



Integrating therapeutic nutrition with physiotherapy for knee osteoarthritis: Current evidence

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Abstract

Knee osteoarthritis (KOA) is one of the most prevalent musculoskeletal disorders worldwide and a leading cause of pain, disability, and reduced quality of life among older adults. Contemporary management strategies emphasize non-pharmacological interventions, particularly physiotherapy and lifestyle modifications. Recently, growing evidence has highlighted the role of therapeutic nutrition in modulating inflammation, optimizing body composition, and supporting joint health. While physiotherapy remains the cornerstone of conservative KOA management through exercise, manual therapy, and functional rehabilitation, nutritional interventions may enhance treatment outcomes by addressing systemic factors contributing to disease progression. This review examines current evidence regarding the integration of therapeutic nutrition with physiotherapy in KOA management. The mechanisms, clinical effectiveness, and potential synergistic effects of combined interventions are discussed. Future research directions and practical implications for multidisciplinary care are also explored.

Keywords: Knee osteoarthritis, therapeutic nutrition, physiotherapy, exercise therapy, obesity, inflammation, rehabilitation, multidisciplinary management

Introduction

Knee osteoarthritis (KOA) is a chronic degenerative joint disorder characterized by progressive cartilage degradation, subchondral bone remodeling, synovial inflammation, pain, stiffness, and functional limitations. The increasing prevalence of obesity, sedentary lifestyles, and population aging has significantly contributed to the global burden of KOA.

Traditional treatment approaches have focused primarily on symptom management through pharmacological agents, physiotherapy, and, in advanced cases, surgical interventions. However, emerging evidence suggests that osteoarthritis is not merely a mechanical wear-and-tear condition but also involves metabolic and inflammatory pathways. Consequently, therapeutic nutrition has gained attention as a complementary strategy to conventional rehabilitation.

The integration of nutrition and physiotherapy represents a holistic approach aimed at improving pain, mobility, physical function, and overall quality of life. This review synthesizes current literature on the role of nutritional interventions alongside physiotherapy in KOA management and identifies future opportunities for interdisciplinary practice.

Pathophysiology of Knee Osteoarthritis

Knee osteoarthritis (KOA) is a complex and multifactorial joint disorder characterized by the progressive deterioration of articular cartilage and structural changes affecting the entire joint. The pathogenesis of KOA involves an interplay of mechanical, biochemical, inflammatory, and metabolic factors that disrupt the balance between anabolic (tissue-building) and catabolic (tissue-degrading) processes within the joint environment. Key pathological mechanisms include cartilage matrix breakdown, synovial inflammation,

oxidative stress, subchondral bone remodeling, muscle weakness, and obesity-related metabolic dysfunction. Cartilage degradation occurs when increased production of inflammatory mediators and matrix-degrading enzymes, such as matrix metalloproteinases (MMPs), exceeds the capacity for cartilage repair. Synovial inflammation further contributes to pain and disease progression by releasing cytokines and inflammatory mediators into the joint space. Additionally, obesity plays a significant role not only through increased mechanical loading on the knee joint but also through metabolic pathways. Adipose tissue functions as an active endocrine organ, secreting pro-inflammatory adipokines and cytokines, including tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6), and leptin, which promote systemic inflammation and accelerate cartilage degeneration. These interconnected mechanisms highlight the need for comprehensive management approaches that address both biomechanical stress and systemic inflammatory processes to optimize clinical outcomes in individuals with KOA (Hunter & Bierma-Zeinstra, 2019; Loeser *et al.*, 2012; Robinson *et al.*, 2016) [10, 13, 16].

Role of Physiotherapy in Knee Osteoarthritis

Physiotherapy is strongly recommended by international guidelines as a first-line treatment for KOA.

