doi:10.4085/1062-6050-0353.24

Title: Individuals with patellofemoral pain have impaired self-reported and performance-based function: Systematic review with meta-analysis and meta-regression

Authors and affiliations:

Ana Flavia Balotari Botta*, MS, PT. São Paulo State University, School of Science and Technology, Physical Therapy Department, Presidente Prudente, Brazil.

E-mail: anafbbotta@hotmail.com. Twitter: @BalotariBotta

Marina Cabral Waiteman, MS, PT. São Paulo State University, School of Science and Technology, Physical Therapy Department, Presidente Prudente, Brazil.

E-mail: mariwaiteman@hotmail.com. Twitter: @mariwaiteman

Júlia de Cássia Pinto da Silva, PT. São Paulo State University, School of Science and Technology, Physical Therapy Department, Presidente Prudente, Brazil.

E-mail: julia.cp.silva@unesp.br. Twitter: @julia_cp_silva

Fábio Mícolis de Azevedo, PhD, PT. São Paulo State University, School of Science and Technology, Physical Therapy Department, Presidente Prudente, Brazil. E-mail: fabiomicolis@gmail.com. Twitter: @FMicolis.

Michelle C. Boling, PhD, ATC. University of North Florida, Brooks College of Health, Jacksonville, United States of America. E-mail: m.boling@unf.edu. Twitter: @mcboling23

David Matthew Bazett-Jones, PhD, ATC. High Point University, Congdon School of Health Sciences, Department of Health and Human Performance, High Point, United States of America. E-mail: dbazettj@highpoint.edu Twitter: @DrBazettJones.

Ronaldo Valdir Briani, PhD, PT. São Paulo State University, School of Science and Technology, Physical Therapy Department, Presidente Prudente, Brazil. E-mail: ronaldobriani@hotmail.com. Twitter: @RonaldoBriani.

*Corresponding author. Ana Flavia Balotari Botta, MS, PT. Sao Paulo State University, School of Science and Technology, Physical Therapy Department, 305 Roberto Simonsen Street, Presidente Prudente, SP, 9060-900, Brazil. Phone: +55 18 32295280. E-mail: anafbbotta@hotmail.com.

Acknowledgements: This work was supported by the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Sao Paulo Research Foundation (FAPESP) [grant numbers 2022/06403-9 and 2023/15990-8]. The funders played no role in the design, conduct, or reporting.

Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Registration: PROSPERO registration number CRD42021234911.

Individuals with patellofemoral pain have impaired self-reported and performance-based function: Systematic review with meta-analysis and meta-regression

ABSTRACT

Objective: To determine impairments on self-reported/performance-based function in individuals with patellofemoral pain (PFP) as well as physical and non-physical factors potentially related with these impairments.

Data sources: We searched MEDLINE, Embase, CINAHL, Web of Science, and SPORTDiscus databases from inception until January 2024.

Study selection: We included studies comparing self-reported/performance-based measures of function between individuals with PFP and their pain-free limbs or pain-free individuals.

Data extraction: Two independent researchers extracted the key information from each study.

Data synthesis: We performed meta-analyses for each self-reported/performance-based measure of function and meta-regressions to identify factors that might explain meta-analyses outcomes. We assessed the certainty of evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE). We included 83 studies (2807 individuals with PFP and 2518 pain-free individuals). We identified very low to high certainty evidence that individuals with PFP have reduced self-reported (large effect sizes, standardized mean difference [SMD], -1.99; 95% confidence interval [CI]:-2.41,-1.57 to SMD, -4.87; 95% CI:-6.97,-2.77) and performance-based (small to large effect sizes: SMD, -.30; 95% CI:-.58, -.02 to SMD, -1.21; 95% CI:-2.71, -.29) measures of function compared to pain-free individuals, but there are no differences between limbs in individuals with unilateral PFP for the most of performance-based measures of function (small to moderate effect sizes, SMD, -.20; 95% CI:-.68, .27 to SMD, -.49; 95% CI:-1.02, .03). Age, body mass index, duration of symptoms and self-reported pain did not

significantly explain self-reported function, whereas age did not significantly explain performance-based function (R^2 <.01 to .02, p =.145 to .914).

Conclusion: Our results highlight the negative impact of PFP on self-reported and performance-based function, which seems to also affect the pain-free limb. Self-reported and performance-based measures of function should be considered when assessing individuals with PFP. None of the factors investigated explained impaired self-reported and performance-based function.

Key Words: Clinical Tests; Functional Capacity; Patient-Reported Outcome Measures; Physical Function; Subjective Function

Key Points:

•Individuals with PFP have impaired function compared to pain-free individuals, thus function measures should be considered primary outcomes in the management of PFP.

•There are no function differences between limbs in individuals with unilateral PFP, therefore caution is warranted when comparing function between PFP and pain-free limbs.

•Age, BMI, duration of symptoms, and self-reported pain did not explain function.

INTRODUCTION

Patellofemoral pain (PFP) frequently presents to orthopedic and sports clinics given its high prevalence in active adolescents and young adults.[1] Individuals with PFP report diffuse anterior knee pain during daily living or sporting activities such as stair ascent and descent, squatting, and hopping.[2] Reductions in health-related quality of life,[3–5] psychological well-being,[6,7] and physical activity/sport participation[8] are reported in individuals with PFP, as are impairments in self-reported and performance-based function.[9,10] Self-reported measures (e.g., Patient-Reported Outcome Measures [PROMs]) indicate how individuals with PFP perceive their functional limitations, while performance-based measures of function (e.g., Single Leg Hop test [SLHT]) represent the actual objectively measured functional limitation.[9] Both provide clinically relevant and complementary information, which can help guide the development of effective interventions.

Measures of function have been considered one of the key determinants of PFP and its prognosis.[11,12] Self-reported function has been related to pain severity, kinesiophobia, and psychological well-being,[7,13] and predicted unfavorable recovery 5-8 years after treatment.[11] Performance-based measures of function, like hopping and stepping tasks, have been related to hip and knee strength,[9,14] which are key targets of PFP management.[12] A greater understanding of the potential magnitude of functional impairments may help inform preferable outcome measures for decision-making processes.[9] Despite the importance of measures of function for PFP, no study has systematically synthesized the literature to determine the impact of PFP on self-reported function as compared to pain-free individuals, and on performance-based function as compared to pain-free individuals or the pain-free limb of individuals with unilateral PFP. In

addition, no systematic review has attempted to identify factors that may explain poor self-reported and performance-based function in individuals with PFP. It is important to determine which measures of function are impaired as well as which physical and non-physical factors may underline these deficits, once function improvement is a common target of PFP rehabilitation.[15]

In this systematic review we aimed to: (i) systematically review and meta-analyze the literature comparing self-reported and performance-based function between individuals with PFP and pain-free individuals or the pain-free limb of individuals with unilateral PFP; and (ii) investigate physical and non-physical factors that might explain poor self-reported and performance-based function in individuals with PFP through meta-regression.

METHODS

We conducted this systematic review in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines[16] and pre-registered its protocol with PROSPERO (CRDXXXXX).[17] We summarized protocol deviations in the Supplemental material A.

Search strategy

We conducted the initial electronic search in MEDLINE, Embase, CINAHL, Web of Science, and SPORTDiscus from inception to February 2021 and then updated it in January 2024. We combined the keywords and Medical Subject Headings (MeSH) related to PFP, self-reported and performance-based measures of function with search filters to develop the search strategy. We

created the primary search for MEDLINE and adapted it to the other databases through pilot searches (Supplemental material B). We did not search the gray literature.

Selection criteria

One author (XXX) imported identified studies into Covidence (Veritas Health Innovation, Melbourne, Australia)[18] and duplicates were removed. Two authors (XXX, XXX) independently screened titles and abstracts for eligibility using the criteria presented in **TABLE 1**. We retrieved full-text articles of potentially relevant abstracts for further review. When the full text was not available, we requested it from the corresponding authors via e-mail. When authors were unable to provide the full text, we excluded the study. When studies from the same author groups presented similar descriptive values of measures of function, we included only the first study published after confirmation with the corresponding author that both publications included the same cohort. Disagreements were resolved by consulting a senior author (XXX).

Data extraction

One author (XXX) extracted study and individuals characteristics (e.g., leading author, year of publication, sample size, sex, age of individuals), self-reported and performance-based measures of function (e.g., Anterior Knee Pain Scale [AKPS], Lower Extremity Functional Scale [LEFS], Knee Injury and Osteoarthritis Outcome Score [KOOS], Knee Injury and Osteoarthritis Outcome Score for Patellofemoral Pain and Osteoarthritis [KOOS-PF], Forward Step-Down Test [FSDT], hop or balance tests), and predictors of interest to be included in the meta-regression. We selected physical (e.g., Body Mass Index [BMI], strength) and non-physical (e.g., kinesiophobia, pain catastrophizing) predictors of interest based on recommended items from REPORT-PFP,

the biomechanical and psychological consensuses of PFP.[6,19,20] A second author (XXX) reviewed all the extracted data. We extracted means, standard deviations and sample size for all outcomes and used them for data analysis. When data were missing, we contacted corresponding authors via e-mail for further information up to three times. When authors were unable to provide the data or did not respond to the requests, and missing data could not be calculated with the software Review Manager 5.4 (The Cochrane Collaboration, Copenhagen, Denmark), we did not enter the study in the meta-analyses. For these studies, we performed only an individual study analysis by calculating the standardized mean differences (SMDs) and discussing them. We provided details on data extraction management in Supplemental material C.

Methodological quality assessment and risk of bias

We assessed the internal and external validity of observational and non-randomized interventional studies with a domain-based evaluation using the modified Downs and Black checklist, as previously performed by Hart et al.[21] We assessed internal validity across five domains: performance bias (items 14,15,19), reporting bias (item 16), detection bias (items 17,18,20), selection bias (items 21-25), and attrition bias (item 26). We assessed external validity using items 11-13. We scored each item as “yes”, “no”, or “unable to determine”. We made an overall quality classification for each study based on concerns across all applicable items/domains rather than the numeric summary score. Each study was classified across domains and external validity as low, moderate, or high-quality based on the items’ evaluation. A similar classification was performed for the internal validity based on the domains’ evaluation. We assessed the methodological quality of the only randomized clinical trial included[22] with the Physiotherapy Evidence Database (PEDro) scale[23] and its risk of bias with The Cochrane Risk of

Bias for Randomized Trials 2 (RoB2) following the Cochrane Handbook recommendations.[24] The PEDro scale consists of a 0-10 score rated according to the presence or absence of some methodological quality criteria.[23] The score classification was high quality (≥7/10), moderate quality (4-6/10), and low quality (≤3/10). The RoB2 comprises five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported study. For each domain the tool comprises a series of signaling questions scored as "yes", "probably yes", "probably no", "no", and "no information". We classified each domain as low, high, or some concerns of risk of bias based on the tool algorithm judgment verified by the authors.[25] We determined the overall risk of bias using the worst-score-counts method which takes the lowest rating across all the domains.[26] We provided further details regarding study quality assessment and risk of bias in Supplemental material D. Two authors (XXX, XXX) independently assessed all studies and disagreements were resolved by consulting a senior author (XXX).

Data synthesis and analysis

One author (XXX) performed meta-analyses using Review Manager 5.4 (The Cochrane Collaboration, Copenhagen, Denmark) and random-effects models when two or more studies investigated the same outcome and comparator (pain-free individuals or pain-free limb of individuals with unilateral PFP). A second author (XXX) reviewed all meta-analyses. We calculated SMDs with 95% confidence intervals (CIs) (Hedges' g) once different scales/unit of measurements were reported across studies, even in those using the same questionnaire or test (e.g. studies[27–29]). We classified the SMDs as small (≥ .2), moderate (.5-.79), and large effect (≥ .80).[30] We quantified statistical heterogeneity for pooled results using I^2 statistics and was

defined as not important (< 50%), moderate (50-75%), or high (> 75%).[31] We estimated publication bias through the Egger's regression test. For the data that were not included in the meta-analyses, we calculated the SMD with 95% CIs for individual comparisons and discussed them. Statistically significant results are the CIs excluding zero.

We performed meta-regressions to identify predictors that could explain the SMDs (Hedges' g) of function outcomes. We performed random effects meta-regressions using Comprehensive Meta-Analysis software (BioSTAT Consultants, Inc., Englewood, EUA) when at least 10 studies included in a meta-analysis also presented data of the same predictor.[25]

Certainty of evidence

Two authors (XXX, XXX) assessed the certainty of evidence using a modified Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach.[32,33] Given the observational nature of the research question of our systematic review, certainty of evidence started as high and was downgraded and/or upgraded according to GRADE Handbook recommendations which are described in TABLE 2.[32,34] We defined levels of certainty of evidence as: high when further research is very unlikely to change confidence in the estimate of the effect; moderate when further research is likely to have an important impact on confidence in the estimate of the effect and may change the estimate; low when further research is very likely to have an important impact on confidence in the estimate of the effect and is likely to change the estimate; and very low when there is very little confidence in the effect estimate.[32]

RESULTS

Our systematic search identified 28,797 titles and abstracts for screening (**FIGURE 1**). After removing duplicates, 21,648 studies underwent title and abstract screening, and 475 studies underwent full-text screening. We ultimately included 83 studies in the review, with 75 of them being observational, seven pre-post studies, and one randomized clinical trial. We presented reasons for study exclusion in Supplemental material E.

Individuals and studies characteristics

We summarized the characteristics of studies and individuals in Supplemental material F. Across studies, 2807 individuals with PFP and 2518 pain-free individuals were included. Mean (SD) of age for PFP and pain-free individuals was 22.91 (6.55) years and 23.24 (6.23) years, respectively. Mean (SD) of BMI for PFP and pain-free individuals was 23.04 (3.58) Kg/cm² and 22.30 (3.05) Kg/cm², respectively. The most common self-reported measures of function were: AKPS (42 studies),[8,9,41–50,27,51–60,29,61–70,35,71,36–40] LEFS (9 studies),[37,63,68,72–77] Functional Index Questionnaire (FIQ, 7 studies),[28,59,78–82] KOOS (7 studies),[69,83–88] Activities of Daily Living Questionnaire (ADLS, 5 studies),[29,89–92] KOOS-PF (5 studies),[9,69,84,93,94] and Lysholm Knee Scoring Scale (Lysholm, 5 studies).[63,90,95–97] The most common performance-based measures of function were: balance tests (i.e., Star Excursion Balance Test [SEBT], 5 studies;[63,98–101] YBT, 8 studies),[22,29,42,93,94,102–104] FSDT (11 studies),[9,27,108,45,57,59,64,100,105–107] and SLHT (8 studies).[9,42,45,64,65,100,107,109]

Methodological quality and risk of bias

We detailed methodological quality and risk of bias assessment of each included study in Supplemental material D. We rated nearly 76% of the studies (63 studies) as low quality for

performance bias, 20% (17 studies) as low quality for reporting bias, 2% (2 studies) as low quality for detection bias, 52% (43 studies) as low quality for selection bias, and 5% (4 studies) as low quality for attrition bias. Overall, we judged most studies as having low quality for internal (84%, 76 studies) and external validity (98%, 81 studies). A single study[22] was assessed with PEDro scale and RoB2 and was classified as moderate quality (6/10) and high risk of bias, respectively.

Publication bias

We could only assess risk of publication bias for the AKPS and balance tests meta-analyses. We did not detect any publication bias (Supplemental material G).

Data findings

We pooled seventy-seven studies in meta-analyses and presented their outcome-level of certainty in **TABLE 2**. We could not pool five studies,[87,96,97,108,110] due to missing descriptive/parametric data,[87,96,97,108,110] or lack of sufficient studies.[108,110] Whereas we pooled only part of the outcomes of 11 studies[9,10,107,29,62,64,65,69–71,105] that reported multiple function measures, due to missing descriptive/parametric data,[65,69] lack of sufficient studies,[9,10,29,62,70,71,105,107] or duplicate data.[64] We presented a synthesis of unpooled studies as well as the SMDs and 95% CI in Supplemental material H, except for between-limb comparisons of performance-based measures of function that are presented below.

Self-reported function

AKPS: Moderate certainty of evidence from 40 studies (2414 individuals)[8,9,41–50,27,51–60,29,61–63,66–71,35–40] showed that individuals with PFP have reduced self-reported function measured with AKPS compared to pain-free individuals (large effect size, SMD=-3.45, 95% CI=-3.84 to -3.06; I^2=88%, p<.001; **FIGURE 2A**).

LEFS: Moderate certainty of evidence from 9 studies (593 individuals)[37,63,68,72–77] showed that individuals with PFP have reduced self-reported function measured with LEFS compared with pain-free individuals (large effect size, SMD=-3.83, 95% CI=-5.10 to -2.55; I^2=95%, p<.001; **FIGURE 2B**).

FIQ: Moderate certainty of evidence from 7 studies (337 individuals)[28,59,78–82] showed that individuals with PFP have reduced self-reported function measured with FIQ compared to pain-free individuals (large effect size, SMD=-4.87, 95% CI=-6.97 to -2.77; I^2=96%, p<.001; **FIGURE 2C**).

KOOS: High certainty of evidence from 5 studies (255 individuals)[83–86,88] showed that individuals with PFP have reduced self-reported function measured with KOOS compared with pain-free individuals (large effect size, SMD=-1.99, 95% CI=-2.41 to -1.57; I^2=43%, p<.001; **FIGURE 2D**).

ADLS: Moderate certainty of evidence from 5 studies (375 individuals)[29,89–92] showed that individuals with PFP have reduced self-reported function measured with ADLS compared with pain-free individuals (large effect size, SMD=-2.79, 95% CI=-3.49 to -2.08; I^2=83%, p<.001; **FIGURE 2E**).

KOOS-PF: Moderate certainty of evidence from 4 studies (124 individuals)[9,84] showed that individuals with PFP have reduced self-reported function measured with KOOS-PF compared

with pain-free individuals (large effect size, SMD=-2.66, 95% CI=-3.47 to -1.86, I^2=60%, p=<.001; **FIGURE 2F**).

Lysholm: Moderate certainty of evidence from 3 studies (102 individuals)[63,90,95] showed that individuals with PFP have reduced self-reported function measured with Lysholm compared with pain-free individuals (large effect size, SMD=-2.23, 95% CI=-3.51 to -.96; I^2=82%, p<.001; **FIGURE 2G**).

Performance-based measures of function

Balance tests: Low certainty of evidence from 12 studies (809 individuals)[29,42,103,104,63,93,94,98–102] showed that individuals with PFP have reduced reach distance in balance tests compared with pain-free individuals (large effect size, SMD=-.66, 95% CI=-1.12 to -.19; I^2=88%, p=.005; **FIGURE 3A**). Low certainty of evidence from 2 studies[22,42] showed no significant differences between limbs in the YBT in individuals with unilateral PFP (small effect size, SMD=-.20, 95% CI=-.68 to .27; p=.39; **FIGURE 4A**).

FSDT: Moderate certainty of evidence from 9 studies (737 individuals)[9,27,45,57,59,64,100,105,106] showed that individuals with PFP have reduced number of repetitions in the FSDT compared with pain-free individuals (large effect size, SMD=-.80, 95% CI=-1.11 to -.50; I^2=68%, p<.001; **FIGURE 3B**). Very low certainty of evidence from 2 studies[105,107] showed no significant differences between limbs for repetitions in the FSDT in individuals with unilateral PFP (small effect size, SMD=-.36, 95% CI=-1.11 to .38; I^2=73%, p=.34; **FIGURE 4B**).

SLHT: Moderate certainty of evidence from 7 studies (711 individuals)[9,42,45,64,65,100,109] showed that individuals with PFP have reduced distance in the SLHT compared with pain-free individuals (small effect size, SMD=-.42, 95% CI=-.57 to -.27; I^2=0%, p<.001; **FIGURE 3C**).

Evidence from one high quality study[107] showed that PFP limb have reduced distance in the SLHT compared with pain-free limb of individuals with unilateral PFP, however this result was not confirmed by calculated SMD and 95% CI (small effect size, SMD=-.29, 95% CI=-.86 to .28; p=.32; **FIGURE 4C**).

Single Leg Triple Hop Test [SLTHT]: Moderate certainty of evidence from 2 studies (196 individuals)[29,42] showed that individuals with PFP have reduced distance in the SLHT compared with pain-free individuals (small effect size, SMD=-.30, 95% CI=-.58 to -.02; I^2=0%, p=.04; **FIGURE 3D**).

Bilateral squat test: Moderate certainty of evidence from 2 pooled studies[27,105] showed no significant differences in the number of repetitions in the bilateral squat test between individuals with PFP and pain-free individuals (large effect size, SMD=-1.21, 95% CI=-2.71 to .29; I^2=86%, p=.11; **FIGURE 3E**).

Between-limb comparisons for other performance-based measures: Evidence from one study[105]showed that PFP limb have reduced number of repetitions in the Anteromedial Lunge compared with pain-free limb of individuals with unilateral PFP (moderate effect size, SMD = -.64, 95% CI = -1.17 to -.11; p = .02). The same study[105] showed that PFP limb have reduced number of repetitions in the Balance and Reach Test, and scores in the Single Leg Press Test compared with pain-free limb of individuals with unilateral PFP, however this result was not confirmed by calculated SMD and 95% CI (small effect sizes, SMD = -.35, 95% CI = -.87 to .17; p =.19 and SMD = -.49, 95% CI = -1.02 to .03; p = .06, respectively) **(FIGURE 4D, 4F)**.

Meta-regressions

We could only perform meta-regressions for self-reported function measured with AKPS and the following predictors: age (years), BMI (kg/m²), duration of symptoms (months), and self-reported pain (0-10). For performance-based function, we could only perform meta-regressions for balance tests and age (years) (Supplemental material I).

Meta-regression results indicate no significant relationship between self-reported function and age (40 studies, R^2<.01, p=.541; FIGURE I1), BMI (20 studies, R^2<.01, p=.183; FIGURE I2), duration of symptoms (21 studies, R^2<.01, p=.855; FIGURE I3), and worst level of pain in the last month, week or 24-72 hours (15 studies, R^2=.02, p=.145; FIGURE I4). No significant relationship was also observed between performance-based function during balance tests and age (12 studies, R^2<.01, p=.914; FIGURE I5).

DISCUSSION

We identified 83 studies investigating self-reported or performance-based measures of function in individuals with PFP. Moderate to high certainty of evidence demonstrated that individuals with PFP have impaired self-reported function compared to pain-free individuals, regardless of instrumentation. Very low to moderate certainty of evidence also demonstrated between-group (i.e., PFP versus pain-free individuals), but not between-limb (i.e., painful versus pain-free limb of individuals with PFP), differences for most of the performance-based measures of function. Reduced performance between PFP and pain-free individuals was observed in tasks simulating dynamic balance (e.g., YBT), stepping (e.g., FSDT), or hopping (e.g., SLHT). Our results highlight the negative impact of PFP on self-reported and performance-based measures of function. However, none of the predictors investigated in our study (i.e., age, BMI, duration of

symptoms, self-reported pain) could explain impaired self-reported or performance-based function in individuals with PFP.

Self-reported function

Our systematic review identified that individuals with PFP have impaired self-reported function when compared to pain-free individuals. This finding is based on large effects across seven different questionnaires/scales and supports previous evidence considering self-reported measures of function as determinants of treatment success or patient recovery after conservative management of PFP.[12,15] Impaired self-reported function, as a consequence of having PFP, not only affects individuals' perception and perspectives about their physical function,[5,111] but can also predict persistent or recurrent PFP (i.e., poor prognosis) in the medium and long-term.[11,112,113] Along with previous evidence, our results highlight the need of considering self-reported function as one of the primary condition-specific outcome measures during rehabilitation of individuals with PFP.

