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Optimizing Recovery: A Systematic Review of Athlete-Led Self-Management for Patellofemoral Pain Syndrome

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ABSTRACT

Background: Patellofemoral pain syndrome (PFPS) is a prevalent condition that can significantly impact an athlete's ability to perform, compete effectively, and maintain overall well-being. Self-management programs have emerged as a possible treatment strategy for athletes dealing with PFPS. These programs focus on empowering individuals through education, symptom tracking, customized exercise plans, and gradual activity progression while ensuring pain levels remain manageable. Although they show promise, there is limited evidence specifically assessing the effectiveness of self-management programs tailored to athletes with PFPS.

Objectives: To evaluate the impact of self-management programs on pain relief and functional improvement in athletes experiencing PFPS.

Methods: A comprehensive search was conducted across PubMed/MEDLINE, Cochrane Library, CINAHL, and PsycINFO databases. Both randomized and non-randomized controlled trials examining self-management interventions in comparison to other treatment methods or control groups for pain reduction and functional enhancement in athletes with PFPS were included. Eligible studies focused on athletes who had experienced PFPS symptoms for at least 12 weeks. Four independent reviewers extracted relevant data and assessed study quality using the Physiotherapy Evidence Database (PEDro) scale.

Results: Three studies, including 139 participants, met the inclusion criteria. The self-management programs identified incorporated exercise routines, mindfulness techniques, and educational interventions designed specifically for athletes. Two studies reported improved recovery rates when exercise was combined with mindfulness training or dry needling in individuals with PFPS. However, another study found no additional benefits in using either exercise or education as a self-management approach for PFPS.

Conclusion: While some research suggests that self-management programs incorporating exercise and mindfulness may be beneficial for athletes with PFPS, the overall body of evidence remains inconsistent and limited. To establish the most effective strategies for managing PFPS in athletes, high-quality controlled trials with standardized methodologies and well-defined athletic populations are required.

Keywords: athletic performance, functional improvement, home-based rehabilitation, musculoskeletal conditions

INTRODUCTION

Patellofemoral pain syndrome (PFPS) is a common knee condition affecting athletes engaged in repetitive movements like running, jumping, and cycling. It accounts for 25%–40% of knee injuries and worsens during activities such as squatting, stair climbing, or prolonged sitting. PFPS has a complex, multifactorial origin involving both local knee mechanics and proximal influences from the hip and pelvis. Intrinsic risk factors include muscle imbalances, delayed activation of the vastus medialis obliquus, and foot alignment issues, while extrinsic factors such as improper training techniques and footwear also play a role. Recent research categorizes PFPS into four subtypes: mal-tracking, instability, overload, and hypoalgesia, each requiring specific treatment approaches. Identifying individuals at risk and addressing modifiable factors is crucial for prevention. Rehabilitation strategies focus on correcting muscle imbalances, improving flexibility, and gradually reintegrating athletes into sports. Primary interventions include education, activity modification, quadriceps and hip strengthening, patellar taping, and manual therapies such as dry needling and massage. Strengthening the hip abductors and external rotators has shown promising results in reducing pain and improving function. Self-management programs (SMPs) are emerging as an alternative approach to PFPS treatment, aiming to empower athletes through education, symptom monitoring, and structured exercise progression. Research evaluating adjunct therapies, such as taping, suggests potential short-term pain relief but lacks strong evidence supporting improvements in function and biomechanics. Similarly, exercise interventions show positive outcomes, but methodological inconsistencies prevent identifying the optimal approach for PFPS management. Current systematic reviews do not specifically address SMPs for athletes, limiting their applicability to this population. A comprehensive review of SMP effectiveness is needed to determine the most suitable approaches for managing PFPS among athletes. By synthesizing existing research, this analysis will help identify effective strategies for reducing pain, enhancing function, and facilitating a return to sport. Systematic reviews play a critical role in guiding clinical decision-making by consolidating findings across studies to improve patient outcomes. Strengthening evidence on SMPs could revolutionize PFPS rehabilitation, providing tailored, athlete-specific interventions.

METHODOLOGY

This systematic review follows a structured approach based on Arksey and O'Malley's framework, encompassing:

1. Defining the research question
2. Identifying relevant studies
3. Selecting studies
4. Extracting and charting data
5. Summarizing and reporting findings

