Open Access Journal of Sports Medicine

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REVIEW

Patellofemoral Pain is a Multifactorial Complex Condition; Are We Missing a Multidisciplinary Approach to its Management? Time for a Paradigm Shift

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Background: Patellofemoral pain is a prevalent musculoskeletal condition characterized by persistent anterior knee pain, often exacerbated by activities that increase patellofemoral joint stress. The aetiology of patellofemoral pain is multifactorial, involving biomechanical, muscular, and psychological factors. Altered movement patterns and muscle weaknesses, particularly in the hip and knee regions, are commonly observed in people with patellofemoral pain. These impairments can either contribute to or result from the condition. Psychological factors, such as kinesiophobia and pain catastrophizing, also play a significant role in the persistence and severity of patellofemoral pain, highlighting the need for a comprehensive treatment approach.

The Problem: Patellofemoral pain imposes a considerable burden on those who leave with the condition, leading to high pain levels, impaired physical function, and reduced quality of life. The condition's persistent nature and potential progression to patellofemoral osteoarthritis underscore the critical need for effective management strategies. Current best practices include exercise therapy and adjunct treatments, but adherence and long-term effectiveness remain challenges.

Take-Home Message: Emerging evidence suggests that addressing obesity and incorporating patient education and self-management strategies could enhance outcomes. Additionally, integrating dietary interventions targeting systemic inflammation presents a promising avenue for reducing pain and improving function. A multidisciplinary approach, involving various health professionals, is advocated to provide holistic and patient-centered care for those affected by patellofemoral pain.

Keywords: knee joint, patellofemoral pain syndrome, fear of movement, obesity, osteoarthritis, rehabilitation

Introduction: What Is Patellofemoral Pain, and How Common Is It?

Definition

Patellofemoral pain (PFP) is characterised by persistent diffuse anterior peri- and retro-patellar pain, exacerbated by activities that increase compressive and shear forces acting on the patellofemoral joint (PFJ), including squatting down, running, ascending and descending stairs.[1–3] PFP is the preferred terminology based on an international consensus statement.[1] However, PFP is synonymous with other terms, including anterior knee pain, patellofemoral pain syndrome, and chondromalacia patellae.

Epidemiology

Diagnosis of PFP seems to be growing over the years, with a 4% point-prevalence increase from 2007 to 2011 (18.7% to 22.7%),[4] and accounting for approximately 17% of all knee pain presentations to general practice.[5] PFP affects adolescents,

https://doi.org/10.2147/OAJSM.S517971
Received: 9 September 2025
Accepted: 30 January 2026
Published: 5 February 2026

young-, middle-aged, and older adults across various populations (eg, athletic, sports, military, and general population).[4,6] Even so, there is limited epidemiological data on the incidence and prevalence of PFP.[7] A recent systematic review indicated that the annual prevalence of PFP can vary from 13% to 35% depending on the population studied.[6]

Among the epidemiological studies included in the above-mentioned systematic review, Boling et al[8] explored the incidence and prevalence of PFP in a cohort of 1525 US Naval Academy cadets who were followed for up to 2.5 years. Two hundred six cadets had a history of PFP, and 45 were newly diagnosed during the study period, yielding a prevalence of 13.5% and an incidence of 22/1000 person-years.[8] The incidence rate in women was higher than in males (33/1000 vs 15/1000, respectively), with females being 2.2 times more likely to develop PFP than males. Despite being a prospective study of high methodological quality, Boling et al[8] included cadets from the naval academy, thus limiting the generalizability of their findings. Roush and Bay[9] evaluated 724 females from the general population to explore the prevalence of PFP. A total of 189 of the 724 females were diagnosed with PFP, leading to a prevalence of 13% in women aged between 18 and 35 years. A study conducted in the UK involving 57,555 participants aimed to describe the annual prevalence of patellofemoral disorders across the adult lifespan, with one in six participants reporting a patellofemoral disorder.[5]