The assessment of self-reported function is clinician-friendly and strongly recommended by the REPORT-PFP.[19] Recommended questionnaires include the AKPS (also known as Kujala scale) and the KOOS-PF.[19] Although the AKPS is by far the most commonly used questionnaire (42 studies included in the present review), the recently developed KOOS-PF[114] seems to have better content validity, reliability, construct validity, and responsiveness.[115,116] KOOS-PF is also more feasible for clinical use due to the its ease of administration and scoring, lower number of items, and short time to complete.[116] KOOS-PF changes ranging from 16 to 17.2 are suggested to detect meaningful differences post-intervention.[116] However, only five studies included in this review

used KOOS-PF. More studies using KOOS-PF to assess self-reported function of individuals with PFP are needed to further support the recommendation for this tool instead of AKPS.

Physical performance

Performance-based measures of function can complement information from self-reported by objectively quantifying functional impairments through physical performance tests that are clinically accessible, low-cost, and time-efficient.[117,118] Our systematic review identified that individuals with PFP have impaired physical performance compared to pain-free individuals during the balance tests, FSDT, SLHT and SLTHT. These tests are easily measured in clinical settings and represent aspects of daily function or sport and simulate common pain-provoking tasks (e.g., stepping, jumping, landing).[119100,102] Given self-reported function does not fully reflect the magnitude of performance deficits, we recommend the use of performance-based measures of function in the assessment of individuals with PFP. While the balance tests and FSDT may be more useful to evaluate sedentary or lower functioning individuals due to their reduced physical demand, the SLHT may be used for athletic populations as it is more challenging. A recent review has also recommended the use of the SLHT for assessing performance deficits of youth and young adults, given its sufficient intrarater reliability, construct validity, and responsiveness.[117]

Although we observed that the performance during balance tests, FSDT, SLHT and SLTHT was impaired when compared to controls, there were no significant differences between the painful and pain-free limbs of individuals with unilateral PFP. This suggested that the functional performance of the pain-free limb may be also compromised in individuals with PFP, as recently

reported by Waiteman et al.[120] individuals with PFP have reduced physical activity, which may result in reduced bilateral lower limb muscle strength and physical performance, regardless of pain laterality.[8,121] Reduced pain-free limb performance may also be a consequence of fear-avoidance beliefs, a commonly reported trait in this population.[7,100] Caution is warranted when comparing limbs with performance-based measures of function in clinical practice as the pain-free limb of individuals with unilateral PFP may not be an accurate comparator.[122] In the absence of reference values of performance-based measures of function for individuals with PFP, we encourage pre and post bilateral assessments to aid clinicians in their decision-making processes, once changes may occur bilaterally.[123,124] Future research is needed to provide reference values from age- and sex-matched pain-free samples as the use of the contralateral limb does not seem appropriate.

Predictors of self-reported or performance-based function

We performed meta-regressions to investigate physical and non-physical factors that might explain poor self-reported and performance-based function in individuals with PFP. We observed no significant relationships between self-reported function and age, BMI, or duration of symptoms. Similarly, no significant relationship between performance-based function and age was observed. Even though previous studies have reported a direct relationship between these factors and clinical outcomes in PFP (e.g., higher BMI was related to lower functional capacity),[125,126] our findings show that they do not seem to explain differences between groups. This means that individuals with PFP have lower self-reported and performance-based function as compared to pain-free controls regardless of age, BMI, or duration of symptoms. Another reason that we did not observe significant relationships between function and these variables is

that, as commonly reported in PFP,[125] the majority of individuals from the studies included in this review had normal BMI (BMI mean [SD] PFP = 23.04 [3.58] Kg/cm²; pain-free = 22.30 [3.05] Kg/cm²) and were young adults (age mean [SD] PFP = 22.91 [6.55] years; pain-free= 23.24 [6.23] years). This results in a constrained range of age and BMI across studies and may influence the statistical analysis. Other factors such as quadriceps strength and/or kinesiophobia may be more associated with impaired self-reported or performance-based function, as previously reported.[13,127,128] Quadriceps strength and kinesiophobia are reported to be associated with pain intensity in individuals with PFP,[7,129,130] which plays an important role in the perception of disability and function. These uncontrolled factors may also be source of potential heterogeneity between the studies. More studies are needed to better understand what physical and non-physical factors might explain impaired self-reported and performance-based function in individuals with PFP. Furthermore, more longitudinal studies are necessary to investigate how function changes across the time in individuals with PFP.

We also did not observe a significant relationship between self-reported function and self-reported pain. Although surprising, a previous study[131] reported high pain variability in individuals with PFP over 10 days which explained almost 60% of the variance in self-reported function. It is important to assume that traditional methods of assessing pain (e.g. worst levels of pain in the last month or week) used in the studies included in our review may not be sensitive to pain variation and are also more susceptible to recall bias.[132] Longitudinal pain assessments of daily pain variability over a period may be better suited to investigate the relationship between self-reported pain and function in individuals with PFP than isolated pain observations.

Study Limitations

The design of studies included in the review did not allow us to infer causality of self-reported and performance-based measures of function in individuals with PFP. We did not review the gray literature; thus, relevant but unpublished studies may have been excluded from our findings. Also, the limited number of studies did not allow us to investigate whether other important physical and non-physical predictors (e.g., hip and knee strength, physical activity level, psychological factors) may be more associated with self-reported and performance-based measures of function. More studies following the REPORT-PFP guidelines will help to fill this gap in the literature.

CONCLUSIONS

Individuals with PFP have impaired self-reported and performance-based function compared to pain-free individuals. Our results also suggest a negative impact of PFP on performance-based measures of function on the pain-free limb of individuals with unilateral PFP. No physical nor non-physical factors explained impaired self-reported function in individuals with PFP. Both self-reported and performance-based measures of function should be clinically assessed when treating individuals with PFP.

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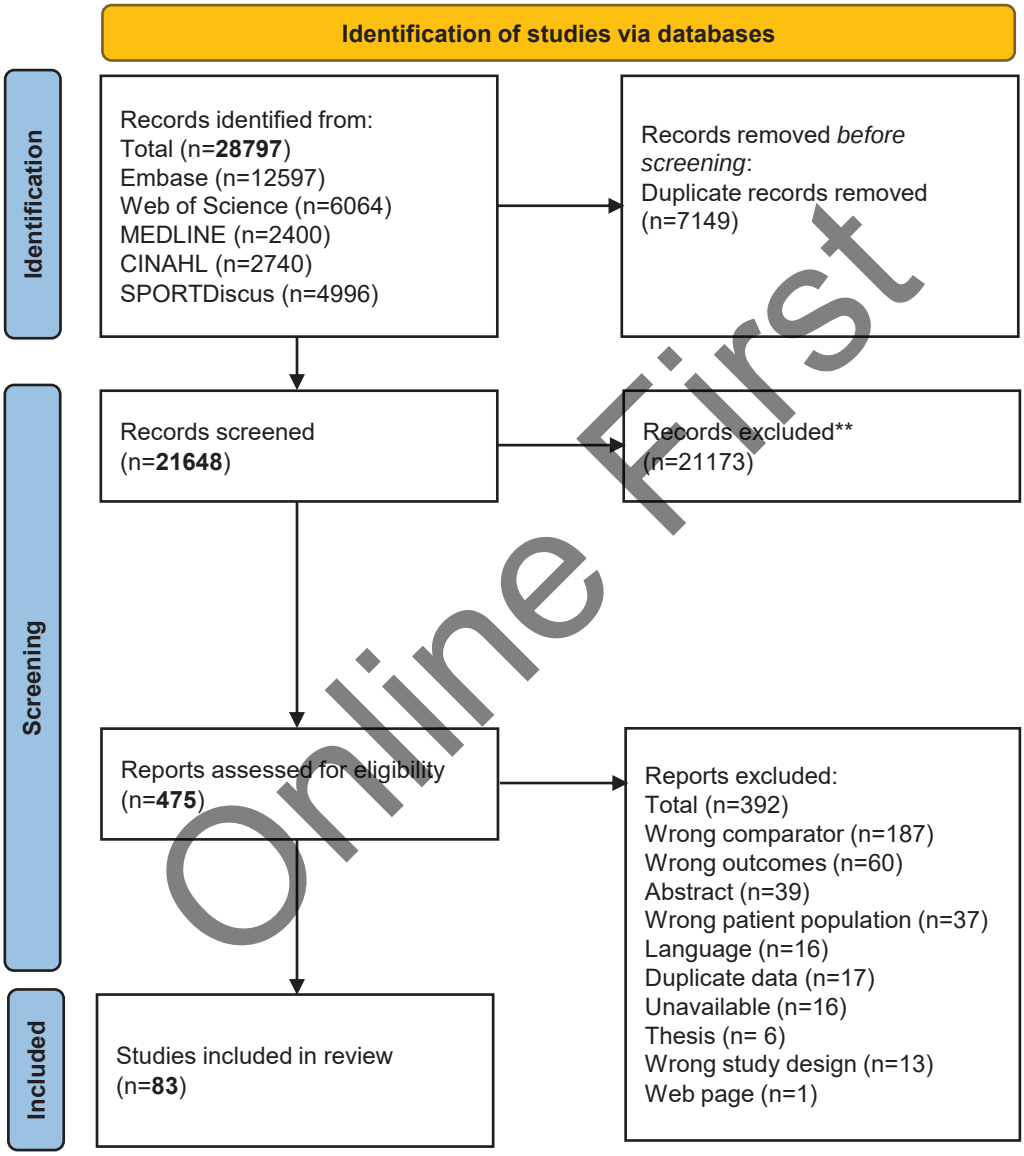
LEGENDS TO FIGURES

FIGURE 1. Flow of studies through the review.

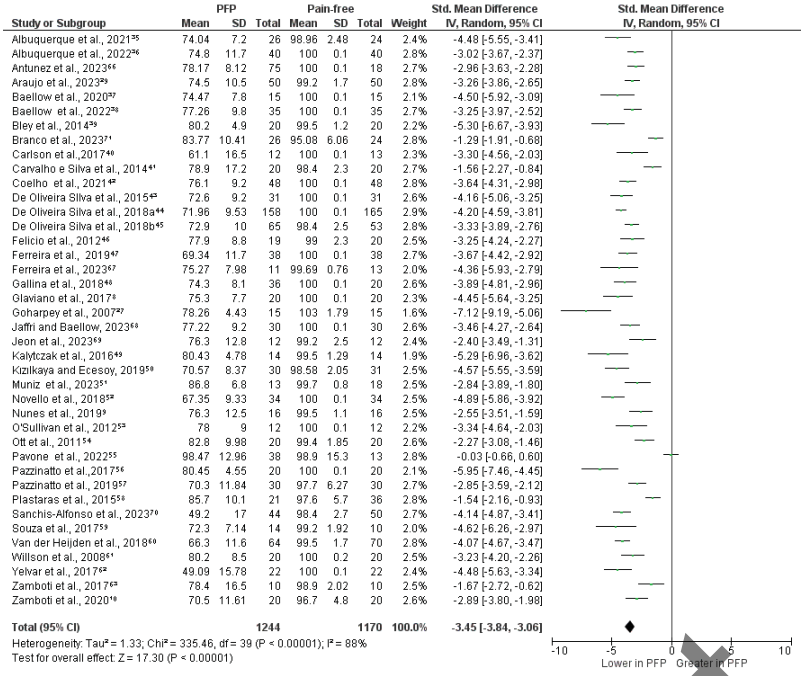
FIGURE 2. Forest plots for self-reported function meta-analyses comparing individuals with PFP and pain-free individuals.

FIGURE 3. Forest plots for performance-based measures of function meta-analyses comparing individuals with PFP and pain-free individuals.

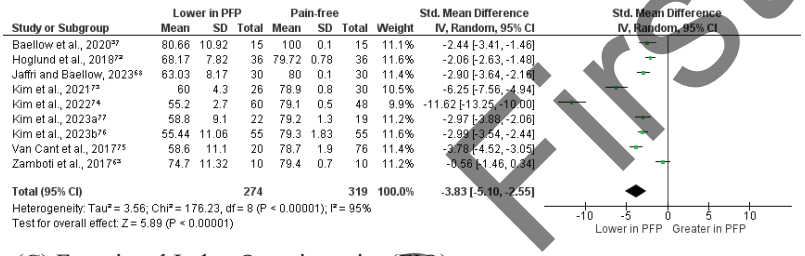
FIGURE 4. Forest plots for performance-based measures of function meta-analyses comparing PFP limb and contralateral pain-free limb of individuals with unilateral PFP.



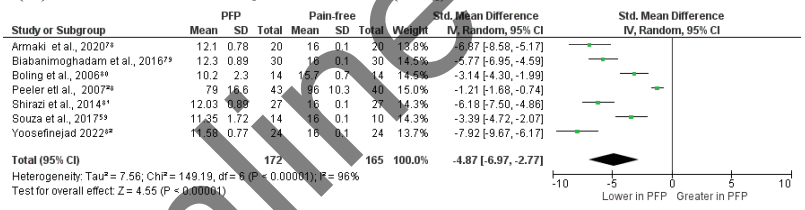
(A) Anterior Knee Pain Scale (AKPS)



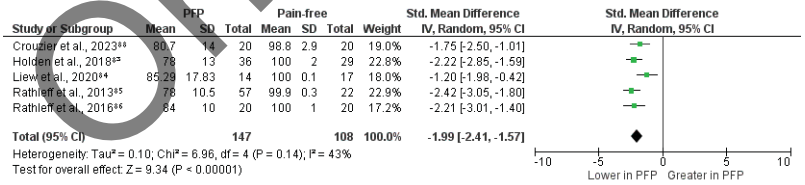
(B) Lower Extremity Functional Scale (LEFS)



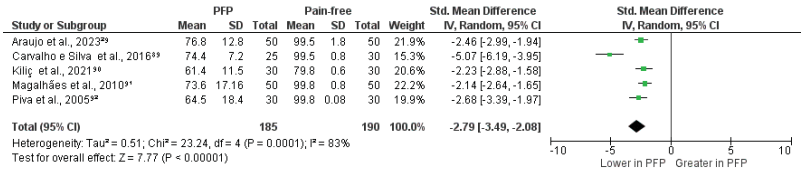
(C) Functional Index Questionnaire (FIQ)



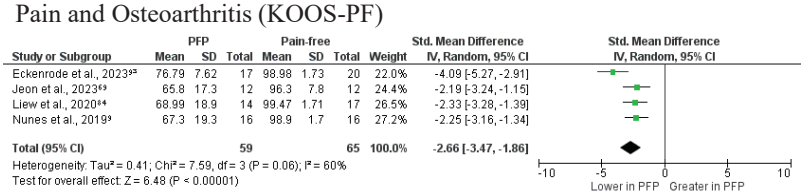
(D) Knee and Osteoarthritis Outcome Score (KOOS)



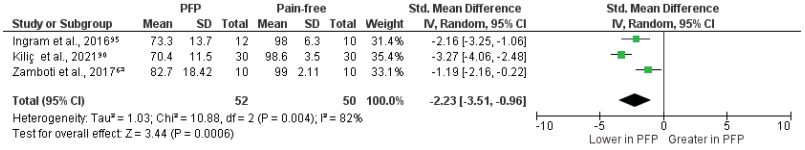
(E) Activities of Daily Living Questionnaire (ADLS)



(F) Knee Injury and Osteoarthritis Outcome Score for Patellofemoral Pain and Osteoarthritis (KOOS-PF)



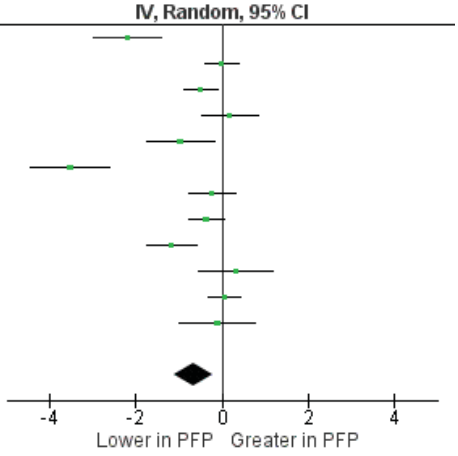
(G) Lysholm Knee Scoring Scale (Lysholm)



(A) Balance Tests

Study or Subgroup	PFP Mean	PFP SD	PFP Total	Pain-free Mean	Pain-free SD	Pain-free Total	Weight	Std. Mean Difference IV, Random, 95% CI
Aminaka and Gribble, 2008[98]	62.8	1.2	20	65.6	1.3	20	7.7%	-2.19 [-2.99, -1.39]
Araujo et al., 2023[29]	0.6	0.1	50	0.6	0.1	50	9.3%	0.00 [-0.39, 0.39]
Coelho et al., 2021[42]	58.6	6.6	48	61.7	5.9	48	9.2%	-0.49 [-0.90, -0.08]
Eckenrode et al., 2023[93]	98.68	8.34	17	97.07	8.69	20	8.3%	0.18 [-0.46, 0.83]
Goto et al., 2018[99]	66.17	4.99	14	70.84	4.39	14	7.7%	-0.96 [-1.75, -0.18]
Nafez et al., 2023[103]	64.76	3.32	26	76.42	3.18	23	7.1%	-3.52 [-4.44, -2.61]
Nakagawa et al., 2020[102]	64.19	5.2	14	65.49	5.62	121	8.7%	-0.23 [-0.79, 0.32]
Priore et al., 2019[100]	76	8	55	79	8	40	9.2%	-0.37 [-0.78, 0.04]
Shallan et al., 2023[94]	56.05	6.56	40	62.9	3.7	20	8.6%	-1.17 [-1.75, -0.59]
Song et al., 2017[101]	65.57	4.83	16	63.54	8.1	8	7.4%	0.32 [-0.53, 1.18]
Steinberg et al., 2020[104]	56.98	6.07	56	56.62	5.16	49	9.3%	0.06 [-0.32, 0.45]
Zamboti et al., 2017[63]	80.55	4.72	10	81.05	4.58	10	7.3%	-0.10 [-0.98, 0.77]
Total (95% CI)			**366**			**423**	**100.0%**	**-0.66 [-1.12, -0.19]**

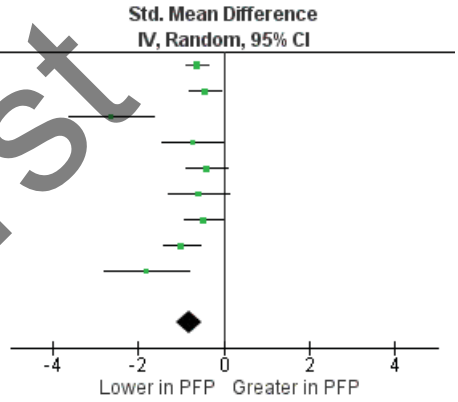
Heterogeneity: Tau² = 0.56; Chi² = 88.86, df = 11 (P < 0.00001); I² = 88%
Test for overall effect: Z = 2.78 (P = 0.005)



(B) Forward Step-Down Test (FSDT)

Study or Subgroup	Lower in PFP Mean	Lower in PFP SD	Lower in PFP Total	Pain-free Mean	Pain-free SD	Pain-free Total	Weight	Std. Mean Difference IV, Random, 95% CI
Botta et al., 2021[64]	16.76	7.12	148	21	6.07	92	16.0%	-0.63 [-0.89, -0.36]
De Oliveira Silva et al., 2018b[45]	17.7	5.6	65	20.2	6	53	14.4%	-0.43 [-0.80, -0.06]
Goharpey et al., 2007[27]	14.06	1.9	15	18.93	1.7	15	6.1%	-2.63 [-3.64, -1.62]
Loudon et al., 2002[105]	13.93	5.49	29	17.75	4.03	11	9.1%	-0.73 [-1.44, -0.01]
Naserpour et al., 2018[106]	20.84	4.23	34	22.29	2.71	34	12.6%	-0.40 [-0.88, 0.08]
Nunes et al., 2019[9]	25	5	16	28	5	16	9.2%	-0.58 [-1.29, 0.12]
Pazzinatto et al., 2023[65]	15.2	5.9	27	17.9	5.4	63	13.0%	-0.48 [-0.94, -0.03]
Priore et al., 2019[100]	18	5	55	23	5	40	13.4%	-0.99 [-1.42, -0.56]
Souza et al., 2017[59]	9.42	1.3	14	12.88	2.43	10	6.3%	-1.81 [-2.79, -0.82]
Total (95% CI)			**403**			**334**	**100.0%**	**-0.80 [-1.11, -0.50]**

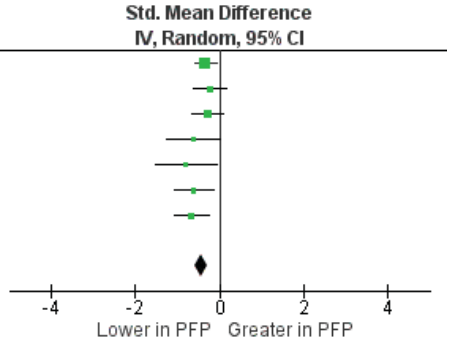
Heterogeneity: Tau² = 0.13; Chi² = 25.33, df = 8 (P = 0.001); I² = 68%
Test for overall effect: Z = 5.15 (P < 0.00001)



(C) Single Leg Hop Test (SLHT)

Study or Subgroup	PFP Mean	PFP SD	PFP Total	Pain-free Mean	Pain-free SD	Pain-free Total	Weight	Std. Mean Difference IV, Random, 95% CI
Botta et al., 2021[64]	90.06	24.76	148	98.26	23.41	92	33.8%	-0.34 [-0.60, -0.08]
Coelho et al., 2021[42]	4.2	0.9	48	4.4	0.9	48	14.4%	-0.22 [-0.62, 0.18]
De Oliveira Silva et al., 2018b[45]	88.1	19.5	65	93.5	19.5	53	17.5%	-0.28 [-0.64, 0.09]
Dos Reis et al., 2015[109]	0.96	0.11	20	1.05	0.17	20	5.7%	-0.62 [-1.25, 0.02]
Nunes et al., 2019[9]	90	29	16	113	28	16	4.4%	-0.79 [-1.51, -0.06]
Pazzinatto et al., 2023[65]	73.4	15.5	27	83.5	16.8	63	11.0%	-0.61 [-1.07, -0.15]
Priore et al., 2019[100]	84.4	16.18	55	95.81	18.14	40	13.2%	-0.66 [-1.08, -0.25]
Total (95% CI)			**379**			**332**	**100.0%**	**-0.42 [-0.57, -0.27]**

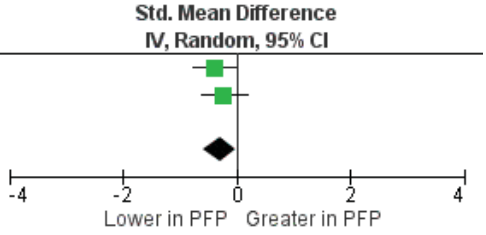
Heterogeneity: Tau² = 0.00; Chi² = 5.26, df = 6 (P = 0.51); I² = 0%
Test for overall effect: Z = 5.39 (P < 0.00001)



(D) Single Leg Triple Hop Test (SLTHT)

Study or Subgroup	PFP Mean	PFP SD	PFP Total	Pain-free Mean	Pain-free SD	Pain-free Total	Weight	Std. Mean Difference IV, Random, 95% CI
Araujo et al., 2023[29]	290.6	59.8	50	312.4	54.4	50	50.7%	-0.38 [-0.77, 0.02]
Coelho et al., 2021[42]	4.2	0.9	48	4.4	0.9	48	49.3%	-0.22 [-0.62, 0.18]
Total (95% CI)			**98**			**98**	**100.0%**	**-0.30 [-0.58, -0.02]**

