, pp. 111–117, 2018, doi: 10.1007/s40520-017-0861-1.

[6] M. M. S. Bramasta Adikurnia Wedhasmara and J. K. Pertiwi, "The Effect of Blood Flow Restriction Training on Increasing Quadriceps Muscle Strength,"*J. Nas. Fisioter.*, pp. 1–8, 2024.

[7] R. A. C. Jardim, T. S. de Sousa, W. N. N. dos Santos, A. P. Matos, and N. C. R. Iosimuta, "Blood flow restriction with different load levels in patients with knee osteoarthritis: protocol of a randomized controlled trial," *Trials*, vol. 23, no. 1, pp. 1–13, 2022, doi: 10.1186/s13063-022-05998-3.

[8] P. A. F. Dugis, D. Tinduh, I. P. A. Pawana, D. N. Utomo, and S. Melaniani, "The effect of blood flow restriction in low-intensity load exercise on isokinetic strength of the quadriceps muscles in knee osteoarthritis," *Bali Med. J.*, vol. 12, no. 3, pp. 2532–2537, 2023, doi: 10.15562/bmj.v12i3.4703.

[9] R. Giorgino, D. Albano, S. Fusco, G. M. Peretti, L. Mangiavini, and C. Messina, "Knee Osteoarthritis: Epidemiology, Pathogenesis, and Mesenchymal Stem Cells: What Else Is New? An Update," *Int. J. Mol. Sci.*, vol. 24, no. 7, 2023, doi: 10.3390/ijms24076405.

[10] A. Swandari, K. Siwi, F. Putri, C. Waritsu, and K. Abdullah, "TEXTBOOK OF EXERCISE THERAPY IN OSTEOARTHRITIS Editor: Ifa Gerhanawati Nurul Faj'ri Romadhona," pp. 1–60, 2022.

[11] A. Jaiswal, K. Gowami, P. Haldar, harshal ramesh Salve, and U. Singh, "Prevalence of knee osteoarthritis, its determinants, and impact on the quality of life in elderly persons in rural Ballabgarh, Haryan," *J. Fam. Med. Prim. Care*, vol. 6, no. 2, pp. 169–170, 2021, doi: 10.4103/jfmpc.jfmpc.

[12] A. Swandari, S. AIsyah, and S. A. Ismanto, "THE EFFECT OF QUADRICEPS EXERCISE ON INCREASING LOWER EXTREMITY MUSCLE STRENGTH AND FUNCTIONAL ABILITY IN KNEE OSTEOARTHRITIS PATIENTS AT SITI KHODIJAH HOSPITAL, SEPENJANG, SIDOARJO,"*J. Researcher. Health*, pp. 150–154, 2025.

[13] S. D. Patterson *et al.*, "Blood flow restriction exercise position stand: Considerations of methodology, application, and safety," *Front. Physiol.*, vol. 10, no. MAY, pp. 1–15, 2019, doi: 10.3389/fphys.2019.00533.