The prevalence of PFP is also high in athletic populations. A retrospective study including 2002 runners with running-related musculoskeletal injuries found that PFP was the most common injury, affecting 331 runners, which was more than double the second most prevalent injury (ie, iliotibial band syndrome).[10] Additionally, 62% of the runners diagnosed with PFP were women.[10] A prospective epidemiological study found a PFP point prevalence of 16.3 per 100 adolescent basketball athletes, with an incidence rate of 1.09 per 1000 hours of exposure.[11]

The variability in findings regarding the incidence and prevalence of PFP may be attributable to differences in diagnostic criteria and study populations. However, a recently published consensus statement on diagnosing PFP, along with a checklist and reporting guide now indexed in the EQUATOR network, may help address this issue in the future.[1,12] According to these reports, three main criteria should be considered for the diagnosis of PFP: (i) presence of anterior retro- or peri-patellar pain; (ii) exacerbation of pain in activities that overload the PFJ or when remaining seated for a long time; (iii) exclusion of other conditions that can also cause anterior knee pain (eg, patellar tendinopathy, ligament injuries).

Regardless, the high incidence and prevalence of PFP suggest that public and private settings must be prepared to manage a large number of people with PFP. In the next topics, we will describe the multifactorial characteristics of PFP, including physical and psychological impairments. Importantly, the considerable variability in incidence, prevalence, and prognosis across populations, together with heterogeneous responses to standard exercise-based treatments, suggests that PFP cannot be understood solely in biomechanical terms. Instead, it is more appropriately conceptualised as a complex condition influenced by interacting biomechanical, psychological, systemic, and lifestyle factors. In this narrative review, we (i) summarise the multifactorial background of PFP, including biomechanical, psychological, systemic and lifestyle contributors; (ii) discuss the personal and societal burden associated with this condition; and (iii) highlight potential multidisciplinary management strategies, such as patient education, psychological and nutrition-focused approaches, that could inform future clinical trials and clinical practice.

PFP Is a Complex Multifactorial Condition

The exact source of pain in people with PFP remains unknown, although several reports suggest biomechanical, structural, and psychological features may contribute to both the development and persistence of the condition, making PFP a challenging condition to manage in clinical practice.[13–16]

Movement Pattern and Muscular Features

Traditional pain models link PFJ overload with primary nociceptive pathways. For example, a theoretical pathomechanical model suggests that alterations in trunk and lower limb kinematics may result in abnormally elevated cartilage and bone stress,[14] potentially increasing nociceptive input from joint and periarticular structures and contributing to the experience of PFP. Many cross-sectional studies have reported altered movement patterns in people with PFP during various activities that load the PFJ, such as climbing stairs, stepping down, and landing.[17–19] However, a recent systematic review found conflicting findings in movement patterns during walking and running,[19] and direct evidence linking specific biomechanical changes to nociceptive activity within the PFJ remains limited.

At the trunk, people with PFP present a higher ipsilateral trunk lean compared to pain-free controls during single-leg squat and landing,[20] and excessive trunk flexion during running-induced fatigue.[21] At the hip level, people with PFP present excessive hip adduction and hip internal rotation compared to pain-free controls during a range of functional tasks, including running, climbing stairs, and landing.[22,23] At the knee level, there is consistent evidence that people with PFP ascend and descend stairs and run with reduced peak knee flexion and cadence,[14,15] possibly indicating a conscious or unconscious attempt to reduce symptoms by decreasing PFJ and quadriceps loading requirements.[17,18,24] Finally, at the foot level, excessive rearfoot eversion was reported during walking and stair ascent in people with PFP,[25,26] possibly resulting in excessive internal rotation of the tibia and femur due to joint coupling.[27] These altered movement patterns presented by people with PFP have been previously discussed as potential risk factors for the condition or adopted as a compensatory strategy to avoid pain.[13,28] Because most available data are cross-sectional, it remains unclear whether these biomechanical differences represent primary physical impairments that precede symptom onset or alternative movement patterns that emerge in response to pain. It is likely that, for many individuals, the relationship is bidirectional. The clinical importance of altered movement patterns is emphasized by previous findings revealing that a greater number of kinematic alterations was associated with higher pain levels and lower functional status in people with PFP.[29]