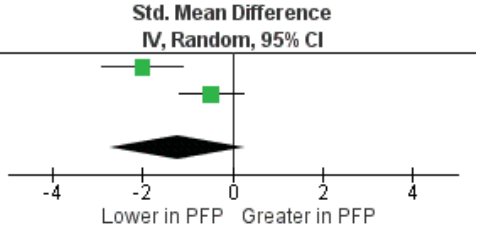
Heterogeneity: Tau² = 0.00; Chi² = 0.30, df = 1 (P = 0.58); I² = 0%
Test for overall effect: Z = 2.09 (P = 0.04)



(E) Bilateral Squat Test

Study or Subgroup	PFP Mean	PFP SD	PFP Total	Pain-free Mean	Pain-free SD	Pain-free Total	Weight	Std. Mean Difference IV, Random, 95% CI
Goharpey et al., 2007[27]	14.06	2.28	15	19.4	2.87	15	48.2%	-2.00 [-2.90, -1.11]
Loudon et al., 2002[105]	16.51	7.21	29	19.6	3.01	11	51.8%	-0.47 [-1.18, 0.23]
Total (95% CI)			**44**			**26**	**100.0%**	**-1.21 [-2.71, 0.29]**

Heterogeneity: Tau² = 1.00; Chi² = 6.90, df = 1 (P = 0.009); I² = 86%
Test for overall effect: Z = 1.59 (P = 0.11)



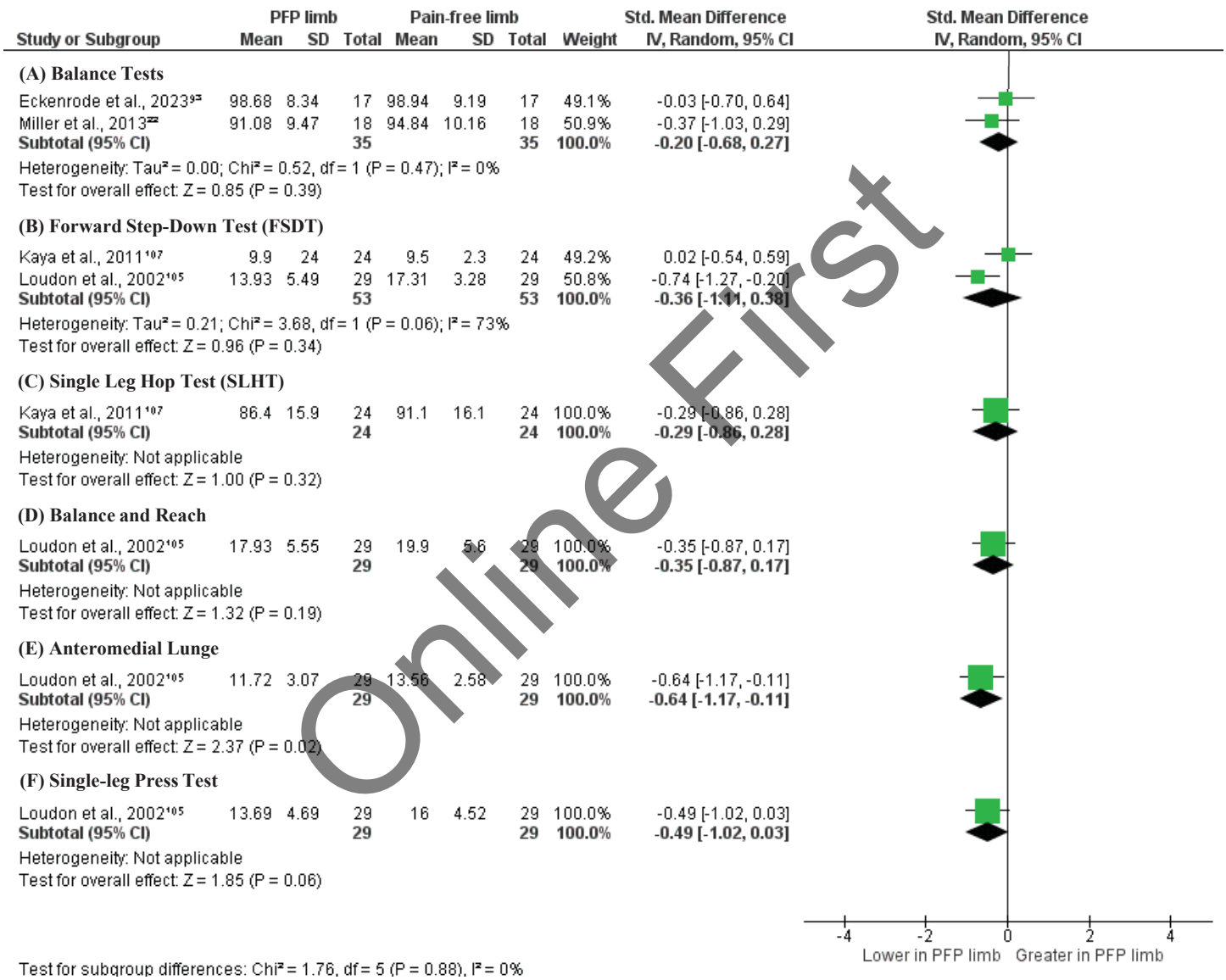


TABLE 1, Inclusion and Exclusion Criteria for Studies.

Inclusion Criteria
Design
Observational prospective or cross-sectional/case-control studies, pre-post-studies, and randomized/non-randomized clinical trials written in English, Portuguese, or Spanish.
Participants
Individuals with insidious unilateral or bilateral PFP of both genders, aged under 50 years old, without any other previous or concomitant knee or lower limb condition reported.
Comparisons
Pain-free control group or pain-free contralateral limb of individuals with unilateral PFP.
Outcomes
Self-reported function as measured by questionnaires or scales. Physical performance during clinical tests.
Exclusion Criteria
Retrospective comparative cohort studies, review papers, theses, editorials, abstracts, and letters; Studies without a comparator (pain-free group or limb).

TABLE 2, Outcome-level of Certainty of Meta-analyses (GRADE approach).

Outcomes	*Number of individuals (studies)*	*SMD (95% CI)*	*I^2*	*Downgrading domains*						*Level of certainty*
				Risk of bias[a]	*Inconsistency*[b]	*Imprecision*[c]	*Indirectness*[d]	*Publication bias*[e]	*Large effect*[f]	
Self-reported function (PFP x pain-free groups)										
AKPS	2414 (40)	-3.45 (-3.84, -3.06)	88%	-1	-1	0	NA	0	+1	Moderate
LEFS	593 (9)	-3.83 (-5.10, -2.55)	95%	-1	-1	0	NA	NA	+1	Moderate
FIQ	337 (7)	-4.87 (-6.97, -2.77)	96%	-1	-1	0	NA	NA	+1	Moderate
KOOS	255 (5)	-1.99 (-2.41, -1.57)	43%	-1	0	0	NA	NA	+1	High
ADLS	375 (5)	-2.79 (-3.49, -2.08)	83%	-1	-1	0	NA	NA	+1	Moderate
KOOS-PF	124 (4)	-2.66 (-3.47, -1.86)	60%	-1	-1	0	NA	NA	+1	Moderate
Lysholm	102 (3)	-2.23 (-3.51, -.96)	82%	-1	-1	0	NA	NA	+1	Moderate
Performance-based function (PFP x pain-free groups)										
Balance tests	789 (12)	-.66 (-1.12, -.19)	88%	-1	-1	0	NA	0	0	Low
FSDT	737 (9)	-.80 (-1.11, -.50)	68%	-1	-1	0	NA	NA	+1	Moderate
SLHT	711 (7)	-.42 (-.57, -.27)	0%	-1	0	0	NA	NA	0	Moderate
SLTHT	196 (2)	-.30 (-.58, -.02)	0%	-1	0	0	NA	NA	0	Moderate
Bilateral squat test	70 (2)	-1.21 (-2.71, -.29)	86%	-1	-1	0	NA	NA	+1	Moderate
Performance-based function (painful limb x contralateral pain-free limb)										
Balance tests	70 (2)	-.20 (-.68; .27)	0%	-1	0	-1	NA	NA	0	Low
FSDT	106 (2)	-.36 (-1.11, .38)	72%	-1	-1	-1	NA	NA	0	Very Low

Downgrading domains:

[a]The domain was downgraded 1 level when >25% of the participants from studies judged as having one-half or majority of domains with high risk of bias in the assessment tool.

[b]The domain was downgraded 1 level when I^2 >50%.

[c]The domain was downgraded 1 level when difference of the effect on the patient would differ depending on use of the upper vs lower boundary of the confidence interval.

[d]As our inclusion and exclusion criteria were rigorous and only studies with populations and outcomes that exactly fit the review question were included, this domain was not applied.

[e]The domain was downgraded 1 level when p<.05 in the Egger's regression test.

Upgrading domain:

[f]Large effect: The domain was upgraded 1 level when pooled results had large effects (≥ .80).

Abbreviations: ADLS = Activities of Daily Living Questionnaire; AKPS = Anterior Knee Pain Scale; CI = Confidence Interval; FIQ = Functional Index Questionnaire; FSDT = Forward Step-Down Test; KOOS = Knee and Osteoarthritis Outcome Score; LEFS = Lower Extremity Functional Scale; Lysholm = Lysholm Knee Scoring Scale; SLHT = Single Leg Hop Test; SLTHT = Single Leg Triple Hop Test; SMD = Standardized mean differences.

SUPPLEMENTAL MATERIAL A

Protocol deviations

This review forms part of a larger systematic review aiming to comprehensively investigate measures of function in individuals with PFP. While the results of this manuscript intend to focus on identifying impairments in self-reported and performance-based function in individuals with PFP and factors that may explain them, future publications will focus on understanding the effectiveness of documented interventions on these outcomes.

We initially planned to use The Risk of Bias Assessment tool for Non-Randomized Studies (RoBANS). After discussion and searches in the literature we observed that this tool is not commonly used among systematic reviews published in high quality journals. Thus, we decided to use a new approach reported by recent studies[21] that conducted a domain-based evaluation using a modified Downs and Black checklist, further described in the "Methodological quality assessment and risk of bias" section of the manuscript. Since there is no Cochrane-endorsed tool available for evaluating the risk of bias in observational non-experimental studies, this effort was undertaken to align our methods as closely as possible with the other Cochrane assessment of risk of bias tools proposed for assessing risk of bias in other study designs.

We did not plan a priori to perform meta-regressions. However, given the available data included in the present systematic review, we decided to include these analyses in order to investigate physical and non-physical factors that might explain impaired self-reported and performance-based function in individuals with PFP.

SUPPLEMENTAL MATERIAL B

Search Strategy

MEDLINE

1. Patellofemoral pain syndrome/
2. Anterior Knee Pain.af.
3. Patellofemoral pain.af.
4. ((Patellofemoral or patello-femoral or anterior) adj2 (pain)).af.
5. ((patella$ or femoro-patella$ or femoropatella$ or retro-patella$ or retropatella$ or peripatella$) *adj2* (pain or syndrome or dysfunction)).af.
6. ((chondromalac* or chondropath* or chondrosis) adj3 (patella$ or femoro-patella$ or femoropatella$ or retro-patella$ or retropatella$)).af.
7. 1 or 2 or 3 or 4 or 5 or 6
8. Physical Functional/
9. Function.af.
10. Knee function.af.
11. ((Function*) adj2 (status or outcome$ or measure*)).af.
12. ((Function*) adj3 (scale$ or scor* or index or system)).af.
13. ((“self-report*” or “self report*” or subjective or objective) and (function*)).af.
14. ((patient report$ or patient-report$) adj2 (function*)).af.
15. ((function* or physic*) adj2 (performance)).af.
16. ((physic*) adj2 (function* or dysfunction*)).af.

17. Dysfunction.af.
18. ((function* or physic*) adj2 (impairment$ or deficit* or limitation$ or impair* or alteration$)).af.
19. Patient Reported Outcome Measures/
20. ((Questionnaire) adj3 (function*)).af.
21. ((Anterior knee pain scale) or (AKPS) or (Kujala scale)).af.
22. ((Knee injury and Osteoarthritis Outcome Score) or (KOOS)).af.
23. ((Knee injury and Osteoarthritis Outcome Score patellofemoral subscale) or (KOOS-PF)).af.
24. ((Knee Outcome Survey-Activities of Daily Living Scale) or (KOS-ADLS)).af.
25. ((International Knee Documentation Committee 2000 Subjective Knee Evaluation Form) or (IKDC)).af.
26. ((Functional Index Questionnaire) or (FIQ)).af.
27. ((Lower Limb Function Index) or (LLFI)).af.
28. ((Lower Extremity Function Scale) or (LEFS)).af.
29. ((Western Ontario and McMaster Universities Osteoarthritis Index) or (WOMAC)).af.
30. ((Cincinnati Knee Rating Scale) or (CKRS)).af.
31. (Subjective Knee Evaluation Form).af.
32. ((Functional) adj2 (test$ or task$ or performanc*)).af.
33. ((clinic* or performanc*) adj2 (test$)).af.
34. Step Test/
35. (("step-down" or "stepdown" or "step down") and (test$)).af.
36. ((Squat*) adj3 (test$)).af.
37. ((hop* or jump*) adj2 (test$ or distance)).af.

38. ((star excursion balance test) or (SEBT)).af.

39. ((balance or "dynamic balance") adj2 (test$)).af.

40. ((Stair) adj2 (ascen* or descen* or negotiation or climb*)).af.

41. (("single-leg* chair") and (test$)).af.

42. ((sit*) adj2 (task*)).af.

43. ((endurance or sorens?n or plank) adj2 (test$)).af.

44. 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18

45. 19 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 43

46. 44 or 45

47. 7 and 46

Embase

1. Patellofemoral pain syndrome
2. Anterior Knee Pain
3. Patellofemoral pain
4. ((Patellofemoral or patello-femoral or anterior) AND (pain))
5. ((patell* or femoropatella$ or (femoro and patella$) or (retro AND patella$) or retropatella$ or peripatella$) AND (pain or syndrome or dysfunction))
6. ((chondromalac* or chondropath* or chondrosis) AND (patella$ or (femoro AND patella$) or femoropatella$ or retro-patella$ or retropatella$))
7. 1 or 2 or 3 or 4 or 5 or 6
8. Physical Functional/

9. Function
10. Knee function
11. ((Function*) AND (status or outcome$ or measure*))
12. ((Function*) AND (scale$ or scor* or index or system))
13. ((self report* or (self AND report*) or subjective or objective) AND (function*))
14. ((patient report$ or (patient AND report$)) AND (function*))
15. ((function* or physic*) AND (performance))
16. ((physic*) AND (function* or dysfunction*))
17. Dysfunction
18. ((function* or physic*) AND (impairment$ or deficit* or limitation$ or impair* or alteration$))
19. Patient Reported Outcome Measures
20. ((Questionnaire) AND (function*))
21. ((Anterior knee pain scale) or (AKPS) or (Kujala scale))
22. ((Knee injury and Osteoarthritis Outcome Score) or (KOOS))
23. ((Knee injury and Osteoarthritis Outcome Score patellofemoral subscale) or (KOOS-PF))
24. ((Knee Outcome Survey-Activities of Daily Living Scale) or (KOS-ADLS))
25. ((International Knee Documentation Committee 2000 Subjective Knee Evaluation Form) or (IKDC))
26. ((Functional Index Questionnaire) or (FIQ))
27. ((Lower Limb Function Index) or (LLFI))
28. ((Lower Extremity Function Scale) or (LEFS))
29. ((Western Ontario and McMaster Universities Osteoarthritis Index) or (WOMAC))

30. ((Cincinnati Knee Rating Scale) or (CKRS))

31. (Subjective Knee Evaluation Form)

32. ((Functional) AND (test$ or task$ or performanc*))

33. ((clinic* or performanc*) AND (test$))

34. Step Test

35. (("step-down" or "stepdown" or "step down") and (test$))

36. ((Squat*) AND (test$))

37. ((hop* or jump*) AND (test$ or distance))

38. ((star excursion balance test) or (SEBT))

39. ((balance or "dynamic balance") adj2 (test$))

40. ((Stair) adj2 (ascen* or descen* or negotiation or climb*))

41. (("single AND leg* chair") and (test$))

42. ((sit*) AND (task*))

43. ((endurance or sorens?n or plank) AND (test$))

44. 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18

45. 19 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 43

46. 44 or 45

47. 7 and 46

CINAHL

1. TX “Patellofemoral pain syndrome”
2. TX “Anterior Knee Pain”

3. TX “Patellofemoral pain”
4. TX ((Patellofemoral OR patello-femoral OR anterior) N2 (pain))
5. TX ((patella$ OR femoro-patella$ OR femoropatella$ OR retro-patella$ OR retropatella$ OR peripatella$) N2 (pain OR syndrome OR dysfunction))
6. TX ((chondromalac* OR chondropath* OR chondrosis) N3 (patella$ OR femoro-patella$ OR femoropatella$ OR retro-patella$ OR retropatella$))
7. 7. S1 OR S2 OR S3 OR S4 OR S5 OR S6
8. TX “Physical Functional”
9. TX “Function”
10. TX “Knee function”
11. TX ((Functional) N2 (status OR outcome$ OR measure*))
12. TX ((Function*) N3 (scale$ OR scor* OR index OR system))
13. TX ((“self-report*” OR “self reported” OR subjective OR objective) AND (function*))
14. TX ((patient report$ OR patient-report$) AND (function*))
15. TX ((function* OR physic*) N2 (performance))
16. TX ((physic*) N2 (function* OR dysfunction*))
17. TX “Dysfunction”
18. TX ((function* OR physic*) N2 (impairment$ OR deficit* OR limitation$ OR impair* OR alteration$))
19. 19. S8 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18
20. TX “Patient Reported Outcome Measures”
21. TX ((Questionnaire) N3 (function*))

22. TX ((Anterior knee pain scale) OR (AKPS) OR (Kujala scale))
23. TX ((Knee injury and Osteoarthritis Outcome Score) OR (KOOS))
24. TX ((patellofemoral pain and osteoarthritis subscale of the Knee injury and Osteoarthritis Outcome Score) OR (KOOS-PF))
25. TX ((Knee Outcome Survey-Activities of Daily Living Scale) or (KOS-ADLS))
26. TX ((International Knee Documentation Committee 2000 Subjective Knee Evaluation Form) OR (IKDC))
27. TX ((Functional Index Questionnaire) OR (FIQ))
28. TX ((Lower Limb Function Index) OR (LLFI))
29. TX ((Lower Extremity Function Scale) OR (LEFS))
30. TX ((Western Ontario and McMaster Universities Osteoarthritis Index) OR (WOMAC))
31. TX ((Cincinnati Knee Rating Scale) OR (CKRS))
32. TX “Subjective Knee Evaluation Form”
33. TX ((Functional) AND (test$ OR task$ or performanc*))
34. TX ((clinic* OR performanc*) N2 (test$))
35. TX “Step Test”
36. TX ((“step-down” OR “stepdown” OR "step down") AND (test$))
37. TX ((Squat*) N3 (test$))
38. TX ((hop* OR jump*) N2 (test$ OR distance))
39. TX ((star excursion balance test) OR (SEBT))
40. TX ((balance OR “dynamic balance”) N2 (test$))
41. TX ((Stair$) N2 (ascen* OR descen* OR negotiation OR climb*))
42. TX (("single-leg* chair") AND (test$))

43. TX ((sit*) N2 (task$))

44. TX ((endurance OR sorens?n or plank) N2 (test$))

45. 45. S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR 43 OR 44

46. 46. S19 OR S45

47. 47. S7 AND S46

Web of Science

#1. TS=(Patellofemoral pain syndrome)

#2. TS=(Anterior knee pain)

#3. ALL=((patella$ OR femoro-patella$ OR femoropatella$ OR retropatella$ OR retro-patella$ OR peripatella$) AND (pain OR syndrome))

#4. ALL=((chondro* OR chondrop*) AND (patella$ OR femoropatella$ OR retropatella$))

5#01 OR #02 OR #03 OR #04

#6. TS=(Physical Functional Performance)

#7. ALL=((Function* OR physic*) AND (scale OR scor* OR or status OR outcome$ OR measure*)

#8. TS=((subjective OR self-report* OR self-rate* or patient*) AND (function*))

#9. TS=((function* OR physic*) AND (impairment$ OR deficit* OR limitation$ OR alteration$))

#10. TS=(Patient Reported Outcome Measures)

#11. ALL=(Anterior knee pain scale OR AKPS OR Kujala scale)

#12. ALL=(Knee injury and Osteoarthritis Outcome Score OR KOOS)

#13.ALL=(KOOSPF OR knee injury and osteoarthritis outcome score patellofemoral subscale)

#14.ALL=(International Knee Documentation Committee 2000 Subjective Knee Evaluation Form OR IKDC)

#15. ALL=(Lower Limb Function Index OR LLFI)

#16. ALL=(Lower Extremity Function Scale OR LEFS)

#17.ALL=(Western Ontario and McMaster Universities Osteoarthritis Index OR WOMAC)

#18. ALL=(Cincinnati Knee Rating Scale OR CKRS)

#19. TS=((function* OR clinic*) AND (test* OR task*))

#20. ALL=((step OR “step-down” OR “stepdown”) AND (test$))

#21. ALL=((hop* OR jump*) AND (test$ OR distance))

#22. ALL=((balance* OR "dynamic-balance") AND (test*))

#23. ALL=((Stair) AND (ascen* OR descen* OR negotiation or climb*))

#24. ALL=((sit*) AND (task$))

#25. ALL=((endurance OR sorens?n OR plank) AND (test$))

#26. ALL=((Squat*) AND (test$))

#06 OR #07 OR #08 OR #09

#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26

#27 OR #28

#05 AND #29

SPORTDiscus

1. TX “Patellofemoral pain syndrome”
2. TX “Anterior Knee Pain”
3. TX “Patellofemoral pain”
4. TX ((Patellofemoral OR patello-femoral OR anterior) N2 (pain))
5. TX ((patella$ OR femoro-patella$ OR femoropatella$ OR retro-patella$ OR retropatella$ OR peripatella$) N2 (pain OR syndrome OR dysfunction))
6. TX ((chondromalac* OR chondropath* OR chondrosis) N3 (patella$ OR femoro-patella$ OR femoropatella$ OR retro-patella$ OR retropatella$))
7. S1 OR S2 OR S3 OR S4 OR S5 OR S6
8. TX “Physical Functional”
9. TX “Function”
10. TX “Knee function”
11. TX ((Functional) N2 (status OR outcome$ OR measure*))
12. TX ((Function*) N3 (scale$ OR scor* OR index OR system))
13. TX ((“self-report*” OR “self reported” OR subjective OR objective) AND (function*))
14. TX ((patient report$ OR patient-report$) AND (function*))
15. TX ((function* OR physic*) N2 (performance))
16. TX ((physic*) N2 (function* OR dysfunction*))
17. TX “Dysfunction”
18. TX ((function* OR physic*) N2 (impairment$ OR deficit* OR limitation$ OR impair* OR alteration$))
19. S8 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S18
20. TX “Patient Reported Outcome Measures”