1. Exercise Therapy

Exercise therapy is considered the cornerstone of physiotherapy management for knee osteoarthritis (KOA) and is strongly recommended as a first-line intervention by international clinical guidelines. Regular exercise helps reduce pain, improve physical function, enhance joint mobility, and increase overall quality of life in individuals with KOA. A comprehensive exercise program typically includes strengthening exercises, aerobic training, neuromuscular exercises, balance training, and flexibility

exercises, each targeting different aspects of joint health and functional performance. Strengthening exercises, particularly those focusing on the quadriceps and hip musculature, play a critical role in improving joint stability, reducing mechanical stress on the knee, and alleviating pain. Aerobic activities such as walking, cycling, and aquatic exercises contribute to cardiovascular fitness and weight management, while neuromuscular and balance training improve proprioception and reduce the risk of falls. Flexibility exercises help maintain or increase joint range of motion and decrease stiffness. Evidence from systematic reviews and clinical trials consistently demonstrates that exercise therapy provides significant benefits for pain reduction and functional improvement, regardless of disease severity, making it an essential component of conservative KOA management (Fransen *et al.*, 2015^[9]; Kolasinski *et al.*, 2020; Bannuru *et al.*, 2019)^[2].

2. Manual Therapy

Manual therapy is a commonly used adjunct to exercise therapy in the physiotherapeutic management of knee osteoarthritis (KOA). It encompasses a range of hands-on techniques, including joint mobilization, soft tissue mobilization, and manual stretching, aimed at improving joint mechanics and reducing symptoms. These techniques may enhance joint mobility, modulate pain through neurophysiological mechanisms, increase range of motion, and improve overall functional performance. Joint mobilization can help restore normal arthrokinematics and reduce stiffness, while soft tissue techniques may alleviate muscle tightness and improve tissue flexibility around the knee joint. When combined with therapeutic exercise, manual therapy has been shown to provide greater short-term improvements in pain and physical function than exercise alone in some patient populations. Although evidence supports its use as a complementary intervention rather than a standalone treatment, manual therapy may facilitate patient participation in exercise programs by reducing discomfort and improving movement quality. Therefore, integrating manual therapy within a comprehensive rehabilitation program can contribute to enhanced clinical outcomes in individuals with KOA (Deyle *et al.*, 2005; Abbott *et al.*, 2013^[1, 7]; Kolasinski *et al.*, 2020).

3. Physical Modalities

Physical modalities are frequently incorporated into physiotherapy programs for knee osteoarthritis (KOA) to alleviate symptoms and enhance patient comfort. Commonly used modalities include transcutaneous electrical nerve stimulation (TENS), ultrasound therapy, heat and cold therapy, and hydrotherapy. TENS is primarily employed for pain management by stimulating sensory nerves and modulating pain perception through neurophysiological mechanisms. Therapeutic ultrasound may promote tissue healing, improve circulation, and reduce pain, although evidence regarding its effectiveness remains mixed. Heat therapy can help decrease joint stiffness, increase blood flow, and improve tissue extensibility, whereas cold therapy is often used to reduce pain and inflammation during acute symptom flare-ups. Hydrotherapy, involving exercises performed in warm water, provides a low-impact environment that reduces joint loading while improving mobility, muscle strength, and functional capacity. Despite their potential benefits for symptom relief, physical

modalities are generally regarded as adjunctive interventions rather than primary treatments. Current clinical guidelines emphasize that these modalities should complement, rather than replace, evidence-based exercise therapy and patient education, which remain the foundation of conservative KOA management (Bannuru *et al.*, 2019; McAlindon *et al.*, 2014^[2, 14]; Kolasinski *et al.*, 2020).