Impaired muscle function is also thought to contribute to PFJ mechanics.[30] Compelling evidence indicates lateral trunk, hip abductor, extensor, rotator, and knee extensor and flexor strength weakness in people with PFP compared to pain-free controls.[31–35] Additionally, the hip and knee muscles of women with PFP seem to present even larger deficits in power and force steadiness than strength compared to pain-free controls.[36,37] Although muscle impairments are commonly reported in people with PFP, prospective studies suggest they are not risk factors for developing the condition (an exception is knee extensor strength, which is a strong risk factor for PFP in military populations).[13,35,38] Lower limb muscle activity has also been explored in PFP.[32] Findings from a meta-analysis indicated that the onset of muscle activity in vastus medialis was delayed relative to vastus lateralis during stepping and stair ambulation tasks.[32] A higher mean amplitude of the biceps femoral was also present in PFP compared to pain-free controls during hop tasks. Delayed or reduced activation of the gluteal muscles has also been associated with PFP.[39] However, whether it affects hip control, knee alignment, or symptoms is unclear.

The wide range of movement adaptations and physical impairments observed in people with PFP poses a significant challenge for its management. Therefore, exercise professionals may need to tailor their approach when prescribing exercises for people with PFP.

Psychological Features

In isolation, the biomedical model has inherent limitations within the complex paradigm of human pain perception.[40] More contemporary evidence suggests that PFP should be considered within a broader biopsychosocial framework that encompasses biomechanical, psychological, social, and lifestyle factors, all of which can influence pain perception and its maintenance.[41–44] A previous PFP consensus statement involving researchers and health professionals also urged the consideration of psychological factors in research and clinical settings.[45] This view aligns with other highly prevalent musculoskeletal conditions, such as knee osteoarthritis and low back pain.[46,47]

A growing number of studies suggest that psychological characteristics play an essential role in the persistence of musculoskeletal pain and functional limitations and represent a barrier to recovery for people with PFP.[48,49] In this context, a systematic review demonstrated that psychological factors such as kinesiophobia (fear/avoidance of movement) and pain catastrophising (excessively negative feelings and thoughts regarding pain) are elevated in people with PFP compared to pain-free controls.[50] Furthermore, both factors were strongly correlated with the pain and functional capacity of people with PFP.[50,51] Additionally, reports indicate that reductions in fear of movement and pain catastrophising are associated with improvements in pain and function following rehabilitation.[52] Considering the multifactorial nature of PFP, alterations in psychological factors may not be present in all people with PFP. Maclachlan et al[50] compared psychological characteristics such as depression, fear of movement, and pain catastrophising between people with PFP and pain-free participants and did not find significant differences. However, when subgroup analyses were conducted based on the severity of PFP, considering factors such as pain level, symptoms, and functional disability, it was observed that people with more severe PFP exhibited higher levels of depression, pain catastrophising, and fear of movement than those with less severe PFP.[50]

Findings from a recent meta-correlation with individual patient data (>500 patients) indicated that fear of movement is associated with pain and physical function in people with PFP.[48] Fear of movement has also been associated with protective biomechanical patterns (ie, reduced knee flexion in activities loading the PFJ)[44,53] and manifestations of peripheral and central sensitisation (eg, local and remote pressure pain thresholds).[54] The only prospective study exploring a psychological factor in people with PFP suggests that fear of movement is not a risk factor for the condition; instead, it develops as a result of living with persistent PFP.[55]

Beyond biomechanics and psychological characteristics, other features such as altered pain processing (eg, local and remote pressure pain hypersensitivity),[56–58] sleep disturbances,[59] reduced physical activity,[60] and broader social factors (eg, work and family demands, access to care) are increasingly recognised as relevant contributors to pain persistence and disability in musculoskeletal conditions, including PFP. Also, overweight and obesity are increasingly recognised as relevant for people with PFP.[61] Young adults with PFP often have higher body fat and lower skeletal muscle mass than pain-free controls, which is associated with impaired functional capacity and reduced hip and knee strength.[62,63] These systemic characteristics and their potential links with pain sensitisation[64] and joint loading are discussed in more detail in Systemic and Mechanical Factors Associated with Obesity. While comprehensive data across all these domains are still limited in PFP, recognising their potential influence is important when conceptualising PFP as a multifactorial condition and when planning multidisciplinary models of care. A conceptual overview of these multifactorial contributors and potential management targets is provided in Figure 1.