21. TX ((Questionnaire) N3 (function*))
22. TX ((Anterior knee pain scale) OR (AKPS) OR (Kujala scale))
23. TX ((Knee injury and Osteoarthritis Outcome Score) OR (KOOS))
24. TX ((patellofemoral pain and osteoarthritis subscale of the Knee injury and Osteoarthritis Outcome Score) OR (KOOS-PF))
25. TX ((Knee Outcome Survey-Activities of Daily Living Scale) or (KOS-ADLS))
26. TX ((International Knee Documentation Committee 2000 Subjective Knee Evaluation Form) OR (IKDC))
27. TX ((Functional Index Questionnaire) OR (FIQ))
28. TX ((Lower Limb Function Index) OR (LLFI))
29. TX ((Lower Extremity Function Scale) OR (LEFS))
30. TX ((Western Ontario and McMaster Universities Osteoarthritis Index) OR (WOMAC))
31. TX ((Cincinnati Knee Rating Scale) OR (CKRS))
32. TX “Subjective Knee Evaluation Form”
33. TX ((Functional) AND (test$ OR task$ or performanc*))
34. TX ((clinic* OR performanc*) N2 (test$))
35. TX “Step Test”
36. TX ((“step-down” OR “stepdown” OR "step down") AND (test$))
37. TX ((Squat*) N3 (test$))
38. TX ((hop* OR jump*) N2 (test$ OR distance))
39. TX ((star excursion balance test) OR (SEBT))
40. TX ((balance OR “dynamic balance”) N2 (test$))
41. TX ((Stair$) N2 (ascen* OR descen* OR negotiation OR climb*))

42. TX (("single-leg* chair") AND (test$))

43. TX ((sit*) N2 (task$))

44. TX ((endurance OR sorens?n or plank) N2 (test$))

45. S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR 43 OR 44

46. S19 OR S45

47. S7 AND S46

SUPPLEMENTAL MATERIAL C

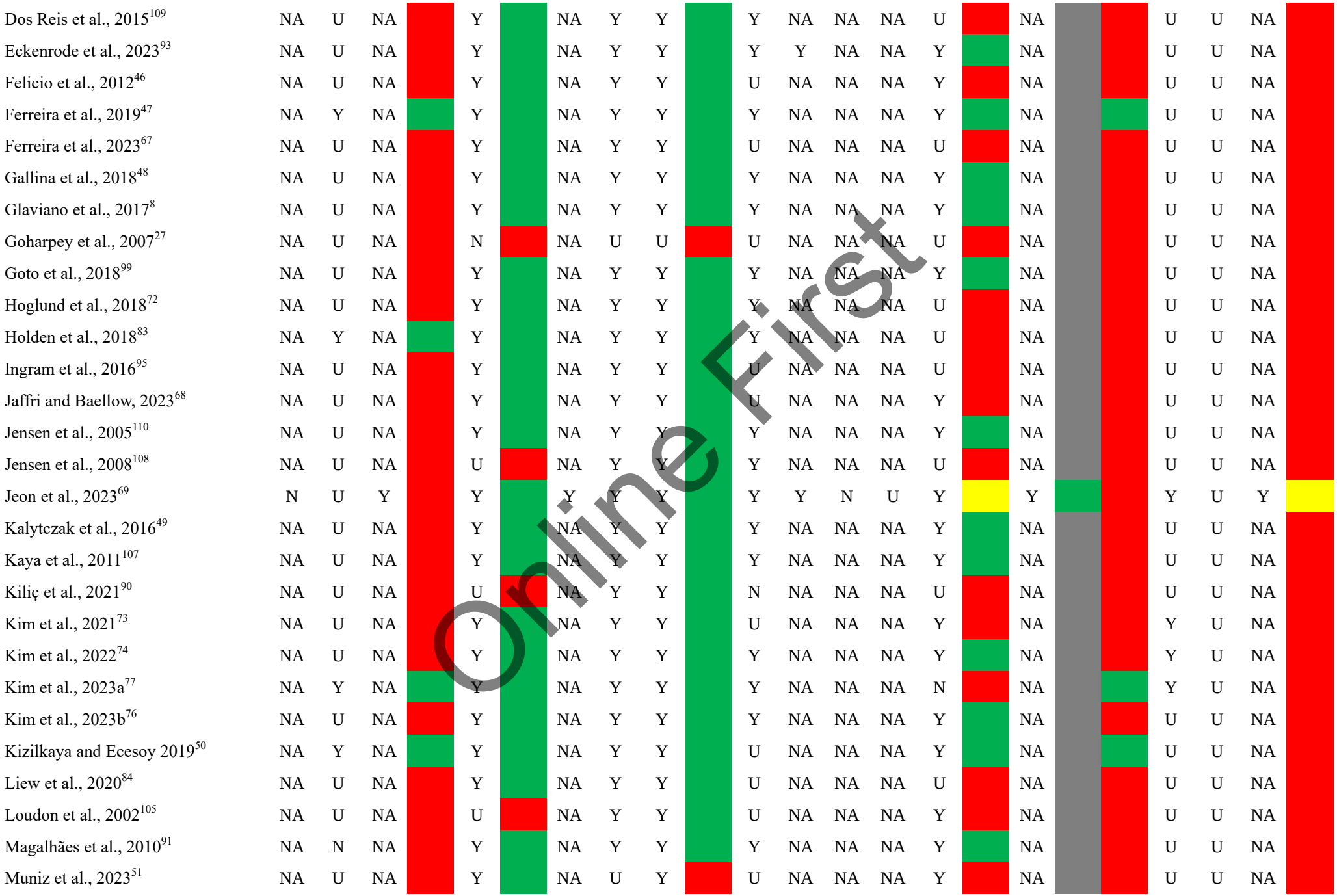
Data extraction management

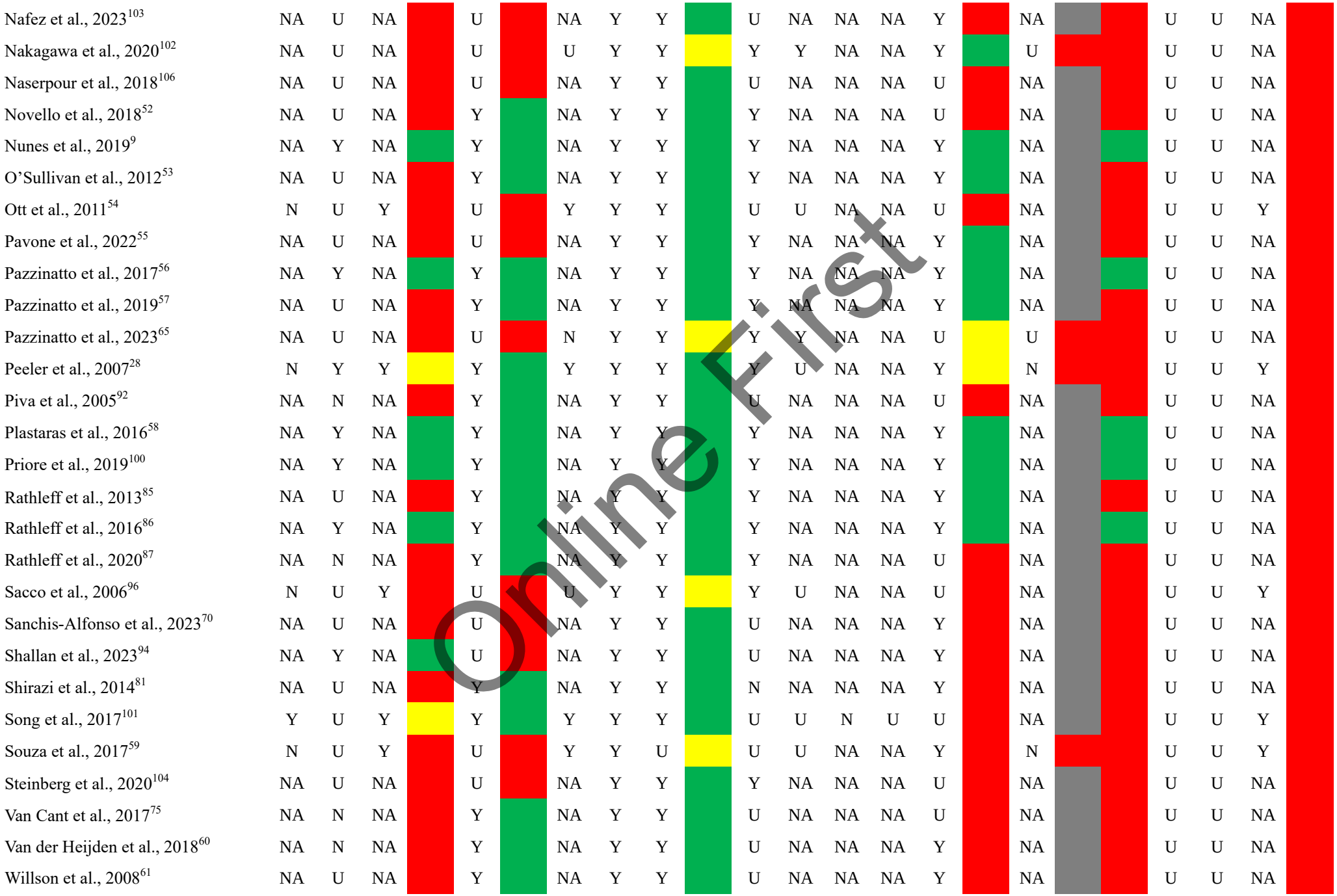
When a study reported multiple self-reported and performance-based measures of function, we extracted all of them. When studies had repeated measures, we extracted only baseline values. For balance tests, we extracted anterior reached distances, except for two studies[22,93] that did not present this data, thus the composite reach score was used instead. When studies reported PFP or pain-free subgroups (e.g. women and men with PFP), we merged the mean and standard deviation (SD) of subgroups using Review Manager 5.4 (The Cochrane Collaboration, Copenhagen, Denmark) calculator. We also calculated the grouped mean (SD) of all studies which reported age and body mass index (BMI) using Review Manager 5.4 (The Cochrane Collaboration, Copenhagen, Denmark). To enable the analysis in the Review Manager 5.4 (The Cochrane Collaboration, Copenhagen, Denmark), we had to use a correction of 0.1 on all SD values reported as zero. The Knee Injury and Osteoarthritis Outcome Score [KOOS] comprises multiple domains, but we only considered the activity domain for extraction, which is most representative of function.

SUPPLEMENTAL MATERIAL D

Internal and external validity of the studies assessed with the modified Downs and Black Checklist

	Internal Validity																		External validity			
	Performance bias				*Reporting bias*		*Detection bias*				*Selection bias*						*Attrition bias*					
Study / Items[a]	**14**	**15**	**19**	**All**	**16**	**All**	**17**	**18**	**20**	**All**	**21**	**22**	**23**	**24**	**25**	**All**	**26**	**All**	**All[b]**	**11**	**12**	**13**	**All[c]**
Albuquerque et al., 2021[35]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Albuquerque et al., 2022[36]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Aliberti et al., 2010[97]	NA	U	NA		Y		NA	Y	Y		U	NA	NA	NA	Y		NA			U	U	NA	
Aminaka et al., 2008[98]	Y	N	Y		Y		Y	Y	Y		Y	U	N	U	Y		NA			U	U	Y	
Antunez et al., 2023[66]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Araujo et al., 2023[29]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Armaki et al., 2020[78]	NA	U	NA		Y		NA	Y	Y		N	NA	NA	NA	Y		NA			U	U	NA	
Baellow et al., 2020[37]	NA	U	NA		Y		NA	Y	Y		U	NA	NA	NA	U		NA			U	U	NA	
Baellow et al., 2022[38]	NA	U	NA		Y		NA	Y	Y		U	NA	NA	NA	Y		NA			U	U	NA	
Biabanimoghadam et al., 2016[79]	NA	U	NA		Y		NA	Y	Y		N	NA	NA	NA	Y		NA			U	U	NA	
Bley et al., 2014[39]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Boling et al., 2006[80]	N	U	Y		U		Y	Y	Y		Y	U	NA	NA	Y		NA			U	U	Y	
Botta et al., 2021[64]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Branco et al., 2023[71]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Carlson et al., 2017[40]	NA	U	NA		Y		NA	Y	Y		N	NA	NA	NA	Y		NA			U	U	NA	
Carvalho e Silva et al., 2014[41]	NA	Y	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Carvalho e Silva et al., 2016[89]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Coelho et al., 2021[42]	NA	Y	NA		U		NA	Y	Y		U	NA	NA	NA	Y		NA			Y	U	NA	
Crouzier et al., 2023[88]	NA	Y	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
De Oliveira Silva et al., 2015[43]	NA	Y	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
De Oliveira Silva et al., 2018a[44]	NA	Y	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
De Oliveira Silva et al., 2018b[45]	NA	Y	NA		Y		NA	Y	Y		Y	NA	NA	NA	U		NA			U	U	NA	





Yelvar et al., 2017[62]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	Y		NA			U	U	NA	
Yoosefinejad et al., 2022[82]	NA	U	NA		Y		NA	Y	Y		N	NA	NA	NA	Y		NA			U	U	NA	
Zamboti et al., 2017[63]	NA	U	NA		Y		NA	Y	Y		Y	NA	NA	NA	U		NA			U	U	NA	
Zamboti et al., 2021[10]	NA	U	NA		Y		NA	Y	Y		U	NA	NA	NA	U		NA			U	U	NA	

Legend

Y	Yes	Not applicable domains	[b]Overall internal validity
N	No	Low study quality	[c]Overall external validity
U	Unable to determine	Moderate study quality	
NA	Not applicable	High study quality	

Domain classification = If all applicable items are scored as 'YES' then the domain is rated as high quality. If majority of the applicable items are scored as 'YES' and one item is scored as 'NO/UNABLE TO DETERMINE' then the domain is rated as moderate quality. If one-half or majority of the applicable items are scored as 'NO/UNABLE TO DETERMINE' then the domain is rated as low quality.
Internal validity = If multiple domains are rated as moderate quality, or at least one domain rated as low quality then internal validity is rated as low quality. If one domain rated as moderate quality and other domains rated as high quality, then internal validity is rated as moderate quality. If all domains are rated as high quality, then internal validity is rated as high quality.
External validity = If all applicable items are scored as 'YES' then external validity is rated as high quality. If majority of the applicable items are scored as "YES" and one item is scored as 'NO/UNABLE TO DETERMINE' then external validity is rated as moderate quality. If one-half or majority of the applicable items are scored as 'NO/UNABLE TO DETERMINE' then external validity is rated as low quality.

[a]Items description:
Item 14 = Was an attempt made to blind study subjects to the intervention they have received?
Item 15 = Was an attempt made to blind those measuring the main outcomes of the intervention?
Item 19 = Was compliance with the intervention/s reliable?
Item 16 = If any of the results of the study were based on "data dredging", was this made clear?
Item 17 = In trials and cohort studies, do the analyses adjust for different lengths of follow-up, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?
Item 18 = Were the statistical tests used to assess the main outcomes appropriate?
Item 20 = Were the main outcome measures used accurate (valid and reliable)?
Item 21 = Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?
Item 22 = Were study subjects in different intervention groups or were they recruited over the same period of time?
Item 23 = Were study subjects randomised to intervention groups?
Item 24 = Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?
Item 25 = Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?
Item 26 = Were losses of patients to follow-up taken into account?
Item 11 = Were the subjects asked to participate in the study representative of the entire population from which they were recruited?
Item 12 = Were those subjects who were prepared to participate representative of the entire population from which they were recruited?
Item 13 = Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?

Study quality of the studies assessed with Physiotherapy Evidence Database (PEDro) Scale	
Criteria / Study	Miller et al., 2013[22]
1. Eligibility criteria were specified	1
2. Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	1
3. Allocation was concealed	0
4. The groups were similar at baseline regarding the most important prognostic indicators	1
5. There was blinding of all subjects	0
6. There was blinding of all therapists who administered the therapy	0
7. There was blinding of all assessors who measured at least one key outcome	1
8. Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	1
9. All subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	0
10. The results of between-group statistical comparisons are reported for at least one key outcome	1
11. The study provides both point measures and measures of variability for at least one key outcome	1
Total[a]	6/10

[a]The criteria 1 does not contribute to total score.

Risk of bias of the studies assessed with The Cochrane Risk of Bias for Randomized Trials 2 (RoB2)

Study		Miller et al., 2013[22]
Domain 1. Randomization process	1.1 Was the allocation sequence random?	Y
	1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	NI
	Note for 1.1&1.2	
	1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?	PY
	Note for 1.3	
	1.0 Algorithm result	High
	1.0 Assessor's Judgement	High
	1.0 General note	
	1.0 Optional Question	
	1.0 Note for optional question	
Domain 2. Deviations from intended interventions	2.1 Were participants aware of their assigned intervention during the trial?	PY
	2.2 Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	PY
	Note for 2.1&2.2	
	2.3 If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	NI
	Note for 2.3	
	2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA
	Note for 2.4	
	2.5 If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA
	Note for 2.5	
	2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	N
	Note for 2.6	
	2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NI
	Note for 2.7	
	2.0 Algorithm result	High
	2.0 Assessor's Judgement	High

	2.0 General Notes	
	2.0 Optional Question	
	2.0 Note for optional question	
Domain 3. Mising outcome data	3.1 Were data for this outcome available for all, or nearly all, participants randomized?	PY
	Note for 3.1	
	3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	NA
	Note for 3.2	
	3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	NA
	Note for 3.3&3.4	
	3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA
	Note for 3.4 (not use)	
	3.0 Algorithm result	Low
	3.0 Assessor's judgement	Low
	3.0 Gerenal notes	
	3.0 Optional Question	
	3.0 Note for optional question	
Domain 4. Measurement of the outcome	4.1 Was the method of measuring the outcome inappropriate?	N
	Note for 4.1	
	4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	PN
	Note for 4.2	
	4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	N
	Note for 4.3	
	4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	NA
	Note for 4.4&4.5	
	4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA
	Note for 4.5 (not use)	
	4.0 Algorithm result	Low
	4.0 Assessor's Judgement	Low

	4.0 General note	
	4.0 Optional Question	
	4.0 Note for optional question	
Domain 5. Selection of the reported result	5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	NI
	Note for 5.1	
	5.2 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	N
	Note for 5.2	
	5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results,multiple eligible analyses of the data?	N
	Note for 5.3	
	5.0 Algorithm result	Some concerns
	5.0 Assessor's Judgement	Some concerns
	5.0 General note	
	5.0 Optional Question	
	5.0 Note for optional question	
Domain 6. Overall Bias	Algorithm's overall Judgement	High
	Assessor's overall Judgement	High
	6.0 General Note	
	6.0 Optional Question	
	6.0 Note for optional question	

Legend

Y	Yes	N	No
PY	Probably yes	PN	Probably no
NI	No information		

Overall risk of bias judgment:
Low risk of bias: The trial is judged to be at low risk of bias for all domains for this result.
Some concerns: The trial is judged to raise some concerns in at least one domain for this result, but not to be at high risk of bias for any domain.
High risk of bias: The trial is judged to be at high risk of bias in at least one domain for this result. Or the trial is judged to have some concerns for multiple domains in a way that substantially lowers confidence in the result.

SUPPLEMENTAL MATERIAL E

TABLE E1, Studies excluded after full-text screening, with reasons for exclusion

Study	Reason
Abrahams et al., 2003	Wrong comparator: no pain-free group/limb data available.
Ageberg and Cronström, 2018	Wrong patient population: inclusion of participants with hip, knee, or foot injuries.
Aghakeshizadeh et al., 2021	Wrong comparator: no pain-free group/limb data available.
Akbas et al., 2011	Wrong patient population: participants aged ≥50 years.
Akkurt et al., 2010	Wrong outcomes: no function outcomes were assessed.
AlAbbad., 2014	Thesis.
Albornoz-Cabello et al., 2020	Wrong patient population: participants aged ≥50 years.
Albuquerque et. al., 2022	Wrong comparator: no pain-free group/limb data available.
Alexander et al., 2021	Wrong comparator: no pain-free group/limb data available.
Aliberti et al., 2012	Duplicate data: Aliberti et al., 2010.[97]
Alrayani et al., 2023	Wrong outcomes: no function outcomes were assessed.
Alshaharania et al., 2019	Wrong comparator: no pain-free group/limb data available.
Aminaka et al., 2011	Abstract.
Araujo et al., 2016	Wrong comparator: no pain-free group/limb data available.
Argut et al., 2017	Abstract.
Arrebola et al., 2020	Wrong comparator: no pain-free group/limb data available.
Ashraf et al., 2017	Language.
Assa et al., 2013	Wrong study design: retrospective study.
Avraham et al., 2007	Wrong comparator: no pain-free group/limb data available.
Aytar et al., 2011	Wrong outcomes: no function outcomes were assessed.
Bagheri et al., 2017	Language.
Bagheri et al., 2021	Wrong comparator: no pain-free group/limb data available.
Baldon et al., 2012	Wrong patient population: inclusion of pain-free participants only.
Baldon et al., 2014	Wrong comparator: no pain-free group/limb data available.
Balci et al., 2009	Wrong comparator: no pain-free group/limb data available.
Bartholomew et al., 2019	Wrong outcomes: no function outcomes were assessed.
Barton et al., 2011a	Wrong outcomes: no function outcomes were assessed.

Barton et al., 2011b	Wrong comparator: no pain-free group/limb data available.
Barton et al., 2018	Abstract.
BayrakciTunay et al., 2008	Language.
Begum et al., 2020	Wrong comparator: no pain-free group/limb data available.
Behrangrad and Kamali, 2017	Wrong comparator: no pain-free group/limb data available.
Behrangrad et al., 2020	Wrong comparator: no pain-free group/limb data available.
Bhagat et al., 2014	Wrong outcomes: no function outcomes were assessed.
Bily et al., 2008	Wrong comparator: no pain-free group/limb data available.
Bolgla et al., 2016	Wrong comparator: no pain-free group/limb data available.
Bolgla et al., 2023	Wrong outcomes: no function outcomes were assessed.
BoluluÇubukçu et al., 2004	Full text not available.
Bomtempo et al., 2020	Abstract.
Bonacci et al., 2018	Wrong comparator: no pain-free group/limb data available.
Borges et al., 2022	Abstract.
Botanlioglu, et al., 2019	Wrong patient population: participants aged ≥50 years.
Botta et al., 2023a	Duplicate data: Botta et al., 2021.[64]
Botta et al., 2023b	Wrong study design: study's protocol only.
Branco et. al., 2022	Wrong patient population: inconclusive diagnosis of PFP.
Branco et. al., 2023	Wrong patient population: inconclusive diagnosis of PFP.
Brantingham et al., 2009	Wrong comparator: no pain-free group/limb data available.
Briani et al., 2017	Wrong outcomes: no function outcomes were assessed.
Briani et. al., 2021	Duplicate data: De Oliveira Silva et al., 2018.[44]
Cabral et al., 2007	Wrong comparator: no pain-free group/limb data available.
Çağiran, 2018	Language.
Callaghan et al., 2001a	Wrong study design: erratum.
Callaghan et al., 2001b	Wrong comparator: no pain-free group/limb data available.
Callaghan et al., 2004	Wrong comparator: no pain-free group/limb data available.
Campolo et al., 2013	Wrong comparator: no pain-free group/limb data available.
Can et al., 2003	Wrong patient population: participants aged ≥50 years.
Carlson et al., 2016	Abstract.
Carlson et al., 2017	Wrong patient population: participants aged ≥50 years.