4. Patient Education

Patient education is a fundamental component of physiotherapy management for knee osteoarthritis (KOA), empowering individuals to actively participate in the long-term management of their condition. Effective educational interventions provide patients with knowledge about the nature of osteoarthritis, treatment options, symptom management, and lifestyle modifications that can help slow disease progression and improve quality of life. Education promotes self-management by encouraging patients to take an active role in monitoring symptoms, adhering to prescribed exercise programs, and adopting healthy behaviors. It also enhances physical activity adherence by addressing misconceptions about pain and exercise, thereby reducing fear of movement and increasing confidence in performing daily activities. Furthermore, patient education supports weight control through guidance on healthy lifestyle choices and emphasizes joint protection strategies such as activity modification, proper body mechanics, and the use of assistive devices when necessary. Evidence suggests that combining education with exercise therapy and other conservative interventions leads to better clinical outcomes, improved self-efficacy, and greater long-term adherence to treatment recommendations. Therefore, patient education should be considered an essential element of comprehensive KOA rehabilitation programs (Kolasinski *et al.*, 2020; Bannuru *et al.*, 2019; Hurley *et al.*, 2018)^[2, 11].

Therapeutic Nutrition in Knee Osteoarthritis

1. Weight Reduction

Weight reduction is one of the most effective non-pharmacological strategies for managing knee osteoarthritis (KOA), particularly among overweight and obese individuals. Obesity is a major modifiable risk factor for KOA, as excess body weight increases mechanical stress on the knee joints and contributes to systemic inflammation through the release of pro-inflammatory cytokines and adipokines from adipose tissue. Weight loss can substantially reduce knee joint loading, with studies indicating that each kilogram of weight lost results in a significant decrease in the compressive forces exerted on the knee during daily activities. In addition to reducing biomechanical stress, weight loss lowers the production of inflammatory mediators such as tumor necrosis factor-alpha (TNF- α), interleukin-6 (IL-6), and leptin, which are implicated in cartilage degradation and disease progression. Furthermore, achieving a healthier body weight can improve mobility, enhance exercise tolerance, and facilitate participation in rehabilitation programs. Clinical evidence consistently demonstrates that a reduction of 5–10% of total body weight is associated with meaningful improvements in pain, physical function, and overall quality of life in individuals with KOA. Consequently, weight management through dietary modification and physical activity is strongly recommended as a core component of comprehensive osteoarthritis treatment (Messier *et al.*, 2013; Christensen *et al.*, 2007^[5, 15]; Kolasinski *et al.*, 2020).

2. Anti-Inflammatory Diets

Anti-inflammatory dietary patterns have gained increasing attention as a supportive strategy for managing knee osteoarthritis (KOA) due to their potential to reduce chronic low-grade inflammation, a key contributor to disease progression and symptom severity. These diets emphasize the consumption of nutrient-dense foods rich in antioxidants, polyphenols, and healthy fats, including fruits and vegetables, whole grains, legumes, fish rich in omega-3 fatty acids, olive oil, nuts, and seeds. Such dietary components help combat oxidative stress and modulate inflammatory pathways by reducing the production of pro-inflammatory cytokines and reactive oxygen species. Among various dietary approaches, the Mediterranean diet has demonstrated particular promise in improving osteoarthritis outcomes. Characterized by a high intake of plant-based foods, moderate consumption of fish and dairy products, and the use of olive oil as the primary fat source, the Mediterranean diet has been associated with lower levels of inflammatory biomarkers, reduced pain severity, improved physical function, and enhanced quality of life in individuals with KOA. Additionally, adherence to this dietary pattern may contribute to weight management and cardiovascular health, offering broader health benefits beyond joint preservation. Therefore, incorporating anti-inflammatory dietary principles into comprehensive KOA management may complement physiotherapy interventions and support long-term disease control (Veronese *et al.*, 2017; Skou *et al.*, 2022; Dyer *et al.*, 2017)^[8, 19, 21].