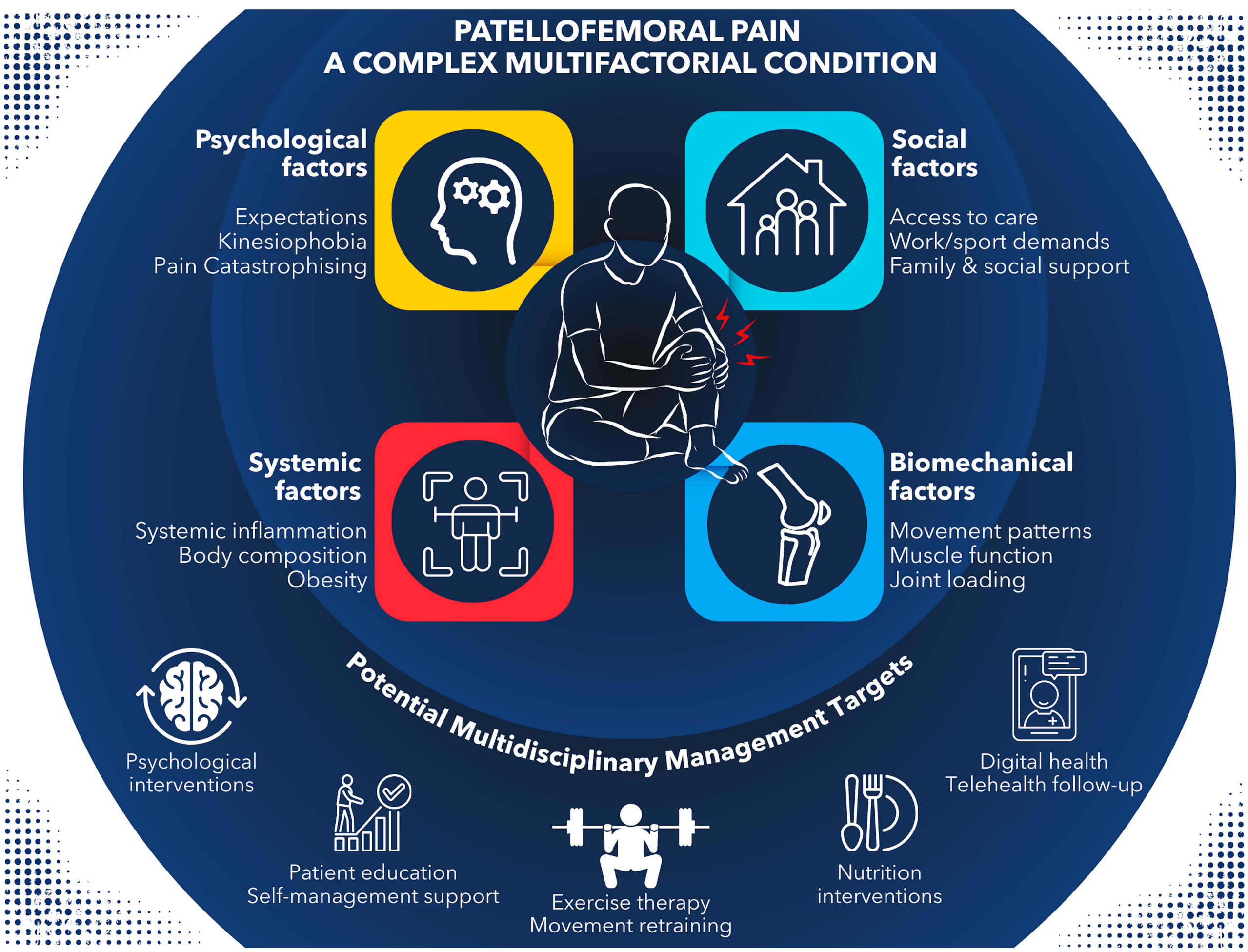

Figure 1 Conceptual model of patellofemoral pain as a multifactorial condition. The figure illustrates the interplay among biomechanical factors, psychological factors, systemic and lifestyle factors, and social context. The lower panel highlights possible multidisciplinary management components, including exercise therapy, patient education, psychological interventions, nutrition interventions, and digital health tools to facilitate long-term engagement.

Burden of Living with PFP

PFP confers a profound personal burden, including unacceptably high pain medication use[65] (costing ~US$5000 in medication per person within a 2-year window after diagnosis),[66] and poor quality of life.[67] Combined with low social interactions and participation in physical activity,[60,68] it underpins a 6-fold increased risk of depression in people with PFP.[69]

Impaired Daily Physical Function

PFP has a detrimental impact on the performance of daily living activities.[70] Several cross-sectional studies have reported impaired performance in physical function in people with PFP compared to pain-free controls, including step-down tasks, single-leg squats, sit-to-stand, and balance tasks.[34,70–73] A recent systematic review[70] found that people with PFP had high pain levels (>6 out of 10 on a visual analogue scale) across ten daily physical activities. Sitting and running were two of the most painful tasks reported by this population. Therefore, adequate management of PFP is necessary to restore the physical function of people affected by this condition. In the following topic, we will summarise the evidence on prognostic studies in PFP.

Poor Prognosis and Progression to Patellofemoral Osteoarthritis

Historically, PFP was considered a self-limited condition (ie, symptoms would resolve spontaneously over time without any intervention).[68] However, contemporary evidence indicates PFP has a persistent nature, with a high number of people (50 to 91%) experiencing persistent symptoms up to 18 years after the initial diagnosis.[74–76] Due to its complex multifactorial aetiology, PFP represents a challenging condition to manage, with over 50% of affected individuals reporting symptom recurrence after 12 months, despite receiving interventions recommended by clinical practice guidelines.[77,78] We are now recognizing that PFP is a pre-stage of knee osteoarthritis.[79] And, people living with chronic PFP are actually in an early non-traumatic osteoarthritis stage.