Carry et al., 2017	Wrong comparator: no pain-free group/limb data available.
Carvalho e Silva et al., 2013	Abstract.
Celik et al., 2020	Wrong patient population: participants aged ≥50 years.
Chen et al., 2015	Wrong patient population: participants aged ≥50 years.
Chen et al., 2020	Abstract.
Chevidikunnan et al., 2016	Wrong comparator: no pain-free group/limb data available.
Chhabra et al., 2016	Wrong outcomes: no function outcomes were assessed.
Chiu et al., 2012	Wrong comparator: no pain-free group/limb data available.
Chivate et al., 2019	Wrong patient population: participants diagnosed with “swimmers’ knee”.
Cho et al., 2023	Wrong outcomes: no function outcomes were assessed.
Cibulka et al., 2023	Wrong patient population: only one mixed group with PFP and pain-free participants.
Clark et al., 2000	Wrong comparator: no pain-free group/limb data available.
Collins et al., 2008	Wrong comparator: no pain-free group/limb data available.
Collins et al., 2009	Wrong comparator: no pain-free group/limb data available.
Collins et al., 2010	Wrong comparator: no pain-free group/limb data available.
Collins et al., 2013	Wrong comparator: no pain-free group/limb data available.
Collins et al., 2016	Wrong comparator: no pain-free group/limb data available.
Corkery et al., 2016	Abstract.
Corkery et. al., 2022	Abstract
Corum et al., 2018	Wrong comparator: no pain-free group/limb data available.
Cowan et al., 2002	Wrong comparator: no pain-free group/limb data available.
Crossley et al., 2002	Wrong comparator: no pain-free group/limb data available.
Crossley et al., 2005	Wrong comparator: no pain-free group/limb data available.
Darós et al., 2023	Wrong outcomes: no function outcomes were assessed.
DeFontenay et al., 2018	Wrong comparator: no pain-free group/limb data available.
Demange et al., 2017	Abstract.
Demirci et al., 2017	Wrong comparator: no pain-free group/limb data available.
Denton et al., 2005	Wrong patient population: participants aged ≥50 years.
Devitt, 2000	Wrong study design: clinical commentary.
Dey et al., 2016	Wrong outcomes: no function outcomes were assessed.
Diekfuss et al., 2022	Wrong comparator: no pain-free group/limb data available.

Dogan et al., 2022	Wrong outcomes: no function outcomes were assessed.
Dolak et al., 2011a	Wrong study design: erratum.
Dolak et al., 2011b	Wrong comparator: no pain-free group/limb data available.
Doozan et al., 2021	Wrong outcomes: no function outcomes were assessed.
Drew et al., 2017	Wrong comparator: no pain-free group/limb data available.
Duffey et al., 2000	Wrong outcomes: no function outcomes were assessed.
Dursun et al., 2001	Wrong comparator: no pain-free group/limb data available.
Earl-Boehm et al., 2018	Wrong comparator: no pain-free group/limb data available.
Earl, 2002	Thesis.
Eijkenboom et al., 2018	Wrong study design: retrospective study.
Eijkenboom et al., 2021	Abstract.
Emamvirdi et al., 2019	Wrong comparator: no pain-free group/limb data available.
Emamvirdi et al., 2023	Wrong outcomes: no function outcomes were assessed.
Erdoganoglu et al., 2020	Wrong patient population: participants aged ≥50 years.
Erel et al., 2011	Language.
Ernst et al., 1999	Wrong outcomes: no function outcomes were assessed.
Esculier et al., 2018a	Wrong comparator: no pain-free group/limb data available.
Esculier et al., 2018b	Wrong comparator: no pain-free group/limb data available.
Esfandiarpour et al., 2018	Wrong comparator: no pain-free group/limb data available.
Espí-López et al., 2017	Wrong comparator: no pain-free group/limb data available.
Evcik et al., 2010	Wrong patient population: participants aged ≥50 years.
Felicio et al., 2011	Abstract.
Ferber et al., 2015	Wrong comparator: no pain-free group/limb data available.
Ferrari et al., 2018	Duplicate data: De Oliveira Silva et al., 2018.[44]
Ferreira et al., 2019	Duplicate data: Ferreira et al., 2019.[47]
Ferreira et. al., 2022	Abstract.
Ferreira et al., 2023	Wrong outcomes: no function outcomes were assessed.
Fick et. al., 2022	Wrong comparator: no pain-free group/limb data available.
Foroughi et al., 2019	Wrong comparator: no pain-free group/limb data available.
Foss et al., 2014	Wrong comparator: no pain-free group/limb data available.
Fox et. al., 2021	Wrong outcomes: no function outcomes were assessed.

Freddolini et al., 2017	Wrong outcomes: no function outcomes were assessed.
Freedman et al., 2014a	Wrong comparator: no pain-free group/limb data available.
Freedman et al., 2014b	Wrong comparator: no pain-free group/limb data available.
Froehling, 1996.	Thesis.
Fukuda et al., 2010	Wrong comparator: no pain-free group/limb data available.
Fukuda et al., 2012	Wrong comparator: no pain-free group/limb data available.
Galloway and Ernst, 1997	Abstract.
Garcia-Bermejo et al., 2020	Wrong patient population: inclusion of participants with other knee conditions.
Gavish et al., 2020	Abstract.
Ghasemi and Dehghan, 2015	Wrong comparator: no pain-free group/limb data available.
Ghourbanpour et al., 2018	Wrong comparator: no pain-free group/limb data available.
Giles et al., 2015	Wrong comparator: no pain-free group/limb data available.
Glaviano et al., 2016a	Wrong comparator: no pain-free group/limb data available.
Glaviano et al., 2016b	Wrong comparator: no pain-free group/limb data available.
Glaviano et al., 2019	Wrong comparator: no pain-free group/limb data available.
Glaviano et al., 2020	Wrong comparator: no pain-free group/limb data available.
Glaviano and Kim, 2023	Wrong comparator: no pain-free group/limb data available.
Golpayegani et al., 2017	Language.
Gornoski et al., 2014	Wrong comparator: no pain-free group/limb data available.
Grassia, 2012	Web page.
Greenwald et al., 1996	Wrong outcomes: no function outcomes were assessed.
Grindstaff et al., 2012	Wrong comparator: no pain-free group/limb data available.
Gümüsay et al., 2018	Abstract.
Günay et al., 2017	Wrong comparator: no pain-free group/limb data available.
Güney et al., 2014	Abstract.
Haghighat et al., 2021a	Wrong outcomes: no function outcomes were assessed.
Haghighat et al., 2021b	Wrong outcomes: no function outcomes were assessed.
Halabchi et al., 2015	Wrong comparator: no pain-free group/limb data available.
Hamada et al., 2017	Wrong comparator: no pain-free group/limb data available.
Hamstra-Wright et al., 2017	Wrong comparator: no pain-free group/limb data available.
Hanafy, 2016	Wrong comparator: no pain-free group/limb data available.

Harrison et al., 1995	Full text not available.
Harrison et al., 1999	Full text not available.
Hart, 2010	Wrong study design: clinical commentary.
Hart et al., 2018	Abstract.
Hart et al., 2019	Wrong comparator: no pain-free group/limb data available.
Hassan et al., 2022	Wrong outcomes: no function outcomes were assessed.
Hassan et al., 2023	Wrong outcomes: no function outcomes were assessed.
Havigh et al., 2023	Wrong comparator: no pain-free group/limb data available.
Herbert, 2001	Full text not available.
Herbst et al., 2014	Abstract.
Herrington and Al-Shehri, 2006	Abstract.
Herrington and Al-Shehri, 2007	Wrong comparator: no pain-free group/limb data available.
Herrington, 2014	Wrong outcomes: no function outcomes were assessed.
Ho et al., 2020	Wrong comparator: no pain-free group/limb data available.
Ho et al., 2021	Wrong outcomes: no function outcomes were assessed.
Hott et al., 2019	Wrong comparator: no pain-free group/limb data available.
Hott et al., 2020a	Wrong comparator: no pain-free group/limb data available.
Hott et al., 2020b	Wrong comparator: no pain-free group/limb data available.
Hunter et al., 2007	Wrong patient population: participants aged ≥50 years.
Iammarrone et al., 2016	Wrong comparator: no pain-free group/limb data available.
Ibrahim et al., 2014	Wrong outcomes: no function outcomes were assessed.
Ismail et al., 2013	Wrong comparator: no pain-free group/limb data available.
Jeon et al., 2022	Wrong outcomes: only post intervention function outcomes data were presented.
Jotkowitz and Garcia, 2009	Abstract.
Kalytczak et al., 2018	Duplicate data: Kalytczak et al., 2016.[49]
Kannus et al., 1992	Wrong comparator: no pain-free group/limb data available.
Kannus et al., 1999	Abstract.
Karakas and Kurucolak, 2018	Abstract.
Karakuş et al., 2013	Abstract.
Karakus et al., 2014	Language.
Kaya et al., 2010	Language.

Kaya et al., 2013	Wrong comparator: no pain-free group/limb data available.
Kaya et al., 2018a	Wrong comparator: no pain-free group/limb data available.
Kaya et al., 2018b	Wrong comparator: no pain-free group/limb data available.
Keays et al., 2016	Wrong comparator: no pain-free group/limb data available.
Kedroff et al., 2019	Wrong comparator: no pain-free group/limb data available.
Keshmarzi et al., 2018	Language.
Kettunen et al., 2007	Wrong comparator: no pain-free group/limb data available.
Kettunen et al., 2012	Wrong comparator: no pain-free group/limb data available.
Khayambashi et al., 2012	Wrong comparator: no pain-free group/limb data available.
Khayambashi et al., 2014	Wrong comparator: no pain-free group/limb data available.
Khojaste 2016 et al., 2016	Wrong comparator: no pain-free group/limb data available.
Kim et al., 2016	Wrong patient population: participants aged ≥50 years.
Kim et. al., 2022a	Wrong outcomes: no function outcomes were assessed.
Kim et. al., 2022b	Duplicate data: Kim et al., 2022.[74]
Kim et. al., 2022c	Duplicate data: Kim et al., 2022.[74]
Kotteeswaran et al., 2017	Full text not available.
Kumar et al., 2013	Wrong comparator: no pain-free group/limb data available.
Kumar et al., 2015	Wrong comparator: no pain-free group/limb data available.
Kurt et al., 2016	Wrong comparator: no pain-free group/limb data available.
Kuru et al., 2012	Language.
Kwon et al., 2014	Wrong outcomes: missing descriptive data of function outcomes.
Lack et al., 2019	Wrong comparator: no pain-free group/limb data available.
Lankhorst et al., 2015	Wrong comparator: no pain-free group/limb data available.
Leal et al., 2020	Wrong comparator: no pain-free group/limb data available.
LeãoAlmeida et al., 2016	Wrong comparator: no pain-free group/limb data available.
Lee et al., 2013	Wrong outcomes: no function outcomes were assessed.
Lee et al., 2021	Wrong comparator: no pain-free group/limb data available.
Lim et al., 2020	Wrong comparator: no pain-free group/limb data available.
Lin et al., 2014	Wrong outcomes: no function outcomes were assessed.
Liporaci et al., 2013	Wrong outcomes: missing descriptive data of function outcomes.
Lobo et al., 2018	Wrong outcomes: missing descriptive data of function outcomes.

LopesFerreira et al., 2019	Wrong outcomes: no function outcomes were assessed.
Loudon et al., 2004	Wrong comparator: no pain-free group/limb data available.
Lucareli et al., 2014	Abstract.
Lun et al., 2005	Wrong patient population: participants aged ≥50 years.
Luz et al., 2022	Wrong comparator: no pain-free group/limb data available.
Ma et al., 2020	Wrong comparator: no pain-free group/limb data available.
Machado et al., 2011	Full text not available.
Macintyre, 2005	Wrong study design: clinical commentary
Maclachlan et al., 2018a	Abstract.
Maclachlan et al., 2018b	Wrong comparator: no pain-free group/limb data available.
Maclachlan et al., 2020	Wrong comparator: no pain-free group/limb data available.
Malmir et al., 2022	Wrong outcomes: no function outcomes were assessed.
Martinez-Valdes et al., 2019	Abstract.
Martins et al., 2022	Wrong outcomes: no function outcomes were assessed.
Maryam et al., 2018	Wrong comparator: no pain-free group/limb data available.
Mascal et al., 2003	Wrong study design: case report
Mason et al., 2016	Wrong comparator: no pain-free group/limb data available.
Mazloum and Rahnama, 2014	Language.
McGuine et al., 2014	Wrong comparator: no pain-free group or limb to compare, only preinjury outcomes.
Mckenzie et al., 2010	Wrong outcomes: no function outcomes were assessed.
McMoreland et al., 2011	Wrong comparator: no pain-free group/limb data available.
Melo et al., 2020	Wrong comparator: no pain-free group/limb data available.
Merrick, 2000	Wrong study design: clinical commentary.
Messier et al., 1991	Wrong outcomes: no function outcomes were assessed.
Mickevicius et al., 2018	Wrong patient population: inclusion of participants with other knee conditions were included.
Mills et al., 2012	Wrong comparator: no pain-free group/limb data available.
Milovanović et al., 2023	Wrong outcomes: no function outcomes were assessed.
Mobarra et al., 2016	Language.
Mokhtarinia et al., 2008	Wrong outcomes: no function outcomes were assessed.
Molgaard et al., 2018	Wrong patient population: participants aged ≥50 years.
Möller, 2015	Language.

Monika et al., 2016	Wrong comparator: no pain-free group/limb data available.
Morita et al., 2023a	Wrong comparator: no pain-free group/limb data available.
Morita et al., 2023b	Wrong outcomes: no function outcomes were assessed.
Mostafaee et. al., 2022	Wrong outcomes: no function outcomes were assessed.
Motealleh et al., 2016	Wrong comparator: no pain-free group/limb data available.
Motealleh et al., 2019	Wrong comparator: function outcomes of pain-free limb were not presented.
Motealleh et al., 2020	Wrong comparator: no pain-free group/limb data available.
Moyano et al., 2013	Wrong comparator: no pain-free group/limb data available.
Muniz et al., 2023	Duplicate data: Muniz et al., 2023[51]
Naidu and Kage, 2018	Wrong comparator: no pain-free group/limb data available.
Nakagawa et al., 2011	Wrong comparator: no pain-free group/limb data available.
Nakhostin-Roohi et al., 2016	Wrong comparator: no pain-free group/limb data available.
Naslund et al., 2002	Wrong comparator: no pain-free group/limb data available.
Naslund et al., 2006	Wrong outcomes: no function outcomes were assessed.
Nazary-Moghadam et al., 2021	Wrong comparator: no pain-free group/limb data available.
Negahban et al., 2013	Wrong comparator: no pain-free group/limb data available.
Nijs et al., 2006	Wrong patient population: participants with other knee conditions were included in the control group.
Noehren, 2009	Thesis.
Noehren et al., 2016	Wrong comparator: no pain-free group/limb data available.
Nouri et al., 2019	Wrong comparator: no pain-free group/limb data available.
Novello et al., 2016	Abstract.
Nunes et al., 2019a	Wrong comparator: no pain-free group/limb data available.
Nunes et al., 2019b	Duplicate data: Nunes et al., 2019.[9]
Ojaghi et al., 2015	Wrong comparator: no pain-free group/limb data available.
Omidi et al., 2017	Abstract.
Ophey et al., 2023	Wrong comparator: no pain-free group/limb data available.
Orakifar et al., 2023	Full text not available.
Örsçelik and Yildiz, 2015	Wrong comparator: no pain-free group/limb data available.
Örsçelik et al., 2020	Wrong patient population: participants aged ≥50 years.
Østera˚s, 2011	Abstract.
Østera˚s et al., 2013a	Wrong comparator: no pain-free group/limb data available.

Østera˚s et al., 2013b	Wrong comparator: no pain-free group/limb data available.
Otsuki et al., NA	Full text not available.
Pacini et al., 2023	Wrong patient population: participants aged ≥50 years.
Pearce, 2003	Thesis.
Petersen et al., 2014	Wrong study design: study's protocol only.
Petersen et al., 2016	Wrong comparator: no pain-free group/limb data available.
Pompeo et. al., 2021	Wrong comparator: no pain-free group/limb data available.
Pompeo et. al., 2022	Wrong outcomes: no function outcomes were assessed.
Powers et al., 1997	Wrong comparator: no pain-free group/limb data available.
Powers et al., 2008	Wrong comparator: no pain-free group/limb data available.
Priore et al., 2019	Wrong comparator: no pain-free group/limb data available.
Qu et al., 2016	Wrong patient population: participants aged ≥50 years.
Rabelo et al., 2017	Wrong comparator: no pain-free group/limb data available.
Ramazzina et al., 2016	Wrong comparator: no pain-free group/limb data available.
Rangole et al., 2015	Wrong patient population: participants aged ≥50 years.
Rasti et al., 2020	Wrong comparator: no pain-free group/limb data available.
Rathleff et al., 2013a	Duplicate data: Rathleff et al., 2013.[85]
Rathleff et al., 2013b	Duplicate data: Rathleff et al., 2013.[85]
Rathleff et al., 2015	Wrong comparator: no pain-free group/limb data available.
Rathleff et al., 2016	Duplicate data: Rathleff et al., 2013.[85]
Rathleff et al., 2018	Wrong comparator: no pain-free group/limb data available.
Rathleff et. al., 2022	Wrong comparator: no pain-free group/limb data available.
Razeghi et al., 2010	Wrong comparator: no pain-free group/limb data available.
Rehman et al., 2020	Wrong comparator: no pain-free group/limb data available.
Rhode et al., 2021	Wrong comparator: no pain-free group/limb data available.
Richards et al., 2015a	Abstract.
Richards et al., 2015b	Abstract.
Riel et al., 2018	Wrong comparator: no pain-free group/limb data available.
Rio et al., 2016	Wrong outcomes: no function outcomes were assessed.
Rodrigues et al., 2021	Wrong comparator: no pain-free group/limb data available.
Rodrigues et al., 2022	Wrong comparator: no pain-free group/limb data available.

Roush et al., 2012	Wrong comparator: no pain-free group/limb data available.
Roush et al., 2000	Wrong comparator: no pain-free group/limb data available.
Rowlands and Brantingham, 1999	Full text not available.
Saad et al., 2018	Wrong comparator: no pain-free group/limb data available.
Sacco et al., 2006	Duplicate data: Sacco et al., 2006.[96]
SafarCherati et al., 2016	Wrong patient population: inconclusive diagnosis of PFP.
Şahin et al., 2016	Wrong comparator: no pain-free group/limb data available.
Sanchez et al., 2017	Wrong comparator: no pain-free group/limb data available.
Sanchis-Alfonso et al., 2023	Wrong outcomes: no function outcomes were assessed.
Santos et al., 2019	Wrong comparator: no pain-free group/limb data available.
Saroja and Vigneshkumar, 2013	Full text not available.
Schmidt et al., 2019	Wrong comparator: no pain-free group/limb data available.
Seeley et al., 2021	Wrong comparator: no pain-free group/limb data available.
Selhorst et al., 2015	Wrong comparator: no pain-free group/limb data available.
Selhorst et al., 2018	Wrong comparator: no pain-free group/limb data available.
Selhorst et. al., 2020	Wrong comparator: no pain-free group/limb data available.
Selkowitz et al., 2022	Wrong outcomes: no function outcomes were assessed.
Selkowitz et al., 2024	Wrong outcomes: no function outcomes were assessed.
Shafique et al., 2017	Wrong outcomes: missing descriptive data of function outcomes.
Shakeri et al., 2019	Wrong patient population: participants aged ≥50 years.
Sharif et al., 2020	Wrong comparator: no pain-free group/limb data available.
Shen et al., 2021	Wrong comparator: no pain-free group/limb data available.
Sherrard et al., 2010	Abstract.
Shetty et al., 2016	Wrong comparator: no pain-free group/limb data available.
Sherwood-Wallace et al., 2016	Abstract.
Shi et al., 2021	Wrong outcomes: no function outcomes were assessed.
Shiravi et al., 2008	Full text not available.
Shroff and Panhale, 2016	Wrong comparator: no pain-free group/limb data available.
Silva et al., 2017	Abstract.
Sinclair et al., 2018	Wrong comparator: no pain-free group/limb data available.
Singer et al., 2011	Wrong comparator: no pain-free group/limb data available.

Sobhani et al., 2017	Language.
Song et al., 2009	Wrong patient population: participants aged ≥50 years.
Song et al., 2015	Wrong comparator: no pain-free group/limb data available.
SportEX Medicine, 2014	Wrong study design: Commentary in an on-line magazine.
Stakes et al., 2006	Full text not available.
Steinberg et al., 2020	Wrong comparator: no pain-free group/limb data available.
Steinberg et al., 2023	Wrong outcomes: no function outcomes were assessed.
Stiene et al., 1996	Wrong comparator: no pain-free group/limb data available.
Sutlive et al., 2018	Wrong comparator: no pain-free group/limb data available.
Swanson, 2009	Thesis.
Syed et al., 2018	Wrong comparator: no pain-free group/limb data available.
Syme et al., 2009	Wrong comparator: no pain-free group/limb data available.
Tadeu et al., 2019	Abstract.
Tadeu et al., 2023	Abstract.
Talbot et al., 2020	Wrong comparator: no pain-free group/limb data available.
Tavares et al., 2011	Wrong patient population: participants aged ≥50 years.
Taylor and Brantingham, 2003	Full text not available.
Telles et al., 2016a	Abstract.
Telles et al., 2016b	Wrong patient population: participants aged ≥50 years.
Thomee, 1997	Wrong comparator: no pain-free group/limb data available.
Timm, 1998	Wrong comparator: no pain-free group/limb data available.
Thompson et al., 2020	Wrong patient population: participants aged ≥50 years.
Trejo-Chavez et al., 2023	Wrong outcomes: no function outcomes were assessed.
Tunay et al., 2003	Full text not available.
Uboldi et al., 2018	Wrong comparator: no pain-free group/limb data available.
VandenDolder and Roberts, 2006	Wrong patient population: participants aged ≥50 years.
VanderHeijden et al., 2016	Wrong comparator: no pain-free group/limb data available.
Van Linschoten et al., 2009	Wrong comparator: no pain-free group/limb data available.
Vasconcelos et al., 2022	Wrong outcomes: no function outcomes were assessed.
Vicenzino et al., 2008	Wrong study design: study's protocol only.
Waiteman et al., 2021	Wrong outcomes: no function outcomes were assessed.

Werner and Eriksson, 1993	Wrong comparator: no pain-free group/limb data available.
Whittingham et al., 2004	Wrong comparator: no pain-free group/limb data available.
Wiener-Ogilvie and Jones 2004	Wrong patient population: participants aged ≥50 years.
Willson and Davis, 2009	Duplicate data: Willson et al., 2008.[61]
Willson and Davis, 2008a	Duplicate data: Willson et al., 2008. [61]
Willson and Davis, 2008b	Duplicate data: Willson et al., 2008. [61]
Witvrouw et al., 2000	Wrong comparator: no pain-free group/limb data available.
Witvrouw et al., 2004	Wrong comparator: no pain-free group/limb data available.
Worrell et al., 1998	Full text not available.
Xiong et al., 2021	Wrong outcomes: no function outcomes were assessed.
Yanez-Alvarez et al., 2020	Wrong patient population: participants aged ≥50 years.
Yang et al., 2022	Wrong outcomes: no function outcomes were assessed.
Yelvar et al., 2015	Language.
Yilmaz et al., 2011	Full text not available.
Yosmaoglu et al., 2013	Wrong comparator: no pain-free group/limb data available.
Yosmaoglu et al., 2020	Wrong comparator: no pain-free group/limb data available.
Yuen et al., 2023	Wrong outcomes: no function outcomes were assessed.
Zago et al., 2021	Wrong comparator: no pain-free group/limb data available.
Zahednejad et al., 2017	Language.
Zarei et al., 2019	Wrong comparator: no pain-free group/limb data available.
Zeinalzadeh et al., 2018	Wrong comparator: no pain-free group/limb data available.
Zemadanis et al., 2015	Wrong comparator: no pain-free group/limb data available.
Zhu et al., 2009	Wrong patient population: participants aged ≥50 years.
Zuk et al., 2023	Wrong outcomes: no function outcomes were assessed.