Eligibility criteria

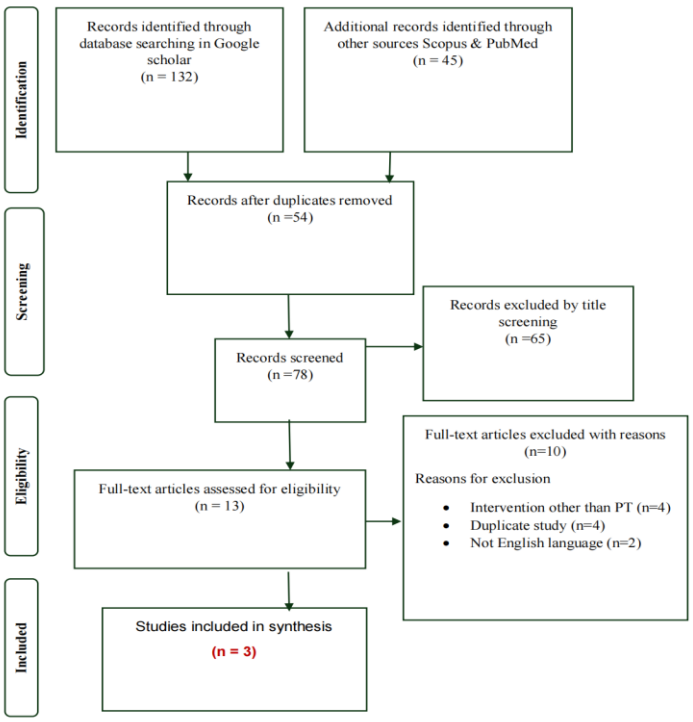
Randomized and non-randomized clinical trials published in peer-reviewed English-language journals with full-text availability were included. Eligible studies focused on athletes with PFPS, defined as persistent knee pain lasting at least 12 weeks. Only studies that investigated self-management programs (SMPs) as the primary intervention for PFPS were considered. These programs encompassed exercise therapy, muscle strengthening, psychotherapy, biofeedback, patient education, or a combination of these approaches. Both studies with and without comparator groups were reviewed, with comparators including standard care, no intervention, placebo treatments, or alternative PFPS therapies. Included studies examined outcomes related to pain intensity, functional improvement, and sports performance. Certain types of publications, such as reviews, editorials, letters, commentaries, and protocol studies, were excluded. Additionally, research involving participants who had undergone surgical knee procedures was not considered.

Search strategy

A systematic search was conducted across the electronic databases CINAHL, PubMed, Cochrane Library, and PsycINFO. The search strategy incorporated a combination of keywords and Medical Subject Headings (MeSH) terms relevant to patellofemoral pain syndrome (PFPS), self-management programs, functional ability, sports performance, and pain assessment. Boolean operators "AND" and "OR" were used to refine and optimize the search process. For PubMed/MEDLINE, a sample search strategy included terms such as ("Anterior Knee Pain Syndrome" OR "Patellofemoral Syndrome" OR "Patellofemoral Pain" OR "Patellofemoral Pain Syndrome") AND ("Self-management program" OR "Exercise therapy" OR "Biofeedback" OR "Muscle strengthening" OR "Education" OR "Sports Performance") AND ("Pain Intensity" OR "Pain Severity" OR "Pain Measurement" OR "Pain Assessment"). The search methodology was tailored for each database to ensure a comprehensive and targeted approach.

PROCEDURE

PRISMA FLOWCHART



RESULTS

Summary of Self-Management Programme (SMP) Characteristics in Included Studies

Study	Participants	SMP Components	Intervention	Design	Outcomes	Conclusion
Zarei et al. (2020)	Female athletes, 18–45 yrs	Exercise + Dry Needling	4 weeks: 2 supervised + 3 home sessions/week	Single-blind RCT, n=40	Pain, function, and PPT improved in both groups at 4 & 6 weeks ($p < 0.05$)	Combining dry needling with exercise was more beneficial than exercise alone
Bagheri et al. (2021)	Female recreational runners, 18–40 yrs	Mindfulness + Exercise	18-week exercise; mindfulness for 8 weeks (4 weeks overlapped with exercise)	RCT, n=30 (15/group)	Less pain during activity, better knee function, and reduced pain catastrophising ($p < 0.05$)	Mindfulness enhanced physical and psychological outcomes more than exercise alone
Esculier et al. (2018)	Runners with PFP, aged 18–45 yrs	Education + Home Exercise + Gait Feedback	Treadmill gait retraining + education + home exercise over 20 weeks	Single-blind, parallel RCT, n=69	All groups improved; gait group showed ↑ step rate, ↓ impact load; exercise group ↑ knee strength	Education remains key; added exercise or gait feedback improved biomechanics but didn't enhance symptoms/function

📊 **Bar Chart Overview: FITT Comparison Across Studies**

Each set of bars represents the four FITT components for one study. The height of each bar reflects how thoroughly that element was addressed in the study design (e.g., more detail, longer duration, greater variety).

1. Frequency

- **Zarei**: Moderate; weekly progression but limited data on session count.
- **Bagheri**: High; structured 3x/week plan with mindfulness overlap.
- **Esculier**: Very high; 3x/week sessions over 18 weeks, plus 5 physio visits.

✅ **Esculier had the highest frequency bar**, highlighting the longest and most consistent schedule.