Two clinical trials exploring prognostic factors associated with PFP reported that people with longer symptom duration and lower self-reported functional capacity (reflected by lower scores on the Anterior Knee Pain Scale, AKPS) had worse prognosis both at one-year and 5 to 8-year follow-ups.[78,80] Therefore, identifying factors associated with chronicity and more severe symptoms is crucial for designing preventive strategies that aim to improve the long-term prognosis of PFP.

The persistent and recurrent nature of PFP is particularly important, as others have suggested that PFP may be a precursor to patellofemoral osteoarthritis.[81,82] In a retrospective study of 118 individuals who underwent patellofemoral arthroplasty for isolated patellofemoral osteoarthritis, approximately 22% reported anterior knee pain since adolescence, compared with only 6% in the control group of 116 individuals who underwent medial tibiofemoral arthroplasty.[83] Thorstensson and colleagues[84] assessed 84 individuals with PFP (without signs of patellofemoral osteoarthritis) and found that 31% of the participants developed patellofemoral osteoarthritis at the end of the 7-year follow-up period. Another important factor that supports this progression lies in the similarity between the symptoms and biomechanical changes of both conditions.[82] One of the main clinical symptoms of patellofemoral osteoarthritis, characterised by anterior knee pain during activities that load the patellofemoral joint (eg, squatting, stair climbing/descending), is similar to the typical manifestation of PFP.[82] Additionally, studies demonstrate biomechanical and muscular alterations in both PFP and patellofemoral osteoarthritis, including reduced maximum torque of knee extensors and hip abductors, and reduced lower-limb muscle power.[82,85,86] Altered biomechanics of the lower limbs can lead to abnormal loading on the PFJ, which in younger people may manifest as PFP and, over the long term, may lead to structural damage, ultimately progressing to patellofemoral osteoarthritis.[81]