Abbreviations: Patellofemoral Pain.

SUPPLEMENTAL MATERIAL F

TABLE F1, Summary of included studies.

Study	Participants		Measures of function (unit of measures)	Results summary	Design
Albuquerque et al., 2021[35]	**PFP group = 26** M/F = 0/26 Age = 23.64 ± 3.96 years Body mass = 61.24 ± 12.28 Kg Height = 1.63 ± .05 m BMI = 23.03 ± 4.09 Kg/cm² Duration of symptoms = 54.15 ± 48.92 months.	**Control group = 24** M/F = 0/24 Age = 22.5 ± 3.79 years Body mass = 59.8 ± 8.62 Kg Height = 1.63 ± .02 m BMI = 22.61 ± 3.43 Kg/cm².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Albuquerque et al., 2022[36]	**PFP group = 40** M/F = 0/40 Age = 21 ± 2 years Body mass = 62.4 ± 9.2 Kg Height = 1.64 ± .07 m BMI = 23.3 ± 3.5 Kg/cm² Duration of symptoms = NA.	**Control group = 40** M/F = 0/40 Age = 21 ± 2 years Body mass = 62.6 ± 9.6 Kg Height = 1.67 ± .07 m BMI = 22.5 ± 3.1 Kg/cm².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Aliberti et al., 2010[97]	**PFP group = 30** M/F = 4/26 Age = 30 ± 7 years Body mass = 63 ± 11 Kg Height = 165 ± 9 cm BMI = NA Duration of symptoms = 4 ± 3 years.	**Control group = 44** M/F = 5/39 Age = 30 ± 8 years Body mass = 60 ± 11 Kg Height = 165 ± 8 cm BMI = NA.	Lysholm (0-100 score).	Not compared.	Cross-sectional/Case control.
Aminaka et al., 2008[98]	**PFP group = 20** M/F = 12/8 Age = 20.3 ± 1.87 years Body mass = 71.57 ± 14.04 Kg Height = 170.1 ± 10.17 cm BMI = NA Duration of symptoms = NA.	**Control group = 20** M/F = 12/8 Age = 21.25 ± 2.67 years Body mass = 70.91 ± 11.41 Kg Height = 172.08 ± 8.76 cm BMI = NA.	SEBT ([reach distance/ leg length] x 100).	Reduced reached distance in the SEBT in individuals with PFP.	Pre-post intervention.

Antunez et al., 2023[66]	**PFP group = 75** M/F = 17/58 Age = 22.46 ± 3.48 years Body mass = 72.99 ± 15.91 Kg Height = 1.7 ± 0.1 m BMI = NA Duration of symptoms = 36.46 ± 34.55 months.	**Control group = 18** M/F = 6/12 Age = 23.5 ± 3.1 years Body mass = 74.6 ± 9.4 Kg Height = 1.71 ± 0.1 m BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case-control.
Araujo et al., 2023[29]	**PFP group = 50** M/F = 0/50 Age = 23.4 ± 2.7 years Body mass = 64.3 ± 10.9 Kg Height = 164.3 ± 6.8 cm BMI = NA Duration of symptoms = NA.	**Control group = 50** M/F = 0/50 Age = 22.3 ± 2.5 years Body mass = 62.1 ± 11.5 Kg Height = 163.1 ± 6.7 cm BMI = NA.	ADLS (0-100 score), AKPS (0-100 score), SLTHT (cm), VJT (cm), YBT (reach distance/ leg length).	Reduced ADLS and AKPS scores, distance in the VJT and reached distance in the YBT in individuals with PFP. No difference in the distance in the SLTHT between groups.	Cross-sectional/Case control.
Armaki et al., 2020[78]	**PFP group = 20** M/F = 9/11 Age = 31.45 ± 6.91 years Body mass = 68.15 ± 9.65 Kg Height = 174.35 ± 8.32 cm BMI = 22.05 ± 2.45 Kg/cm² Duration of symptoms = NA.	**Control group = 20** M/F = 9/11 Age = 30.40 ± 5.93 years Body mass = 67.25 ± 11.31 Kg Height = 173.8 ± 8.39 cm BMI = 21.70 ± 2.67 Kg/cm².	FIQ (0-16 score).	Reduced FIQ scores in individuals with PFP.	Cross-sectional/Case control.
Baellow et al., 2020[37]	**PFP group = 15** M/F = 0/15 Age = 22.33 ± 3.49 years Body mass = 65.67 ± 13.75 Kg Height = 166.42 ± 6.01 cm BMI = NA Duration of symptoms = 21.6 ± 24.31 months.	**Control group = 15** M/F = 0/15 Age = 20.23 ± 1.39 years Body mass = 67.73 ± 9.57 Kg Height = 169.32 ± 5.38 cm BMI = NA.	AKPS (0-100 score), LEFS (score).	Reduced AKPS and LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Baellow et al., 2022[38]	**PFP group = 35** M/F = 9/26 Age = 20.46 ± 3.79 years Body mass = 73.28 ± 26.58 Kg Height = 170.80 ± 11.91 cm BMI = NA Duration of symptoms = 51.14 ± 39.71 months.	**Control group = 35** M/F = 9/26 Age = 20.4± 3.16 years Body mass = 64.76 ± 11.52 Kg Height = 169.55 ± 9.1 cm BMI = NA.	AKPS (0-100 score).	Not compared.	Cross-sectional/Case control.

Biabanimoghadam et al., 2016[79]	**PFP group = 30** M/F = 0/30 Age = 26.2 ± 3.4 years Body mass = 64.20 ± 4.93 Kg Height = 166.13 ± 4.13 cm BMI = NA Duration of symptoms = NA.	**Control group = 30** M/F = 0/30 Age = 25.17 ± 3.68 years Body mass = 62.43 ± 5.48 Kg Height = 164.83 ± 4.26 cm BMI = NA.	FIQ (0-16 score).	Not compared.	Cross-sectional/Case control.
Bley et al., 2014[39]	**PFP group = 20** M/F = 0/20 Age = 23.5 ± 2.1 years Body mass = 53.3 ± 4.8 Kg Height = 1.65 ± .04 m BMI = 20.2 ± 1.8 Kg/cm² Duration of symptoms = NA.	**Control group = 20** M/F = 0/20 Age = 23.1 ± 3.3 years Body mass = 55.9 ± 7.1 Kg Height = 1.62 ± .06 m BMI = 21.3 ± 2.7 Kg/cm².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Boling et al., 2006[80]	**PFP group = 14** M/F = 5/9 Age = 24 ± 6 years Body mass = 71.6 ± 12.2 Kg Height = 167.5 ± 10.1 cm BMI = NA Duration of symptoms = 22 ± 25 months.	**Control group = 14** M/F = 5/9 Age = 23 ± 2 years Body mass = 72.4 ± 15.6 Kg Height = 170.9 ± 7.3 cm BMI = NA.	FIQ (0-16 score).	Not compared.	Pre-post intervention.
Botta et al., 2021[64]	**PFP group = 148** M/F = 38/110 Age = 23.26 ± 4.05 years Body mass = 68.44 ± 14.6 Kg Height = 166.43 ± 8.15 cm BMI = 24.64 ± 4.48 Kg/cm² Duration of symptoms = 55.33 ± 49.45 months.	**Control group = 92** M/F = 31/61 Age = 22.59 ± 3.03 years Body mass = 66.31 ± 14.07 Kg Height = 166.2 ± 9.81 cm BMI = 23.13 ± 3.82 Kg/cm².	AKPS (0-100 score), FSDT (repetitions/30s), SLHT (cm).	Not compared.	Cross-sectional/Case control.
Branco et al., 2023[71]	**PFP group = 26** M/F = NA Age = 35.54 ± 5.64 years Body mass = 76.59 ± 12.02 Kg Height = 1.75 ± 0.07 m BMI = NA Duration of symptoms = NA.	**Control group = 24** M/F = NA Age = 38.79 ± 7.58 years Body mass = 74.14 ± 16.59 Kg Height = 1.74 ± 0.08 m BMI = NA.	AKPS (0-100 score), PSFS (0-10 score).	Reduced AKPS and PSFS scores in individuals with PFP.	Cross-sectional/Case-control.
Carlson et al., 2017[40]	**PFP group = 12** M/F = 0/12 Age = 14.1 ± 1.1 years	**Control group = 13** M/F = 0/13 Age = 14.2 ± 1.0 years	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

	Body mass = 51.1 ± 7.4 Kg Height = 160 ± 5.2 cm BMI = 20.4 ± 3.1 Kg/cm² Duration of symptoms = NA.	Body mass = 53.4 ± 9.6 Kg Height = 156.9 ± 7.6 cm BMI = 21.6 ± 3.1 Kg/cm².			
Carvalho e Silva et al., 2014[41]	**PFP group = 20** M/F = 0/20 Age = 22.8 ± 2.8 years Body mass = 56.8 ± 10 Kg Height = 162 ± 7 cm BMI = NA Duration of symptoms = 28 ± 18 months.	**Control group = 20** M/F = 0/20 Age = 24.1 ± 2.6 years Body mass = 61.9 ± 10 Kg Height = 163 ± 6 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Carvalho e Silva et al., 2016[89]	**PFP group = 25** M/F = 0/25 Age = 25.2 ± 6.6 years Body mass = 60.9 ± 10.2 Kg Height = 163 ± 8 cm BMI = NA Duration of symptoms = 34.1 ± 23.3 months.	**Control group = 25** M/F = 0/25 Age = 24.1 ± 4 years Body mass = 58.8 ± 7 Kg Height = 163.3 ± 5 cm BMI = NA.	ADLS (0-100 score).	Not compared.	Cross-sectional/Case control.
Coelho et al., 2021[42]	**PFP group = 48** M/F = 30/18 Age = 31.2 ± 5.8 years Body mass = 74.8 ± 14.2 Kg Height = 1.7 ± .1 m BMI = NA Duration of symptoms = 37.6 ± NA months.	**Control group = 48** M/F = 30/18 Age = 31.5 ± 6 years Body mass = 74.8 ± 13.1 Kg Height = 1.7 ± .1 m BMI = NA.	AKPS (0-100 score), SLTHT (m), YBT ([reach distance/ leg length] x 100).	AKPS was not compared. Reduced reached distance in the YBT in individuals with PFP. No difference in the distance in the SLTHT between groups.	Cross-sectional/Case control.
Crouzier et al., 2023[88]	**PFP group = 20** M/F = 1/19 Age = 15.3 ± 1.8 years Body mass = 61.2 ± 13.2 Kg Height = 165.4 ± 6.7 cm BMI = 22.2 ± 3.7 Kg/m² Duration of symptoms = NA.	**Control group = 20** M/F = 1/19 Age = 15.4 ± 2 years Body mass = 55.3 ± 10.8 Kg Height = 162.9 ± 8.9 cm BMI = 20.7 ± 3.2 Kg/m².	KOOS (0-100 score).	Reduced KOOS scores in individuals with PFP.	Cross-sectional/Case control.
De Oliveira Silva et al., 2015[43]	**PFP group = 31** M/F =0/31 Age = 21.9 ± 2.7 years Body mass = 65.7 ± 10.7 Kg Height = 1.65 ± .05 m	**Control group = 31** M/F = 0/31 Age = 22 ± 3.6 years Body mass = 63.3 ± 7.3Kg Height = 1.65 ± .04 m	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

	BMI = NA Duration of symptoms = NA.	BMI = NA.			
De Oliveira Silva et al., 2018a[44]	**PFP group = 165** M/F = 0/165 Age = 22.09 ± 3.15 years Body mass = NA Height = NA BMI = 23.43 ± 3.77 Kg/m² Duration of symptoms = NA.	**Control group = 158** M/F = 0/158 Age = 22 ± 2.88 years Body mass = NA Height = NA BMI = 21.7 ± 2.77 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
De Oliveira Silva et al., 2018b[45]	**PFP group = 65** M/F = 0/65 Age = 22.23 ± 3.32 years Body mass = 63.35 ± 6.95 Kg Height = 1.63 ± .06 m BMI = 23.77 ± 3.66 Kg/cm² Duration of symptoms = NA.	**Control group = 53** M/F = 0/53 Age = 21.88 ± 2.61 years Body mass = 57.53 ± 6.03 Kg Height = 1.63 ± .03 m BMI = 21.88 ± 2.61 Kg/cm².	AKPS (0-100 score), FSDT (repetitions/30s), SLHT (cm).	Reduced AKPS scores in individuals with PFP. Reduced repetitions in the FSDT and distance in the SLHT in individuals with PFP than individuals without crepitus and PFP.	Cross-sectional/Case control.
Dos Reis et al., 2015[109]	**PFP group = 20** M/F = 0/20 Age = 23.5 ± 2.1 years Body mass = 55.3 ± 4.8 Kg Height = 1.71 ± .13 m BMI = 20.2 ± 1.8 Kg/cm² Duration of symptoms = NA.	**Control group = 20** M/F = 0/20 Age = 23.1 ± 3.3 years Body mass = 55.9 ± 7.1 Kg Height = 1.65 ± .12 m BMI = 21.3 ±2.7 Kg/cm².	SLHT (m).	No difference in the distance in the SLHT between groups.	Cross-sectional/Case control.
Eckenrode et al., 2023[93]	**PFP group = 17** M/F = 0/17 Age = 29.47 ± 7.53 years Body mass = 63.95 ± 11.13 Kg Height = 166.15 ± 6.23 cm BMI = 23.21 ± 4.04 Kg/cm² Duration of symptoms = 70.35 ± 68.35 weeks.	**Control group = 20** M/F = 0/20 Age = 33.95 ± 8.06 years Body mass = 59.12 ± 7.19 Kg Height = 164.15 ± 5.48 cm BMI = 21.93 ± 2.32 Kg/cm².	KOOS-PF (0-100 score), YBT (NA).	Reduced KOOS-PF scores in individuals with PFP. No difference in the reached distance in the YBT between groups.	Cross-sectional/Case control.
Felicio et al., 2012[46]	**PFP group = 19** M/F = 0/19 Age = 23.47 ± 3.24 years Body mass = 57.89 ± 6.91 Kg Height = 161.63 ± 2.24 cm BMI = NA Duration of symptoms = 60.6 ±	**Control group = 20** M/F = 0/20 Age = 21.5 ± 2.16 years Body mass = 54.44 ± 5.23 Kg Height = 160.75 ± 5.23 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

	27.2 months.				
Ferreira et al., 2019[47]	**PFP group = 38** M/F = 0/38 Age = 22.00 ± 3.37 years Body mass = 61.73 ± 9.70 Kg Height = 1.62 ± .05 m BMI = 23.55 ± 3.75 Kg/m² Duration of symptoms = 57.30 ± 50.1 months.	**Control group = 38** M/F = 0/38 Age = 22.13 ± 2.75 years Body mass = 57.07 ± 7.83 Kg Height = 1.62 ± .06 m BMI = 21.73 ± 2.89 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Ferreira et al., 2023[67]	**PFP group = 11** M/F = 0/11 Age = 24.18 ± 4.24 years Body mass = 64.65 ± 13.11 Kg Height = 1.66 ± 0.04 m BMI = 23.37 ± 4.84 Kg/cm² Duration of symptoms = 59.09 ± 57.43 months	**Control group = 13** M/F = 0/13 Age = 24.15 ± 4.98 years Body mass = 56.5 ± 8.32 Kg Height = 1.61 ± 0.05 m BMI = 21.86 ± 3.23 Kg/cm²	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case-control.
Gallina et al., 2018[48]	**PFP group = 36** M/F = 0/36 Age = 26.7 ± 4.1 years Body mass = 62.3 ± 8.9 Kg Height = 166.4 ± 7.9 cm BMI = 22.5 ± 2.9 Kg/m² Duration of symptoms = (12-60) months§.	**Control group = 20** M/F = 0/20 Age = 25.6 ± 4.3 years Body mass = 58.2 ± 8.5 Kg Height = 167.7 ± 8.5 cm BMI = 20.6 ± 1.7 Kg/cm².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Glaviano et al., 2017[8]	**PFP group = 20** M/F = 5/15 Age = 22.2 ± 2.6 years Body mass = 68.6 ± 15.4 Kg Height = 167.9 ± 7.6 cm BMI = NA Duration of symptoms = 25 ± 27.1 NA.	**Control group = 20** M/F = 5/15 Age = 20.8 ± 1.8 years Body mass = 70.1 ± 9.9 Kg Height = 172.6 ± 7.9 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Goharpey et al., 2007[27]	**PFP group = 15** M/F = NA Age = 23.46 ± 2.35 years Body mass = 62.26 ± 7.77 Kg Height = 169.43 ± 6.15 cm	**Control group = 15** M/F = NA Age = 23 ± 1.98 years Body mass = 63 ± 6.04 Kg Height = 170.4 ± 8.09 cm	AKPS (score), Bilateral squat test (repetitions), FSDT (repetitions/30s).	Reduced AKPS scores, repetitions in the Bilateral squat test and in the SDT in individuals with PFP.	Cross-sectional/Case control.

	BMI = 21.74 ± 2.74 Kg/cm² Duration of symptoms = NA.	BMI = 21.89 ± 2.08 Kg/cm².			
Goto et al., 2018[99]	**PFP group = 14** M/F = NA Age = 21.07 ± 3.27 years Body mass = 69.95 ± 9.05 Kg Height = 172.09 ± 10.26 cm BMI = NA Duration of symptoms = NA.	**Control group = 14** M/F = NA Age = 20.93 ± 3 years Body mass = 70.31 ± 8.75 Kg Height = 170.18 ± 8.94 cm BMI = NA.	SEBT ([reach distance/ leg length] x 100).	Reduced reached distance in the SEBT in individuals with PFP.	Cross-sectional/Case control.
Hoglund et al., 2018[72]	**PFP group = 36** M/F = 36/0 Age = 23.5 (6) years§ Body mass = 79.6 (22.7) Kg§ Height = 1.79 ± .08 m BMI = 24.88 (3.85) Kg/m²§ Duration of symptoms = NA.	**Control group = 36** M/F = 36/0 Age = 22 (5) years§ Body mass = 83.53 (20.91) Kg§ Height = 1.77 ± .09 m BMI = 26.34 (4.15) Kg/m²§.	LEFS (0-80 score).	Reduced LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Holden et al., 2018[83]	**PFP group = 36** M/F = 0/36 Age = 22.8 ± 1.1 years Body mass = 69.2 ± 13.8 Kg Height = 1.69 ± .08 m BMI = 24.1 ± 4.1 Kg/cm² Duration of symptoms = 8 (7-10) years§.	**Control group = 29** M/F = 0/29 Age = 23.1 ± 1.2 years Body mass = 63.3 ± 11.1 Kg Height = 1.67 ± .09 m BMI = 22.7 ± 4.1 Kg/cm².	KOOS (0-100 score).	Not compared.	Cross-sectional/Case control.
Ingram et al., 2016[95]	**PFP group = 12** M/F = 2/10 Age = 23.4 ± 3.8 years Body mass = 70.2 ± 7.2 Kg Height = 172.7 ± 7.2 cm BMI = NA Duration of symptoms = NA.	**Control group = 10** M/F = 2/8 Age = 20.2 ± 1.4 years Body mass = 63.7 ±10.5 Kg Height = 166.9 ± 9.4 cm BMI = NA.	Lysholm (0-100 score).	Reduced Lysholm scores in individuals with PFP.	Cross-sectional/Case control.
Jaffri and Baellow, 2023[68]	**PFP group = 30** M/F = 11/19 Age = 20.23 ± 3.32 years Body mass = 69.55 ± 13.15 Kg Height = 166.69 ± 6.41 cm BMI = NA Duration of symptoms = NA.	**Control group = 30** M/F = 11/19 Age = 20.33 ± 3.37 years Body mass = 64.02 ± 11 Kg Height = 169.31 ± 9.3 cm BMI = NA.	AKPS (0-100 score), LEFS (0-80 score).	Reduced AKPS and LEFS scores in individuals with PFP.	Cross-sectional/Case control.

Jensen et al., 2005[110]	**PFP group = 25** M/F = 9/16 Age = 32.2 ± 7.1 years Body mass = NA Height = NA BMI = 23.8 ± 3.2 Kg/cm² Duration of symptoms = 74 ± NA months.	**Control group = 23** M/F = 11/12 Age = 29.1 ± 8.7 years Body mass = NA Height = NA BMI = 23.4 ± 2.3 Kg/cm².	CKRS (0-100 score), Coop-Wonca Chart (1-5 score), SLHTH (cm).	Reduced CKRS scores and distance difference in the SLTHT and increased Coop-Wonca Chart scores in individuals with PFP.	Cross-sectional/Case control.
Jensen et al., 2008[108]	**PFP group = 91** M/F = 56/35 Age = 31.2 ± NA years Body mass = NA Height = NA BMI = 25.3 ± NA Kg/cm² Duration of symptoms = 70 ± NA months.	**Control group = 23** M/F = 11/12 Age = 29.1 ± NA years Body mass = NA Height = NA BMI = 23.4 ± NA Kg/cm².	CKRS (0-100 score), FSDT (repetitions/30s).	CKRS was not compared. Reduced repetitions in the FSDT in individuals with PFP.	Cross-sectional/Case control.
Jeon et al., 2023[69]	**PFP group = 12** M/F = NA Age = 21 ± 2.04 years Body mass = 68.66 ± 12.61 Kg Height = 1.72 ± 0.09 m BMI = NA Duration of symptoms = 54 ± 34.69 months.	**Control group = 12** M/F = NA Age = 21.25 ± 2.77 years Body mass = 65.99 ± 12.23 Kg Height = 1.71 ± 0.09 m BMI = NA.	AKPS (0-100 score), KOOS (0-100 score), KOOS-PF (0-100 score).	Not compared.	Crossover.
Kalytczak et al., 2016[49]	**PFP group = 14** M/F = NA Age = 23.50 ± 2.02 years Body mass = 56 ± 5.23 Kg Height = 1.66 ± .05 m BMI = 20.47 ± 1.98 Kg/m² Duration of symptoms = NA.	**Control group = 14** M/F = NA Age = 23.14 ± 3.35 years Body mass = 55.93 ± 7.15 Kg Height = 1.62 ± .06 m BMI = 21.33 ± 2.71 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Kaya et al., 2011[107]	**PFP group = 24** M/F = 0/24 Age = 41 (NA) years§ Body mass = 69 (NA) Kg§ Height = 162 (NA) cm§ BMI = NA Duration of symptoms = NA.	NA.	FSDT (repetitions/30s), SLHT (cm).	No difference in the repetitions in the FSDT between limbs. Reduced distance in the SLHT in PFP limb.	Case series.