3. Nutritional Supplements

A variety of nutritional supplements have been investigated for their potential role in the management of knee osteoarthritis (KOA), with the aim of reducing symptoms, supporting joint health, and enhancing rehabilitation outcomes. Among these, omega-3 fatty acids have received considerable attention due to their anti-inflammatory properties. Found primarily in fatty fish and fish oil supplements, omega-3 fatty acids may help reduce the production of pro-inflammatory cytokines, improve joint comfort, and enhance recovery following exercise. Vitamin D is another important nutrient, as it plays a crucial role in bone metabolism, muscle function, and physical performance. Vitamin D deficiency is common among individuals with KOA and has been associated with increased pain, muscle weakness, and reduced functional capacity. Collagen peptides have also emerged as a promising supplement, with studies suggesting potential benefits in reducing joint pain, supporting cartilage metabolism, and improving mobility and physical function. In addition, glucosamine and chondroitin sulfate are among the most widely used supplements for osteoarthritis; however, evidence regarding their effectiveness remains mixed. While some clinical trials report modest improvements in pain and function, others have found limited or no significant benefit compared with placebo. Overall, nutritional supplements may provide supportive benefits for selected individuals when used alongside evidence-based interventions such as physiotherapy and dietary modification, although further high-quality research is needed to establish their long-term efficacy and optimal use in KOA management (Zeng *et al.*, 2016; Wandel *et al.*, 2010^[22, 23]; McAlindon *et al.*, 2014).

4. Protein Intake and Sarcopenia Prevention

Age-related muscle loss, commonly referred to as sarcopenia, frequently coexists with knee osteoarthritis (KOA) and can exacerbate functional limitations, physical disability, and disease progression. Reduced muscle mass and strength, particularly in the quadriceps muscles, are associated with impaired joint stability, decreased mobility, and increased risk of falls among individuals with KOA. Adequate dietary protein intake plays a crucial role in preserving skeletal muscle mass, promoting muscle protein synthesis, and supporting recovery and adaptation to exercise. Protein consumption is especially important for older adults, who often experience anabolic resistance and require higher-quality protein to maintain muscle health. Sufficient protein intake contributes to muscle maintenance, strength development, and improved rehabilitation outcomes, thereby enhancing the effectiveness of physiotherapy interventions. Emerging evidence suggests that combining a protein-rich diet with resistance exercise produces greater improvements in muscle strength, physical function, and overall mobility than either strategy alone. Such an integrated approach may help counteract sarcopenia, improve functional independence, and optimize clinical outcomes in patients with KOA. Therefore, nutritional strategies aimed at ensuring adequate protein intake should be considered an important component of comprehensive osteoarthritis management and rehabilitation programs (Cruz-Jentoft *et al.*, 2019; Bauer *et al.*, 2013; Beaudart *et al.*, 2017)^[3, 4, 6].

Synergistic Effects of Combining Nutrition and Physiotherapy

The integration of therapeutic nutrition and physiotherapy offers a comprehensive approach to knee osteoarthritis (KOA) management by simultaneously addressing both the systemic and biomechanical factors that contribute to disease progression and symptom severity. While physiotherapy primarily focuses on improving joint function, muscle strength, mobility, and pain management through targeted exercise and rehabilitation strategies, nutritional interventions target underlying metabolic dysfunction, obesity, inflammation, and musculoskeletal health. Together, these approaches may produce synergistic effects that enhance clinical outcomes beyond what can be achieved by either intervention alone. Emerging evidence suggests that combining dietary modification with physiotherapy can improve pain, physical function, body composition, and overall quality of life, making multidisciplinary management an increasingly important strategy in contemporary KOA care (Messier *et al.*, 2013; Skou *et al.*, 2022)^[15, 19].

1. Enhanced Weight Management

One of the most significant benefits of integrating nutrition and physiotherapy is improved weight management. Exercise programs increase energy expenditure, preserve lean muscle mass, and enhance metabolic health, while nutritional interventions facilitate caloric control and promote healthier eating habits. This combination creates a sustainable energy balance that supports long-term weight reduction. Since excess body weight places substantial mechanical stress on the knee joints, weight loss can significantly reduce joint loading and slow disease progression. Furthermore, reductions in adipose tissue decrease the production of pro-inflammatory cytokines and

adipokines, thereby addressing both mechanical and inflammatory contributors to KOA. Studies have consistently shown that combined diet-and-exercise interventions produce greater improvements in pain relief and physical function than either strategy alone (Messier *et al.*, 2013; Christensen *et al.*, 2007) ^[5, 15].