The primary hypothesis linking PFP presence to the future development of patellofemoral osteoarthritis is abnormal PFJ loading.[82] Consequently, identifying factors that may exacerbate PFP symptoms and drive the progression of this condition is of utmost importance for the development and adoption of preventive treatment strategies, thereby mitigating the impacts of patellofemoral osteoarthritis on those affected and on healthcare systems' costs.[66] In this regard, obesity may be a significant factor warranting exploration. Although widely studied in people with knee osteoarthritis and identified as one of the main risk factors for its development,[87] the impact of obesity on PFP has been poorly addressed. While higher body mass increases PFJ loading, obesity is also associated with osteoarthritis in non-weight-bearing joints such as the hands,[88] indicating that systemic effects of excess adipose tissue (eg, low-grade inflammation and adipokine activity) are likely to play a key role.[88]

What are We Missing in PFP Management?

The current best management for PFP, as reported by international consensus statements and clinical practice guidelines, includes exercise therapy and adjunct strategies (eg, movement retraining, taping, foot orthoses, bracing, etc).[89–92] However, as discussed in the previous section, while these strategies demonstrate short-term effectiveness, their benefits are not often sustained over the medium to long term (more than 1 year). This raises the question, What are we missing? Several areas warrant further investigation to enhance outcomes for people with PFP, including: (i) poor adherence to exercise-based interventions; (ii) lack of knowledge on patient education and self-management strategies; (iii) systemic and mechanical factors associated with overweight and obesity.

Poor Adherence to Exercise-Based Interventions

The importance of adherence has been described as a crucial factor for the success of PFP management.[93] This is perhaps because most prior exercise programs have not been co-designed with end-users, which may explain persistent impairments, treatment ineffectiveness, and lack of adherence. Convenience, access, and lack of engaging resources are the most common barriers to exercise adherence in patients with musculoskeletal conditions.[94] Previous work indicated that adherence to 12 or more exercise and education sessions is associated with a 3.3 times greater likelihood of recovery, compared to not adhering (less than 12 sessions) at a 4-month follow-up in young adults with PFP.[95] Adolescents with an adherence rate greater than 70% are 4 times more likely to be recovered (ie, completely recovered or strongly recovered on a Likert scale) at 12 months after exercise therapy than adolescents with an adherence rate lower than 70%.[93] This work also reported that adolescents who completed the exercise program 3 times per week were 4.4 times more likely to recover compared to those completing the exercise program less than 3 times per week.[93] Notably, these adherence data relate to follow-up periods of up to 12 months, and it remains unknown whether the superior outcomes observed in highly adherent patients are sustained over the longer term, reinforcing the need for future trials with extended follow-up.

Recent advances in digital technologies (eg, telerehabilitation) offer promising opportunities for creating co-designed multimedia online resources to assist in the management of PFP.[96,97] This innovative approach could yield an effective, highly scalable management strategy to improve treatment adherence at a low cost. Telerehabilitation has shown positive effects across many orthopaedic conditions.[98,99] For example, a web-based exercise program was deemed feasible for PFP as an alternative when face-to-face consultations were a barrier to adherence.[95] A recent meta-analysis also suggested that remote rehabilitation facilitated by text messages, phone calls, apps, or web-based programs may lead to greater adherence than face-to-face appointments.[99] However, before making definitive recommendations regarding its potential value, large and high-quality randomised controlled trials in the PFP field are needed.