Kiliç et al., 2021[90]	**PFP group = 30** M/F = 9/21 Age = 36 ± 6.9 years Body mass = NA Height = NA BMI = NA Duration of symptoms = NA.	**Control group = 30** M/F = 16/14 Age = 32.1 ± 6.4 years Body mass = NA Height = NA BMI = NA.	ADLS (0-100 score), Lysholm (0-100 score).	Reduced ADLS and Lysholm scores in individuals with PFP.	Cross-sectional/Case control.
Kim et al., 2021[73]	**PFP group = 26** M/F = 18/8 Age = 22.2 ± 1.1 years Body mass = 71.3 ± 5.3 Kg Height = 172.6 ± 3.7 cm BMI = 23.8 ± 1.1 Kg/cm² Duration of symptoms = NA.	**Control group = 30** M/F = 22/8 Age = 22.7 ± .8 years Body mass = 71.2 ± 3.7 Kg Height = 173.4 ± 2.9 cm BMI = 23.8 ± .9 Kg/cm².	LEFS (0-80 score).	Reduced LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Kim et al., 2022[74]	**PFP group = 60** M/F = 33/22 Age = 21.9 ± .7 years Body mass = 68.6 ± 3.8 Kg Height = 170.4 ± 2.0 cm BMI = 23.4 ± .9 Kg/cm² Duration of symptoms = 38 ± 8.2 months.	**Control group = 48** M/F = 35/13 Age = 22.5 ± .7 years Body mass = 71.2 ± 3.3 Kg Height = 172.7 ± 2.2 cm BMI = 23.8 ± .8 Kg/cm².	LEFS (0-80 score).	Reduced LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Kim et al., 2023a[77]	**PFP group = 22** M/F = 7/15 Age = 22.4 ± 2.9 years Body mass = 60.3 ± 10.2 Kg Height = 165 ± 8.6 cm BMI = 22 ± 2.1 Kg/cm² Duration of symptoms = 4-110 months.	**Control group = 19** M/F = 10/9 Age = 22.9 ± 1.9 years Body mass = 63.2 ± 8.9 Kg Height = 170.7 ± 7.3 cm BMI = 21.6 ± 2.2 Kg/cm².	LEFS (0-80 score)	Reduced LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Kim et al., 2023b[76]	**PFP group = 55** M/F = 30/25 Age = 21.85 ± 2.91 years Body mass = 67.75 ± 10.99 Kg Height = 170.76 ± 8.04 cm BMI = 23.11 ± 2.38 Kg/cm² Duration of symptoms = 48.57 ± 22.49 months.	**Control group = 55** M/F = 30/25 Age = 22.01 ± 2.17 years Body mass = 67.62 ± 10.37 Kg Height = 171.14 ± 7.75 cm BMI = 23.04 ± 2.48 Kg/cm².	LEFS (0-80 score)	Not compared.	Cross-sectional/Case control.

Kizilkaya and Ecesoy 2019[50]	**PFP group = 30** M/F =14/16 Age = 31.57 ± 7.37 years Body mass = NA Height = NA BMI = 24.66 ± 4.09 Kg/m² Duration of symptoms = 15 ± NA months.	**Control group = 31** M/F = 14/17 Age = 30.03 ± 5.67 years Body mass = NA Height = NA BMI = 24.62 ± 3.4 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Liew et al., 2020[84]	**PFP group = 14** M/F = 6/8 Age = 20.86 ± 1.83 years Body mass = 64.96 ± 10.51 Kg Height = 1.71 ± .1 m BMI = NA Duration of symptoms = NA.	**Control group = 17** M/F = 9/8 Age = 23.47 ± 2.67 years Body mass = 67.02 ± 10.87 Kg Height = 1.7 ± .08 m BMI = NA.	KOOS (0-100 score), KOOS-PF (0-100 score).	Not compared.	Cross-sectional/Case control.
Loudon et al., 2002[105]	**PFP group = 29** M/F = 10/19 Age = 27.6 ± 5.3 years Body mass = 69.59 ± 15.8 Kg Height = 169.8 ± 10.5 cm BMI = NA Duration of symptoms = NA.	**Control group = 11** M/F = 4/7 Age = 30.3 ± 5.2 years Body mass = 69.42 ± 14.6 Kg Height = 169.55 ± 9.9 cm BMI = NA.	Anteromedial Lunge (repetitions), Balance and Reach Test (repetitions), Bilateral Squat Test (repetitions), FSDT (repetitions/30s), Single Leg Press Test (score).	Reduced repetitions in the FSDT in individuals with PFP. Reduced Anteromedial Lunge and FSDT repetitions and Single Leg Press Test score in PFP limb. No difference in the repetitions in the Bilateral Squat Test between groups and limbs.	Test-retest reliability design.
Magalhães et al., 2010[91]	**PFP group = 50** M/F = 0/50 Age = 24.57 ± 6.39 years Body mass = 59.7 ± 11.81 Kg Height = 161.77 ± 6.8 cm BMI = NA Duration of symptoms = 44.68 ± 45.56 months.	**Control group = 50** M/F = 0/50 Age = 24.1 ± 6.3 years Body mass = 57.9 ± 8.3 Kg Height = 161.2 ± 5.9 cm BMI = NA.	ADLS (0-100 score).	Reduced ADLS scores in individuals with PFP.	Cross-sectional/Case control.
Miller et al., 2013[22]	**PFP group = 18** M/F = 12/6 Age = 19.5 ± 1.15 years Body mass = 71.67 ± 9.81 Kg Height = 173.78 ± 9.1 cm	NA.	YBT (reach distance / leg length)	Not compared.	Randomized clinical trial.

	BMI = NA Duration of symptoms = NA				
Muniz et al., 2023[51]	**PFP group = 13** M/F = 0/13 Age = 27.8 ± 3.1 years Body mass = 75.7 ± 10.2 Kg Height = 1.8 ± .1 cm BMI = NA Duration of symptoms = 3.3 ± 2 years.	**Control group = 18** M/F = 0/18 Age = 28.9 ± 4.4 years Body mass = 74.1 ± 7.8 Kg Height = 1.7 ± .1 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Nafez et al., 2023[103]	**PFP group = 26** M/F = 0/26 Age = 23.27 ± 4.1 years Body mass = 59.85 ± 8.03 Kg Height = 1.65 ± 0.05 m BMI = 22.83 ± 2.4 Kg/cm² Duration of symptoms = NA.	**Control group = 23** M/F = 0/23 Age = 23.22 ± 3.71 years Body mass = 61.91 ± 5.31 Kg Height = 1.65 ± 0.04 m BMI = 22.7 ± 1.58 Kg/cm².	YBT (NA)	Reduced reached distance in the YBT in individuals with PFP.	Cross-sectional/Case control.
Nakagawa et al., 2020[102]	**PFP group = 14** M/F = 14/0 Age = 18.71 ± .88 years Body mass = 68.74 ± 6.62 Kg Height = 172.46 ± 6.67 cm BMI = NA Duration of symptoms = NA.	**Control group = 121** M/F = 121/0 Age = 18.43 ± .54 years Body mass = 66.63 ± 12.44 Kg Height = 171.12 ± 7.24 cm BMI = NA.	YBT ([reach distance/ leg length] x 100)	No difference in the reached distance in the YBT between groups.	Cohort study.
Naserpour et al., 2018[106]	**PFP group = 34** M/F = 17/17 Age = 24.24 ± 2.93 years Body mass = 67.76 ± 14.6 Kg Height = 168.78 ± 8.89 cm BMI = NA Duration of symptoms = NA.	**Control group = 34** M/F = 17/17 Age = 23.15 ± 3.04 years Body mass = 63.55 ± 9.64 Kg Height = 166.5 ± 8.96 cm BMI = NA.	FSDT (repetitions/30s).	No difference in the repetitions in the FSDT between groups.	Cross-sectional/Case control.
Novello et al., 2018[52]	**PFP group = 34** M/F = 0/34 Age = 23 (20-31) years§ Body mass = 58 (52-62) Kg§ Height = 1.6 (1.55-1.65) m§ BMI = 22.4 (20-24) Kg/m²§ Duration of symptoms = NA.	**Control group = 34** M/F = 0/34 Age = 26 (23-28) years§ Body mass = 55 (51-61) Kg§ Height = 1.61 (1.60-1.70) m§ BMI = 20.5 (19-23) Kg/m²§	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

Nunes et al., 2019[9]	**PFP group = 16** M/F = 7/9 Age = 32 ± 9 years Body mass = 67.3 ± 14.6 Kg Height = 1.67 ± .12 m BMI = NA Duration of symptoms = 2.3 ± 1.7 years.	**Control group = 16** M/F = 7/9 Age = 29 ± 7 years Body mass = 66.4 ± 14.2 Kg Height = 1.7 ± .1 m BMI = NA.	AKPS (0-100 score), KOOS-PF (0-100 score), FSDT (repetitions/30 s), SLHT (cm), Single-Legged Chair Stand Test (repetitions), Side Hop Test (repetitions), Stair Ascend and Descend Test (seconds).	Reduced AKPS and KOOS-PF scores, distance in the SLHT and repetitions in the Single-Legged Chair Stand Test and longer time in the Stair Ascend and Descend Test in individuals with PFP. No difference in the repetitions in the FSDT and Side Hop Test.	Cross-sectional/Case control.
O'Sullivan et al., 2012[53]	**PFP group = 12** M/F = 0/12 Age = 23 ± 4 years Body mass = 62.8 ± 7.6 Kg Height = 165.7 ± 5.9 cm BMI = 22.8 ± 2 Kg/m² Duration of symptoms = NA.	**Control group = 12** M/F = 0/12 Age = 21 ± 1 years Body mass = 62.6 ± 9.9 Kg Height = 164.6 ± 7.9 cm BMI = 22.8 ± 3.1 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Pre-post intervention
Ott et al., 2011[54]	**PFP group = 20** M/F = NA Age = 20.9 ± 1.76 years Body mass = 70.34 ± 7.88 Kg Height = 170.69 ± 6.72 cm BMI = 23.9 ± 1.8 Kg/cm² Duration of symptoms = NA.	**Control group = 20** M/F = NA Age = 22.6 ± 3.6 years Body mass = 65.5 ± 7.23 Kg Height = 168.21 ± 6.63 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Pre-post intervention
Pavone et al., 2022[55]	**PFP group = 38** M/F = 0/38 Age = 13.98 ± 3.35 Body mass = NA Height = NA BMI = NA Duration of symptoms = 6.13 ± 1.75 months	**Control group = 13** M/F = 0/13 Age = 14.5 ± 4.3 Body mass = NA Height = NA BMI = NA	AKPS (0-100 score).	No difference in the AKPS score between groups.	Cross-sectional/Case control.
Pazzinatto et al., 2017[56]	**PFP group = 20** M/F = 0/20 Age = 25.62 ± 4.05 years Body mass = 58.33 ± 6.89 Kg	**Control group = 20** M/F = 0/20 Age = 27 ± 5.58 years Body mass = 60 ± 7.35 Kg	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

	Height = 1.63 ± .06 m BMI = NA Duration of symptoms = 37.69 ± 49.31 months.	Height = 1.62 ± .04 BMI = NA.			
Pazzinatto et al., 2019[57]	**PFP group = 30** M/F = 0/30 Age = 21.83 ± 3.35 years Body mass = 62 ± 7.98 Kg Height = 1.62 ± .06 m BMI = 23.6 ± 3.39 Kg/m² Duration of symptoms = 52.73 ± 56.43 months.	**Control group = 30** M/F = 0/30 Age = 22.47 ± 3.19 years Body mass = 58.1 ± 7.07 Kg Height = 1.62 ± .06 m BMI = 22.05 ± 2.63 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Pazzinatto et al., 2023[65]	**PFP group = 27** M/F = 0/27 Age = 19 ± 1 years Body mass = 60.6 ± 10.3 Kg Height = 1.6 ± .1 m BMI = 22.8 ± 4 Kg/cm² Duration of symptoms = NA.	**Control group = 63** M/F = 0/63 Age = 20 ± 2 years Body mass = 56.4 ± 8.6 Kg Height = 1.6 ± .1 m BMI = 21.3 ± 3 Kg/cm².	AKPS (0-100 score), FSDT (repetitions/30s), SLHT (cm).	Not compared.	Cohort study.
Peeler et al., 2007[28]	**PFP group = 40** M/F = 16/24 Age = 31 ± 7.9 years Body mass = 71.2 ± 14.8 Kg Height = 1.69 ± .1 m BMI = 24.9 ± 3.7 Kg/cm² Duration of symptoms = NA.	**Control group = 43** M/F = 13/30 Age = 28 ± 7 years Body mass = 68.2 ± 12 Kg Height = 1.67 ± .1 m BMI = 24.3 ± 3.3 Kg/cm².	FIQ (score).	Reduced FIQ scores in individuals with PFP.	Pre-post intervention.
Piva et al., 2005[92]	**PFP group = 30** M/F = 13/17 Age = 25.8 ± 6 years Body mass = 76.9 ± 17.4 Kg Height = 169.7 ± 14.2 cm BMI = NA Duration of symptoms = NA.	**Control group = 30** M/F = 13/17 Age = 25.7 ± 5.9 years Body mass = 68.8 ± 14.2 Kg Height = 170.9 ± 10.6 cm BMI = NA.	ADLS (0-100 score).	Reduced ADLS scores in individuals with PFP.	Cross-sectional/Case control.
Plastaras et al., 2016[58]	**PFP group = 21** M/F = 0/21 Age = 30.5 ± 6.1 years Body mass = 62.1 ± 9.9 Kg Height = 164.6 ± 5.8 cm BMI = NA Duration of symptoms = NA.	**Control group = 36** M/F = 0/36 Age = 30.4 ± 15.2 years Body mass = 62.6 ± 8 Kg Height = 166.4 ± 6.6 cm BMI = NA.	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.

Priore et al., 2019[100]	**PFP group = 55** M/F = 0/55 Age = 21.86 ± 2.76 years Body mass = 60.03 ± 6.7 Kg Height = 1.61 ± .59 m BMI = 22.94 ± 2.79 Kg/cm² Duration of symptoms = 58.51 ± 22.64 months.	**Control group = 40** M/F = 0/40 Age = 22.05 ± 3.11 years Body mass = 57.2 ± 8.17 Kg Height = 1.61 ± .62 m BMI = 22.09 ± 3 Kg/cm².	FSDT (repetitions/30s), Modified SEBT ([reach distance/ leg length] x 100), SLHT (cm).	Reduced repetitions in the FSDT, reached distance in the Modified SEBT and distance in the SLHT in individuals with PFP.	Cross-sectional/Case control.
Rathleff et al., 2013[85]	**PFP group = 57** M/F = 0/57 Age = 17.3 ± 1.1 years Body mass = 58.5 ± 6.7 Kg Height = 168.3 ± 5.1 cm BMI = 20.5 ± 1.9 Kg/cm² Duration of symptoms = 34 (18-35) months§.	**Control group = 22** M/F = 0/22 Age = 17.1 ± .9 years Body mass = 60.6 ± 9 Kg Height = 168.6 ± 5.1 BMI = 21.4 ± 3.1.	KOOS (0-100 score).	Reduced KOOS scores in individuals with PFP.	Cross-sectional/Case control.
Rathleff et al., 2016[86]	**PFP group = 20** M/F = 0/20 Age = 20 (19-21) years§ Body mass = 63.8 ± 8.3 Kg Height = 170 ± 5 cm BMI = NA Duration of symptoms = 6 (4.5-7) months§.	**Control group = 20** M/F = 0/20 Age = 20.5 (20-21) years§ Body mass = 61.7 ± 7.4 Kg Height = 169 ± 5 cm BMI = NA.	KOOS (0-100 score).	Reduced KOOS scores in individuals with PFP.	Cross-sectional/Case control.
Rathleff et al., 2020[87]	**PFP group = 151** M/F = 36/115 Age = 12.6 ± 1.2 years Body mass = 50.4 ± 9.4 Kg Height = 162 ± 9.6 cm BMI = 19 (17.2-20.8) Kg/cm²§ Duration of symptoms = 21.3 ± 17 months.	**Control group = 50** M/F = 19/31 Age = 12.3 ± 1.4 years Body mass = 48 ± 10.4 Kg Height = 159.8 ± 10.5 cm BMI = 18 (17.1-20) Kg/cm²§.	KOOS (0-100 score).	Reduced KOOS scores in individuals with PFP.	Cross-sectional/Case control.
Sacco et al., 2006[96]	**PFP group = 6** M/F = NA Age = 30.5 ± 8.8 years Body mass = 77.5 ± 24.7 Kg Height = 170.3 ± 10.3 cm BMI = 23 ± 3.2 Kg/cm² Duration of symptoms = NA	**Control group = 5** M/F = NA Age = 27 ± 7 years Body mass = 71.2 ± 9.8 Kg Height = 170 ± 7 cm BMI = 24.6 ± 2.8 Kg/cm²	Karlsson Scale (0-100 score), Lysholm (0-100 score).	Reduced Karlsson Scale and Lysholm scores in individuals with PFP.	Pre-post intervention.

Sanchis-Alfonso et al., 2023[70]	**PFP group = 44** M/F = 0/44 Age = 22.7 ± 9.1 years Body mass = NA Height = NA BMI = NA Duration of symptoms = NA.	**Control group = 50** M/F = 0/50 Age = 26.1 ± 6 years Body mass = NA Height = NA BMI = NA.	AKPS (0-100 score), IKDC (0-100 score).	Reduced AKPS and IKDC scores in individuals with PFP.	Cross-sectional/Case-control.
Shallan et al., 2023[94]	**PFP group = 40** M/F = NA Age = 29.23 ± 2.64 years Body mass = NA Height = NA BMI = 24.65 ± 2.74 Kg/cm² Duration of symptoms = NA.	**Control group = 20** M/F = NA Age = 28.16 ± 3 years Body mass = NA Height = NA BMI = 24.3 ± 2.6 Kg/cm².	KOOS-PF (0-100 score), YBT ([reach distance/ leg length] x 100).	Not compared.	Cross-sectional/Case-control.
Shirazi et al., 2014[81]	**PFP group = 27** M/F = 0/27 Age = 26.59 ± 3.56 years Body mass = 60.7 ± 6.25 Kg Height = 162.66 ± 5.49 cm BMI = 22.44 ± 2.24 Kg/cm² Duration of symptoms = NA.	**Control group = 27** M/F = 0/27 Age = 26.37 ± 3.32 years Body mass = 61.62 ± 5.93 Kg Height = 164.11 ± 4.61 cm BMI = 22.4 ± 2.2 Kg/cm².	FIQ (0-16 score).	Not compared.	Cross-sectional/Case control.
Song et al., 2017[101]	**PFP group = 16** M/F = 0/16 Age = 25.7 ± 6.1 years Body mass = 55.5 ± 5.8 Kg Height = 164.1 ± 5.4 cm BMI = NA Duration of symptoms = NA.	**Control group = 8** M/F = 0/8 Age = 28.6 ± 5.7 years Body mass = 52.1 ± 5.6 Kg Height = 161.1 ± 5.7 cm BMI = NA.	SEBT ([reach distance/ leg length] x 100).	No difference in the reached distance in the SEBT between groups.	Pre-post intervention.
Souza et al., 2017[59]	**PFP group = 14** M/F = 0/14 Age = 22.7 ± 0.6 years Body mass = 60.05 ± 1.8 Kg Height = 1.64 ± 0 m BMI = NA Duration of symptoms = NA	**Control group = 10** M/F = 0/10 Age = 21.5 ± 0.5 years Body mass = 58.5 ± 2.1 Kg Height = 1.61 ± 0 m BMI = NA	AKPS (0-100 score), FIQ (0-16 score), FSDT (repetitions/30s).	Reduced AKPS and FIQ scores and repetitions in the FSDT in individuals with PFP.	Pre-post intervention.
Steinberg et al., 2020[104]	**PFP group = 83** M/F = 0/83 Age = 12.96 ± 0.83 Body mass = 46.54 ± 8.20 Height = 155.55 ± 7.30	**Control group = 49** M/F = 0/49 Age = 13.12 ± 0.83 Body mass = 47.38 ± 8.42 Height = 157.10 ± 7.40	YBT (NA)	Not compared.	Cross-sectional/Case control.

	BMI = 19.16 ± 2.48 Duration of symptoms = NA	BMI = 19.08 ± 2.51			
Van Cant et al., 2017[75]	**PFP group = 20** M/F = 0/20 Age = 21.1 ± 2.6 years Body mass = 55.9 ± 7.4 Kg Height = 162.1 ± 5.8 cm BMI = NA Duration of symptoms = NA.	**Control group = 76** M/F = 0/76 Age = 20.5 ± 2.8 years Body mass = 58.3 ± 7.4 Kg Height = 165.5 ± 5.8 cm BMI = NA.	LEFS (0-80 score).	Reduced LEFS scores in individuals with PFP.	Cross-sectional/Case control.
Van der Heijden et al., 2018[60]	**PFP group = 64** M/F = 35/29 Age = 23.4 ± 7 years Body mass = NA Height = NA BMI = 23.6 ± 3.8 Kg/m² Duration of symptoms = 12 ±7.07 months	**Control group = 70** M/F = 41/29 Age = 23.1 ± 5.9 years Body mass = NA Height = NA BMI = 22.3 ± 3 Kg/m².	AKPS (0-100 score).	Reduced AKPS scores in individuals with PFP.	Cross-sectional/Case control.
Willson et al., 2008[61]	**PFP group = 20** M/F = 0/20 Age = 23.3 ± 3.1 years Body mass = 61.7 ± 10.6 Kg Height = 1.66 ± 0.08 m BMI = NA Duration of symptoms = NA	**Control group = 20** M/F = 0/20 Age = 23.7 ± 3.6 years Body mass = 61.1 ± 5.4 Kg Height = 1.66 ± 0.06 m BMI = NA	AKPS (0-100 score).	Not compared.	Cross-sectional/Case control.
Yelvar et al., 2017[62]	**PFP group = 22** M/F = 0/22 Age = 36.09 ± 2.97 years Body mass = NA Height = NA BMI = 25.37 ± 4.35 Kg/m^2 Duration of symptoms = 7.87 ± 5.13 NA.	**Control group = 22** M/F = 0/22 Age = 35.81 ± 3.17 years Body mass = NA Height = NA BMI = 25.87 ± 3.38 Kg/m^2.	AKPS (0-100 score), TUG (repetitions).	Reduced AKPS scores and longer time in the Timed Up and Go Test in individuals with PFP.	Cross-sectional/Case control.
Yoosefinejad et al., 2022[82]	**PFP group = 24** M/F = 0/24 Age = 24.95 ± 2.38 years Body mass = 59.45 ± 5.91 Kg Height = 1.65 ± 0.04 cm BMI = 21.53 ± 1.62 Kg/cm² Duration of symptoms = NA.	**Control group = 24** M/F = 0/24 Age = 23.25 ± 2.55 years Body mass = 59.16 ± 7.20 Kg Height = 1.65 ± 0.04 m BMI = 21.39 ± 1.95 Kg/cm².	FIQ (0-16 score).	Not compared.	Cross-sectional/Case control.