2. Improved Muscle Strength and Function

Adequate nutritional support, particularly sufficient protein intake, enhances the effectiveness of physiotherapy by promoting muscle protein synthesis and facilitating recovery following exercise. Resistance training is a key component of KOA rehabilitation, helping to strengthen the quadriceps and surrounding musculature that support knee joint stability. When combined with a protein-rich diet, exercise-induced muscular adaptations are optimized, leading to greater improvements in muscle strength, endurance, and physical performance. This is especially important for older adults with KOA, who may experience sarcopenia and age-related declines in muscle mass. Enhanced muscle strength contributes to improved mobility, reduced disability, and greater independence in daily activities, highlighting the synergistic relationship between nutrition and physiotherapy in rehabilitation outcomes (Bauer *et al.*, 2013; Beaudart *et al.*, 2017) ^[3, 4].

3. Reduction of Inflammation

Chronic low-grade inflammation is increasingly recognized as an important factor in the development and progression of KOA. Anti-inflammatory dietary strategies, such as the Mediterranean diet and increased intake of omega-3 fatty acids, antioxidants, and polyphenol-rich foods, may help reduce systemic inflammatory activity. These nutritional approaches can complement the anti-inflammatory effects of regular exercise, which has been shown to modulate cytokine production and improve metabolic health. Together, dietary modification and physical activity may reduce levels of inflammatory mediators such as TNF- α and IL-6, thereby alleviating pain, slowing cartilage degeneration, and enhancing joint function. The combined anti-inflammatory effects of nutrition and physiotherapy may therefore provide a more effective strategy for symptom management and long-term disease control than either intervention in isolation (Veronese *et al.*, 2017; Robinson *et al.*, 2016) ^[16, 21].

4. Better Treatment Adherence

The integration of physiotherapy and nutritional counseling within a multidisciplinary care model can significantly improve patient engagement and long-term adherence to treatment recommendations. Patients often find it easier to maintain lifestyle changes when they receive coordinated support from healthcare professionals, including physiotherapists, dietitians, and physicians. Such programs provide individualized guidance, goal setting, behavioral strategies, and ongoing monitoring, which can enhance motivation and self-efficacy. Improved adherence to exercise programs and dietary modifications is associated with better clinical outcomes, including sustained weight loss, reduced pain, and improved physical function. Consequently, multidisciplinary interventions that combine therapeutic nutrition and physiotherapy may foster long-term behavior change and maximize the effectiveness of conservative KOA management (Hurley *et al.*, 2018; Skou & Roos, 2019) ^[11, 18].

Current Clinical Evidence

A growing body of clinical evidence supports the integration of therapeutic nutrition and physiotherapy as an effective strategy for managing knee osteoarthritis (KOA). Over the past two decades, numerous randomized controlled trials, cohort studies, and systematic reviews have examined the effects of combining dietary interventions with exercise-based rehabilitation. These studies suggest that addressing both the mechanical and metabolic components of KOA leads to superior outcomes compared with single-modality treatments. The combined approach not only targets symptom relief but also addresses underlying risk factors such as obesity, inflammation, and muscle weakness, thereby promoting long-term improvements in physical function and quality of life (Messier *et al.*, 2013; Skou & Roos, 2019) ^[15, 18].