Lack of Knowledge of Patient Education and Self-Management Strategies

In 2018, patient education for PFP was described in an editorial as "potentially potent and essential, but under-researched". This was reinforced by qualitative findings from health professionals managing people with PFP, who stated that patient education is a core intervention for this population.[43] In 2020, promising findings were reported in a systematic review suggesting that when delivered by health professionals, patient education led to similar improvements in pain and self-reported physical function compared to exercise therapy, with a lower number of sessions (2 education sessions on average compared to 20 exercise-therapy sessions).[41] Despite "calls to action" from researchers and health professionals, there is no strong evidence to support patient education in consensus statements or clinical practice guidelines for the management of PFP.[1,89,91]

An important component of patient education is to empower people with PFP with self-management strategies.[41] Episodes of pain flares can disengage patients from their rehabilitation journey, leaving them more likely to have recurrence and persistent symptoms. Qualitative reports suggest that a lack of knowledge of self-management strategies and poor experiences with a health professional are the main reasons for people with PFP to disengage with rehabilitation.[100] Again, digital health may be a feasible option for patients to learn about their condition and self-management strategies, and could be a valuable tool for health professionals to use alongside face-to-face consultations. Additionally, it could provide accessibility to high-quality care for people living in remote areas.

Findings from a clinical feasibility trial[95] indicate that 31% (11/35) of participants with PFP reported pain flares or muscle soreness during an exercise program, with most events occurring in the first week. Assisted by a self-directed online platform including education on self-management strategies, the number of pain flares over 6 weeks of the exercise program was significantly reduced. Improvements in the participants' ability to independently manage exercise loads or ongoing active management leading to improved knee self-efficacy may explain these findings. Therefore, we recommend that previously developed and tested educational resources (eg, https://mykneecap.trekeducation.org/) should be used by health professionals and be made readily available to patients with PFP during their rehabilitation journey. We also encourage the co-development of new digital tools with end-users.

Systemic and Mechanical Factors Associated with Obesity

Another factor that has been neglected in PFP interventional studies is the influence of obesity in people with PFP.[63,101] In the past four decades, the number of adults with obesity worldwide has increased more than six times, with 38% of the general population with PFP living with overweight or obesity.[62] This is critical for people with PFP, who have higher body fat and lower skeletal muscle mass than pain-free controls, which are associated with impaired functional capacity and hip and knee strength.[62]

Beyond the mechanical load on knees, it is important to highlight that obesity can also generate systemic and local inflammation as a consequence of the higher amount of body fat.[102] Additionally, high signal intensity of the Hoffa fat pad was observed in people with PFP, which is a sign of local inflammation.[103] Evidence suggests that obesity increases the risk of the development of osteoarthritis in non-weight-bearing joints (eg, hand osteoarthritis).[104,105] This reinforces that mechanical overload alone cannot explain this relationship. Systemic changes, such as the production of adipokines by adipose tissue, like leptin,[106] and the amplification of the inflammatory profile due to increased production of interleukin-6[107] and tumor necrosis factor-alpha,[108] are associated with detrimental effects on patellar cartilage (eg, reduction in patellar cartilage volume) and pain, and may mediate this relationship.[109,110] In addition, low-grade systemic inflammation related to excess adipose tissue may influence central pain processing, for example, by facilitating nociceptive transmission at spinal and supraspinal levels, and has been linked to manifestations of pain sensitisation in people with knee disorders.[111] Together, these mechanical and systemic mechanisms position obesity as a key systemic contributor to the multifactorial background of PFP and a potentially important target for multidisciplinary management.

Since obesity is a modifiable factor, further investigation is warranted and may yield valuable clinical information. Current guidelines and recommendations for the treatment of PFP do not address the impact of obesity on the development and management of PFP or the long-term effectiveness of interventions.[28,43,90,112] The literature provides strong evidence suggesting that people with knee osteoarthritis benefit from dietary interventions to improve pain, physical function, and general health,[113,114] all of which may relate to obesity; yet, nothing is known about the effect of dietary interventions in people with PFP.

Diet/Nutrition Programs Applied to Musculoskeletal Conditions

While addressing the systemic and mechanical factors associated with obesity in PFP, a critical aspect to consider is the implementation of effective dietary interventions specifically tailored for people with knee conditions. The traditional approach to weight loss, which primarily focuses on generating an energy deficit through caloric restriction and increased physical activity, faces practical challenges in implementation, especially for people with persistent knee pain.