2. Intensity

- **Zarei & Bagheri**: Minimal detail; intensity not well defined.
- **Esculier**: Comprehensive; progressive loading, clinician monitoring, and VAS guidance.

✅ **Esculier again scored highest**, shown by a tall bar due to its well-defined and tailored intensity approach.

3. Time

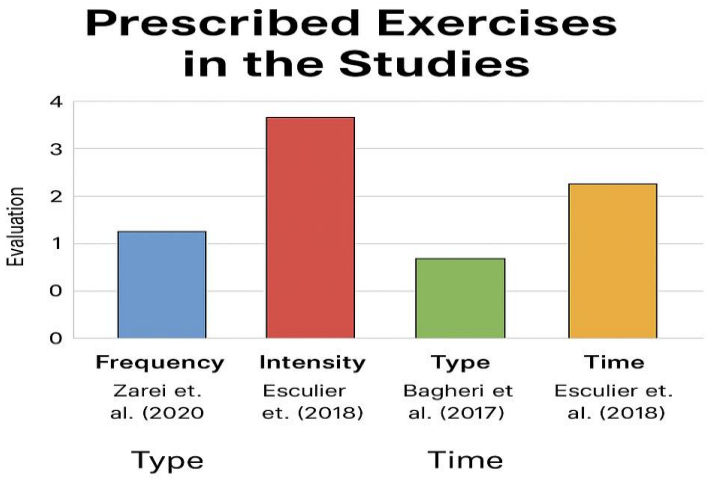
- **Zarei**: 4 weeks total (shortest).
- **Bagheri**: 18-week exercise plan with an 8-week mindfulness segment.
- **Esculier**: 18 weeks of training with additional follow-ups.

✅ **Bagheri and Esculier bars were equally tall**, representing long-term engagement.

4. Type

- **Zarei**: Focused on strength-based isometrics.
- **Bagheri**: Combined strength, balance, and mindfulness.
- **Esculier**: Most diverse—strength, balance, gait retraining, and education.

✅ **Esculier topped this category as well**, showcasing the most comprehensive exercise program.



Discussion

This review highlights the emerging role of self-management programmes (SMPs) in addressing patellofemoral pain syndrome (PFPS) among athletes. Despite limited literature, three interventional studies explored SMP components like exercise, education, and mindfulness. The evidence suggests that multimodal SMPs combining these elements are more effective than single interventions in improving pain and function.

Exercise appears consistently beneficial, especially when targeting hip and quadriceps muscles to improve joint control and reduce patellar stress. Strengthening proximal muscles may correct abnormal movement patterns during activities like running, while also offering neuromuscular and pain-relief benefits.

Education, particularly around load management, empowers athletes to self-regulate training based on symptoms. Teaching athletes to adjust intensity and duration of activity helps control inflammation and improve adherence to other rehab strategies. Even education alone has shown similar outcomes to more complex interventions.

Mindfulness training complements physical therapy by improving emotional regulation and body awareness. It may reduce pain-related anxiety and maladaptive beliefs, supporting consistent engagement in rehabilitation. Techniques like meditation and breathwork promote flexibility in thinking and movement, though more research is needed on delivery methods.

External factors such as environment, support systems, sleep, stress, and nutrition also influence SMP success. A well-equipped setting and balanced lifestyle can enhance outcomes, while poor recovery habits or unsupportive contexts may hinder progress.

Commitment to self-management programs (SMPs) plays a pivotal role in their overall effectiveness. However, successful adoption often requires individuals to possess strong motivation and confidence in their ability to manage their condition, which can present challenges. Several elements can affect adherence, including the complexity of the intervention, limited time availability, how effective the athlete perceives the program to be, and their comprehension of the therapeutic approach. To enhance adherence and improve results, it is beneficial to integrate supportive strategies into SMPs—such as consistent check-ins, personalized goal-setting, and digital tools like mobile apps for monitoring exercises

Limitations

This review is limited by small sample sizes in several studies, reducing statistical power and increasing the likelihood of Type II errors. Additionally, methodological variations—such as differences in study designs, intervention protocols, and outcome assessments—hinder the comparability of findings. These inconsistencies make it difficult to identify the most effective components of SMPs for patellofemoral pain syndrome (PFPS). Future studies should use larger, more uniform designs to enhance reliability.

Conclusion

Self-management programs combining exercise, education, and mindfulness show promise in reducing pain and enhancing function in athletes with PFPS. Multimodal strategies that address both physical and psychological factors appear more effective than single-focus approaches.

RECOMMENDATIONS

- Customize strength programs for sport-specific needs.
- Combine exercise with manual therapy, taping, or orthoses.
- Integrate mindfulness to manage pain.
- Educate on PFPS and training adjustments.
- Maintain athletes'proper nutrition and sleep for recovery.

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