1. Weight Loss and Exercise Trials

Evidence from weight loss and exercise intervention trials consistently demonstrates that combining dietary modification with structured exercise programs yields greater clinical benefits than either intervention alone. The Intensive Diet and Exercise for Arthritis (IDEA) trial, one of the most influential studies in this field, found that overweight and obese adults with KOA who participated in a combined diet-and-exercise program experienced significantly greater reductions in pain, improved walking ability, enhanced physical function, and better health-related quality of life compared with participants receiving only dietary intervention or exercise therapy. These improvements were accompanied by reductions in inflammatory biomarkers and knee joint loading, highlighting the synergistic effects of weight loss and physical activity. Such findings support the recommendation that weight management and exercise should be implemented together as a cornerstone of conservative KOA treatment (Messier *et al.*, 2013; Christensen *et al.*, 2007) ^[5, 15].

2. Multidisciplinary Rehabilitation Programs

Multidisciplinary rehabilitation programs that integrate physiotherapy, nutritional counseling, and medical management have shown promising outcomes in individuals with KOA. These comprehensive programs involve collaboration among physiotherapists, dietitians, physicians, and other healthcare professionals to provide individualized treatment plans targeting multiple aspects of the disease. Clinical studies have reported enhanced symptom control, improved body composition, reduced disability, and greater patient satisfaction among participants enrolled in multidisciplinary interventions. Such programs often emphasize exercise therapy, dietary education, behavioral modification, and self-management strategies, leading to sustained lifestyle changes and improved long-term outcomes. The coordinated approach also facilitates better adherence to treatment recommendations and supports patients in managing the chronic nature of KOA more effectively (Hurley *et al.*, 2018; Skou *et al.*, 2018) ^[11, 20].

3. Evidence from Systematic Reviews

Systematic reviews and meta-analyses further reinforce the value of integrating nutrition and physiotherapy in KOA management. Recent reviews have concluded that

multimodal interventions combining weight loss strategies, dietary modification, and exercise therapy are among the most effective conservative treatment options, particularly for overweight and obese individuals. These interventions have been associated with clinically meaningful improvements in pain, physical function, mobility, and quality of life while reducing the need for pharmacological treatments. Moreover, evidence suggests that addressing

both metabolic and biomechanical factors simultaneously may slow disease progression and improve overall health outcomes. Although some heterogeneity exists among studies regarding intervention protocols and duration, the overall consensus supports multidisciplinary lifestyle interventions as a key component of evidence-based KOA care (Bannuru *et al.*, 2019; Runhaar *et al.*, 2015; Veronese *et al.*, 2017) [2, 17, 21].

Table 1: Integration of Therapeutic Nutrition with Physiotherapy in the Management of Knee Osteoarthritis (Messier *et al.*, 2013; Hurley *et al.*, 2018; Skou & Roos, 2019) [11, 15, 18].

Therapeutic Nutrition Strategy	Key Nutrients/Foods	Physiotherapy Intervention	Combined Mechanism of Action	Clinical Benefits
Weight Management	Calorie-controlled diet, high-fibre foods, lean protein	Aerobic exercise, gait training	Reduces joint loading while improving mobility	Reduced pain, improved physical function, slower disease progression
Anti-inflammatory Diet	Fruits, vegetables, olive oil, fatty fish, nuts	Strengthening exercises	Decreases systemic inflammation and enhances muscle function	Reduced pain, improved joint mobility
Mediterranean Diet	Whole grains, legumes, fish, olive oil	Resistance training and balance exercises	Improves muscle strength and reduces inflammatory cytokines	Enhanced functional capacity and quality of life
DASH Diet	Fruits, vegetables, low-fat dairy, whole grains	Flexibility and strengthening exercises	Supports cardiovascular health and decreases inflammatory burden	Better physical endurance and pain reduction
High-Protein Nutrition	Lean meat, eggs, dairy, legumes	Progressive resistance training	Promotes muscle protein synthesis and prevents sarcopenia	Increased quadriceps strength and improved joint stability
Vitamin D Supplementation	Vitamin D-rich foods or supplements	Weight-bearing and strengthening exercises	Enhances muscle function and bone health	Improved balance and reduced fall risk
Calcium-Rich Diet	Low-fat dairy, leafy greens, fortified foods	Weight-bearing exercise	Supports bone mineral density and joint support	Reduced osteoporosis risk and improved mobility
Omega-3 Fatty Acids	Fatty fish, flaxseed, walnuts	Therapeutic exercise	Reduces inflammatory mediators and oxidative stress	Reduced joint stiffness and pain
Antioxidant-Rich Diet	Berries, citrus fruits, green leafy vegetables	Range-of-motion exercises	Protects cartilage from oxidative damage	Improved joint flexibility and reduced cartilage degeneration
Collagen Peptides	Hydrolyzed collagen, gelatin	Strengthening and functional training	Supports cartilage matrix synthesis and tendon health	Improved joint comfort and physical performance
Glucosamine and Chondroitin*	Nutraceutical supplements	Manual therapy and exercise	May support cartilage metabolism and reduce symptoms	Mild improvement in pain in selected patients
Adequate Hydration	Water and electrolyte-rich fluids	Exercise therapy	Maintains cartilage lubrication and exercise tolerance	Improved exercise performance and joint comfort