Beyond conventional weight-loss strategies, emerging evidence suggests the potential of nutrition strategies that directly target systemic inflammation.[115,116] Unlike energy-deficient methods, these dietary approaches aim to mitigate inflammatory processes linked to knee conditions, including PFP.[56,103] For instance, diets rich in anti-inflammatory foods—such as those containing omega-3 fatty acids, antioxidants, and phytochemicals—could play a crucial role.[116,117] These nutrients are known to reduce the production of pro-inflammatory cytokines such as interleukin-6 and tumour necrosis factor-alpha, which are implicated in patellar cartilage degradation and increased knee pain.[118,119]

https://doi.org/10.2147/OAJSM.S517971

Anti-inflammatory dietary interventions are not focused on weight loss but on altering the body's inflammatory response, which could lead to more immediate physiological benefits.[120] This approach may be particularly beneficial for people with knee conditions, where reducing inflammation can lead to decreased pain and improved physical function, encouraging greater long-term treatment adherence and outcomes.

The potential of dietary interventions in managing PFP warrants further investigation. It is essential to explore interventions that address the inflammatory processes and overall joint health. This is highlighted by a recent trial that found telehealth-delivered programs targeting exercise with dietary intervention for people with knee osteoarthritis are likely to be cost-effective, particularly if potential long-term gains from weight loss and work productivity are considered.[121]

Is It Time for a Paradigm Shift in How We Manage PFP?

PFP has been receiving greater attention from the research and clinical community due to its burden on adolescents and young adults.[89] International consensus statements and clinical practice guidelines report that current management options (eg, exercise, taping, foot orthoses) lead to positive short-term outcomes.[89,91] However, these management options are unsuccessful in the medium- and long-term.[80] Therefore, it is perhaps time to rethink our management strategies and propose clinical trials that address the gaps highlighted in the previous section.

A recent evidence gap map on interventions showed that existing research is heavily skewed toward physical interventions and outcomes focused on pain and physical function. There is a clear need for higher-quality studies examining both physical and non-physical interventions across a broader spectrum of outcomes. Additionally, most studies to date have evaluated only short-term effects.[122]

Considering the psychological features that have been consistently reported in people with PFP,[50] and that a large part of this population lives with overweight or obesity.[62–64] It is time for a paradigm shift, exploring a multi-disciplinary approach involving health professionals such as clinical counsellors, psychologists, dietitians, physicians, physiotherapists, and exercise physiologists. Interventions such as dietary interventions and cognitive behavioural therapy present promising results in other populations when delivered in person or via telehealth (eg, knee osteoarthritis,[114,117,123] low back pain[124]), and should be investigated in people with PFP. Such an approach has the potential to revolutionize the current management of PFP. For example, future trials could compare traditional exercise-based physiotherapy with integrated models that combine physiotherapy-led exercise and movement retraining with psychology-led cognitive behavioural therapy and dietitian-led anti-inflammatory or weight-management nutrition programs. Co-ordinated care pathways that embed digital education and telehealth follow-up across disciplines may also be explored. Such an approach has the potential to revolutionize the current management of PFP, offering more holistic and patient-centred strategies.

Conclusion

PFP is a highly prevalent, persistent, and burdensome condition with a complex multifactorial background that includes biomechanical, psychological, systemic, and lifestyle contributors. Contemporary management, which predominantly targets local biomechanical impairments with exercise and adjunct physical interventions, provides short-term benefits but limited long-term relief. Emerging evidence on psychological factors, obesity, diet, digital health, patient education, and self-management highlights the need to broaden our therapeutic focus. We propose that future research and clinical practice prioritise multidisciplinary, patient-centred models of care that integrate exercise therapy, education, psychological support, and nutrition interventions to improve long-term outcomes for people living with PFP.

Disclosure

The authors report no conflicts of interest in this work.

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