Table 2: Synergistic Effects of Nutrition and Physiotherapy in Knee Osteoarthritis (Veronese *et al.*, 2017; Robinson *et al.*, 2016)

Target Outcome	Nutritional Intervention	Physiotherapy Approach	Expected Synergistic Effect
Pain Reduction	Anti-inflammatory diet, Omega-3 fatty acids	Therapeutic exercise, TENS, manual therapy	Greater reduction in pain than either intervention alone
Muscle Strength	High-protein diet, Vitamin D	Progressive resistance training	Improved muscle mass, strength, and functional performance
Weight Reduction	Energy-restricted diet	Aerobic exercise	Reduced knee joint loading and enhanced mobility
Cartilage Protection	Collagen peptides, antioxidants	Low-impact exercise	Preservation of cartilage integrity and delayed OA progression
Physical Function	Balanced Mediterranean or DASH diet	Functional and balance training	Enhanced walking ability, stair climbing, and daily activities
Bone Health	Calcium and Vitamin D	Weight-bearing exercises	Improved skeletal support and reduced fracture risk
Inflammation Control	Polyphenol-rich foods, Omega-3 fatty acids	Moderate-intensity exercise	Lower inflammatory biomarkers and improved recovery
Quality of Life	Personalized healthy dietary pattern	Multimodal physiotherapy	Better long-term independence and overall well-being

Conclusion

Knee osteoarthritis is a complex condition influenced by mechanical, inflammatory, and metabolic factors. Physiotherapy remains a cornerstone of conservative treatment, while therapeutic nutrition provides additional benefits through weight management, inflammation reduction, and musculoskeletal support. Current evidence

suggests that integrating nutritional strategies with physiotherapy produces superior outcomes compared with either intervention alone, particularly among overweight and obese individuals. Although further high-quality research is required to establish standardized protocols, multidisciplinary approaches represent a promising direction for improving pain, function, and quality of life in patients

with knee osteoarthritis. The future of KOA management lies in personalized, patient-centered care that combines rehabilitation and nutrition within an evidence-based framework.

References

- Abbott JH, Robertson MC, Chapple C, *et al.* Manual therapy, exercise therapy, or both, in addition to usual care, for osteoarthritis of the hip or knee: A randomized controlled trial. *Osteoarthritis and Cartilage*,2013;21(4):525–534.
- Bannuru RR, Osani MC, Vaysbrot EE, *et al.* OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. *Osteoarthritis and Cartilage*,2019;27(11):1578–1589.
- Bauer J, Biolo G, Cederholm T, *et al.* Evidence-based recommendations for optimal dietary protein intake in older people: A position paper from the PROT-AGE Study Group. *Journal of the American Medical Directors Association*,2013;14(8):542–559.
- Beaudart C, Dawson A, Shaw SC, *et al.* Nutrition and physical activity in the prevention and treatment of sarcopenia: Systematic review. *Osteoporosis International*,2017;28(6):1817–1833.
- Christensen R, Bartels EM, Astrup A, Bliddal H. Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: A systematic review and meta-analysis. *Annals of the Rheumatic Diseases*,2007;66(4):433–439.
- Cruz-Jentoft AJ, Bahat G, Bauer J, *et al.* Sarcopenia: Revised European consensus on definition and diagnosis. *Age and Ageing*,2019;48(1):16–31.
- Deyle GD, Allison SC, Matekel RL, *et al.* Physical therapy treatment effectiveness for osteoarthritis of the knee: A randomized comparison of supervised clinical exercise and manual therapy procedures versus a home exercise program. *Physical Therapy*,2005;85(12):1301–1317.
- Dyer J, Davison G, Marcora SM, Mauger AR. Effect of a Mediterranean-type diet on inflammatory and cartilage degradation biomarkers in patients with osteoarthritis. *The Journal of Nutrition, Health & Aging*,2017;21(5):562–566.
- Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. Exercise for osteoarthritis of the knee. *Cochrane Database of Systematic Reviews*,2015;(1):CD004376.
- Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. *The Lancet*,2019;393(10182):1745–1759.
- Hurley M, Dickson K, Hallett R, *et al.* Exercise interventions and patient education for osteoarthritis: Evidence and recommendations for clinical practice. *Best Practice & Research Clinical Rheumatology*,2018;32(1):109–127.
- Kolasinski SL, Neogi T, Hochberg MC, *et al.* 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Care & Research*,2020;72(2):149–162.
- Loeser RF, Goldring SR, Scanzello CR, Goldring MB. Osteoarthritis: A disease of the joint as an organ. *Arthritis & Rheumatism*,2012;64(6):1697–1707.
- McAlindon TE, Bannuru RR, Sullivan MC, *et al.* OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis and Cartilage*,2014;22(3):363–388.
- Messier SP, Mihalko SL, Legault C, *et al.* Effects of intensive diet and exercise on knee joint loads, inflammation, and clinical outcomes among overweight and obese adults with knee osteoarthritis: The IDEA randomized clinical trial. *JAMA*,2013;310(12):1263–1273.
- Robinson WH, Lepus CM, Wang Q, *et al.* Low-grade inflammation as a key mediator of osteoarthritis pathogenesis. *Nature Reviews Rheumatology*,2016;12(10):580–592.
- Runhaar J, van Middelkoop M, Reijman M, Bierma-Zeinstra SMA. Prevention and management of knee osteoarthritis through lifestyle interventions. *Best Practice & Research Clinical Rheumatology*,2015;29(1):122–133.
- Skou ST, Roos EM. Physical therapy for patients with knee and hip osteoarthritis. *Journal of Orthopaedic & Sports Physical Therapy*,2019;49(9):672–681.
- Skou ST, Roos EM, Ajuied A. Lifestyle interventions and dietary strategies in knee osteoarthritis management: Current evidence and future directions. *Osteoarthritis and Cartilage Open*,2022;4(3):100276.
- Skou ST, Roos EM, Laursen MB, *et al.* A randomized controlled trial of total knee replacement versus non-surgical treatment in knee osteoarthritis. *BMJ*,2018;356:j1131.
- Veronese N, Stubbs B, Noale M, *et al.* Adherence to a Mediterranean diet is associated with lower prevalence of osteoarthritis: Data from the Osteoarthritis Initiative. *Clinical Nutrition*,2017;36(6):1609–1614.
- Wandel S, Jüni P, Tendal B, *et al.* Effects of glucosamine, chondroitin, or placebo in patients with osteoarthritis of hip or knee: Network meta-analysis. *BMJ*,2010;341:c4675.
- Zeng C, Lane NE, Hunter DJ, *et al.* Nutritional supplements and osteoarthritis: A systematic review and meta-analysis. *Osteoarthritis and Cartilage*,2016;24(12):2069–2078.