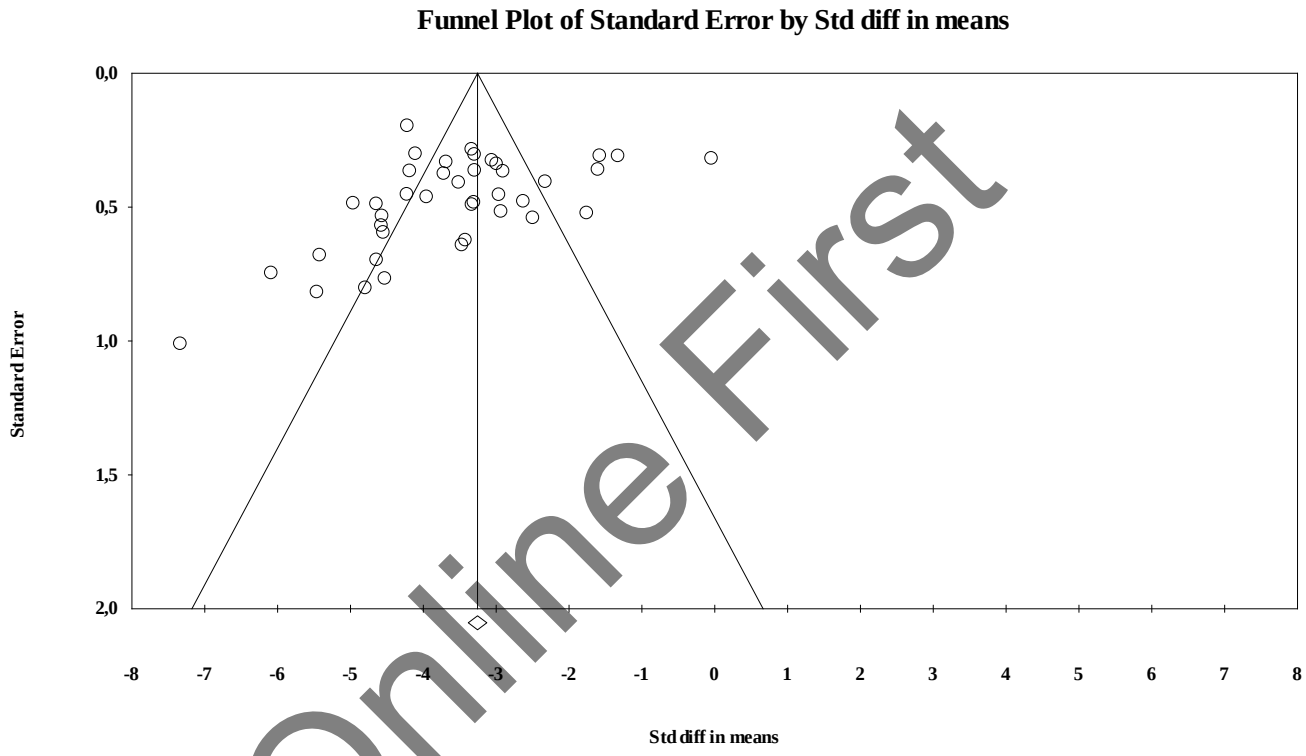
Zamboti et al., 2017[63]	**PFP group = 10** M/F = 0/10 Age = 21.1 ± 1.1 years Body mass = 60.2 ± 8.07 Kg Height = 1.65 ± 0.06 m BMI = 21.8 ± 1.79 Kg/m². Duration of symptoms = 3.75 ± 1.24 years.	**Control group = 10** M/F = 0/10 Age = 22 ± 1.59 years Body mass = 63 ± 7.4 Kg Height = 1.64 ± 0.03 m BMI = 23.25 ± 3.2 Kg/m²	AKPS (0-100 score), LEFS (0-80 score), Lysholm (0-100 score), SEBT ([reach distance/ leg length] x 100).	Reduced AKPS, LEFS and Lysholm scores in individuals with PFP. No difference in the reached distance in the SEBT.	Cross-sectional/Case control.
Zamboti et al., 2021[10]	**PFP group = 20** M/F = 0/20 Age = 25.6 ± 4.97 years Body mass = 67.55 ± 12.40 Kg Height = 164 ± 0.05 cm BMI = 25.05 ± 3.49 Kg/m^2 Duration of symptoms = 70.35 ± 77.84 months.	**Control group = 20** M/F = 0/20 Age = 26.5 ± 4.13 years Body mass = 59.15 ± 9.40 Kg Height = 165 ± 0.08 cm BMI = 21.75 ± 2.77 Kg/m^2.	AKPS (0-100 score), Stair Climbing Test (seconds), Stair Descent Test (seconds), Sitting-Rising Test (score), Sit-To-Stand Test (repetitions/30s), Six-Min Step Test (repetitions).	Reduced AKPS score, repetitions in the Sit-To-Stand Test and Six-Min Step Test in individuals with PFP. Longer Stair Climbing Test. No difference in the Sitting-Rising Test score and in time of Stair Descent Test between groups.	Cross-sectional/Case control.

Abbreviations: ADLS = Activities of Daily Living Questionnaire; AKPS = Anterior Knee Pain Scale; CKRS = Cincinnati Knee Rating System; FIQ = Functional Index Questionnaire; FSDT = Forward Step-Down Test; IKDC = International Knee Documentation Committee; KOOS = Knee and Osteoarthritis Outcome Score; KOOS-PF = Knee Injury and Osteoarthritis Outcome Score for Patellofemoral Pain and Osteoarthritis; LEFS = Lower Extremity Functional Scale; Lysholm = Lysholm Knee Scoring Scale; NA = Not Available; NRS = Numeric Rating Scale; PFP = Patellofemoral Pain; PSFS = Patient-Specific Functional Scale; SEBT = Star Excursion Balance Test; SLHT = Single Leg Hop Test; SLTHT = Single Leg Triple Hop Test; TUG = Timed Up and Go Test; VAS = Visual Analogue Pain Scale; Vertical Jump Test = VJT; YBT = Y-Balance Test. §Median/interquartile range.

SUPPLEMENTAL MATERIAL G

Publication bias

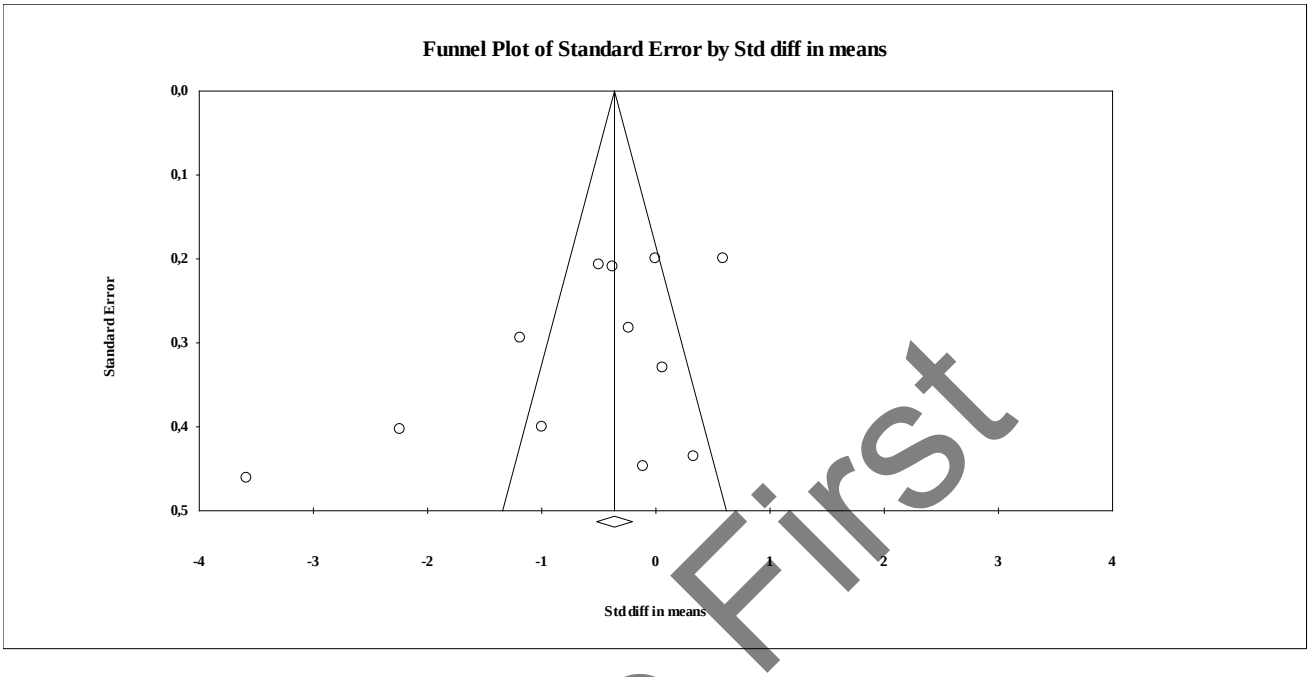
FIGURE G1. Funnel plot assessing publication bias in studies included in meta-analyses of Anterior Knee Pain Scale (AKPS) of individuals with PFP compared to pain-free individuals.



Egger's regression intercept

Intercept	-2,78487
Standard error	1,38901
95% lower limit (2-tailed)	-5,59678
95% upper limit (2-tailed)	0,02703
t-value	2,00493
df	38,00000
P-value (1-tailed)	0,02607
P-value (2-tailed)	0,05213

FIGURE G2. Funnel plot assessing publication bias in studies included in meta-analyses of balance tests of individuals with PFP compared to pain-free individuals.



Egger's regression intercept

Intercept	-5,40636
Standard error	2,61801
95% lower limit (2-tailed)	-11,23965
95% upper limit (2-tailed)	0,42692
t-value	2,06507
df	10,00000
P-value (1-tailed)	0,03291
P-value (2-tailed)	0,06583

SUPPLEMENTAL MATERIAL H

Synthesis of unpooled data

Self-reported function

Cincinnati Knee Rating System (CKRS): Evidence from one study[110] showed that individuals with PFP have reduced self-reported function measured with CKRS compared with pain-free individuals (SMD=-3.72, 95% CI=-4.69 to -2.76, p<.001). Evidence from one study[108] also showed that PFP limb have reduced self-reported function measured with CKRS compared with contralateral pain-free limb of individuals with unilateral PFP (SMD=-3.49, 95% CI=-3.96 to -3.03; p<.001).

Coop-Wonca Chart: Evidence from one study[110] showed that individuals with PFP have reduced self-reported function measured with Coop-Wonca Chart compared with pain-free individuals (SMD=1.26, 95% CI=0.63 to 1.88; p<.001).

International Knee Documentation Committee (IKDC): Evidence from one study[70] showed that individuals with PFP have reduced self-reported function measured with IKDC compared to pain-free individuals (SMD=-4.86, 95% CI=-5.67 to -4.04; p<.001).

Karlsson scale: Evidence from one study[96] showed that individuals with PFP (median=58) have reduced self-reported function measured with Karlsson scale compared with pain-free individuals (median=100; p<.05).

Knee and Osteoarthritis Outcome Score (KOOS): Evidence from one study[87] showed that individuals with PFP (median [interquartile range]=77 [75-80]) have reduced self-reported

function measured with KOOS compared to pain-free individuals (median [interquartile range]=100 [100-100]; p<.05).

Lysholm Knee Scoring Scale (Lysholm): Evidence from one study[96] showed that individuals with PFP (median=66.5) have reduced self-reported function measured with Lysholm compared with pain-free individuals (median=100; p<.05). One study[97] showed that individuals with PFP have Lysholm score median (range) of 68 (40-85) and pain-free individuals of 98 (85 to 100), however no comparisons were made.

Patient-Specific Functional Scale (PSFS): Evidence from one study[71] showed that individuals with PFP have reduced self-reported function measured with PSFS compared to pain-free individuals (SMD=-1.65, 95% CI=-2.30 to -1.00; p<.001).

Performance-based measures of function

Anteromedial Lunge: Evidence from one study[105] showed no significant differences in the number of repetitions in the Anteromedial Lunge between individuals with PFP and pain-free individuals (SMD=.05, 95% CI=-.47 to .56; p= .86).

Balance and Reach Test: Evidence from one study[105] showed that there is no difference in the number of repetitions in the Balance and Reach Test between individuals with PFP and pain-free individuals (SMD=.28, 95% CI=-.42 to .98; p=.43).

Hop tests: Evidence from one study[29] showed that individuals with PFP have reduced high in the Vertical Jump Test compared to pain-free individuals (SMD=-.53, 95% CI-.93 = to -.14; p=.009). Evidence from one study[9] showed no significant differences in the number of repetitions in the Side Hop Test between individuals with PFP and pain-free individuals (SMD=-.60, 95% CI=-1.32 to .11; p =.10).

Single Leg Press Test: Evidence from one study[105] showed no significant differences in the number of repetitions in the Single Leg Press Test between individuals with PFP and pain-free individuals (SMD=-.02, 95% CI=-.72 to .67; p=.95).

Sit and stand tests: Evidence from two studies[9,10] showed that individuals with PFP have reduced number of repetitions in the Single-Legged Chair Stand Test (SMD=-.62, 95% CI=-1.33 to .09; p=.09) and in the Sit-To-Stand Test (SMD=-.71, 95% CI=-1.36 to -.07; p=.03), respectively, compared with pain-free individuals. One study[10] showed no significant differences in the score of Sitting-Rising Test between individuals with PFP and pain-free individuals, however this result was not confirmed by calculated SMD and 95% CI (SMD=-.75, 95% CI=-1.39 to -.10; p =.02).

Stair tests: Evidence from two studies[9,10] showed that individuals with PFP have longer time in the Stair Ascend and Descent Test (SMD=.90, 95% CI=.17 to 1.64; p=.02) and in the Stair Climbing Test (SMD=.90, 95% CI=.25 to 1.56; p=.007), respectively, compared with pain-free individuals. One study[10] showed no significant differences for the time in the Stair Descent Test between individuals with PFP and pain-free individuals (SMD=.49, 95% CI=-.14 to 1.12; p =.13).

Step tests: Evidence from one study[10] showed that individuals with PFP have reduced number of repetitions in the Six-Minutes Step Test compared with pain-free individuals (SMD =-1.22, 95% CI=-1.90 to -.54; p<.001). Evidence from one study[108] showed that PFP limb have reduced number of repetitions in the FSDT (mean=17) compared with contralateral pain-free limb (mean=20) of individuals with unilateral PFP. However, the study was not pooled due to missing SD.

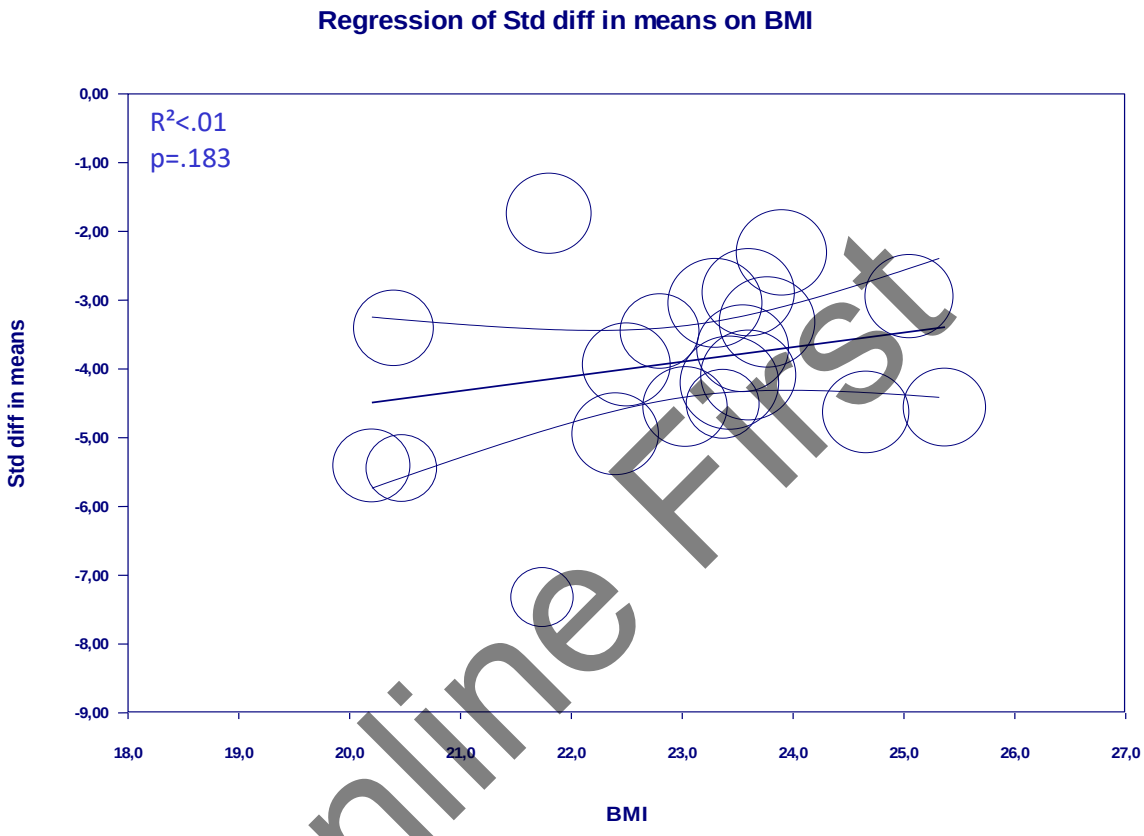
Timed Up and Go Test (TUG): Evidence from one study[62] showed longer time in the TUG in individuals with PFP compared with pain-free individuals (SMD=2.12, 95%CI=1.37 to 2.88; p<.001).

SUPPLEMENTAL MATERIAL I

FIGURE I1. Meta-regression for self-reported function measured with Anterior Knee Pain Scale and age.

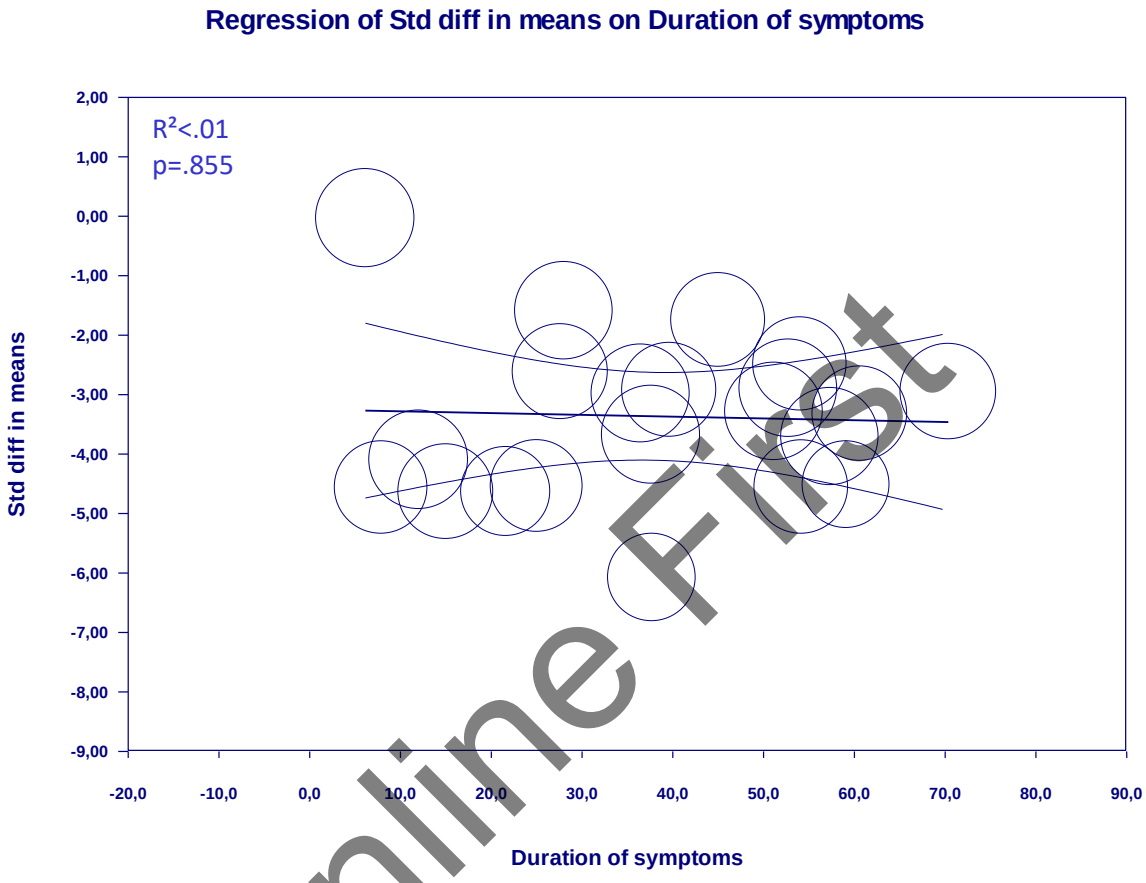
Abbreviations: STD = Standardized differences.

FIGURE I2. Meta-regression for self-reported function measured with Anterior Knee Pain Scale and Body Mass Index (BMI).



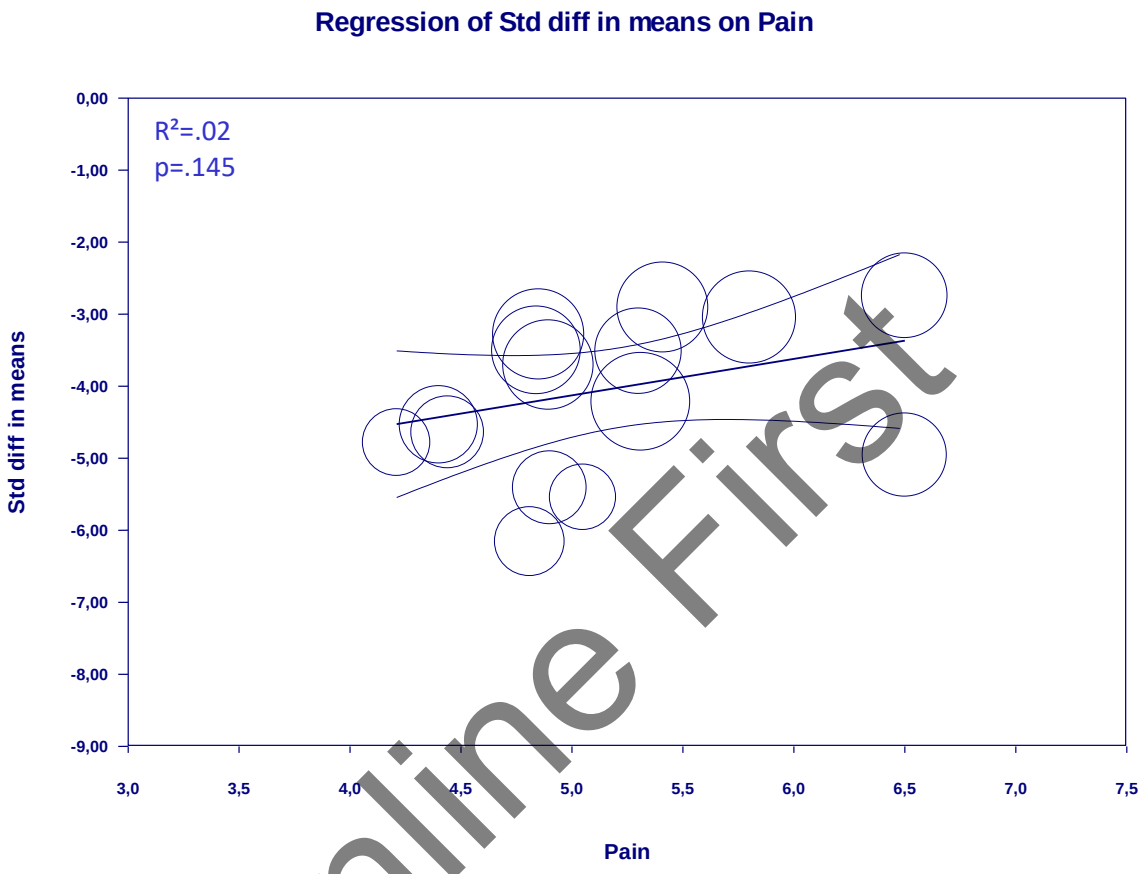
Abbreviations: BMI = Body Mass Index; STD = Standardized differences.

FIGURE I3. Meta-regression for self-reported function measured with Anterior Knee Pain Scale and duration of symptoms.



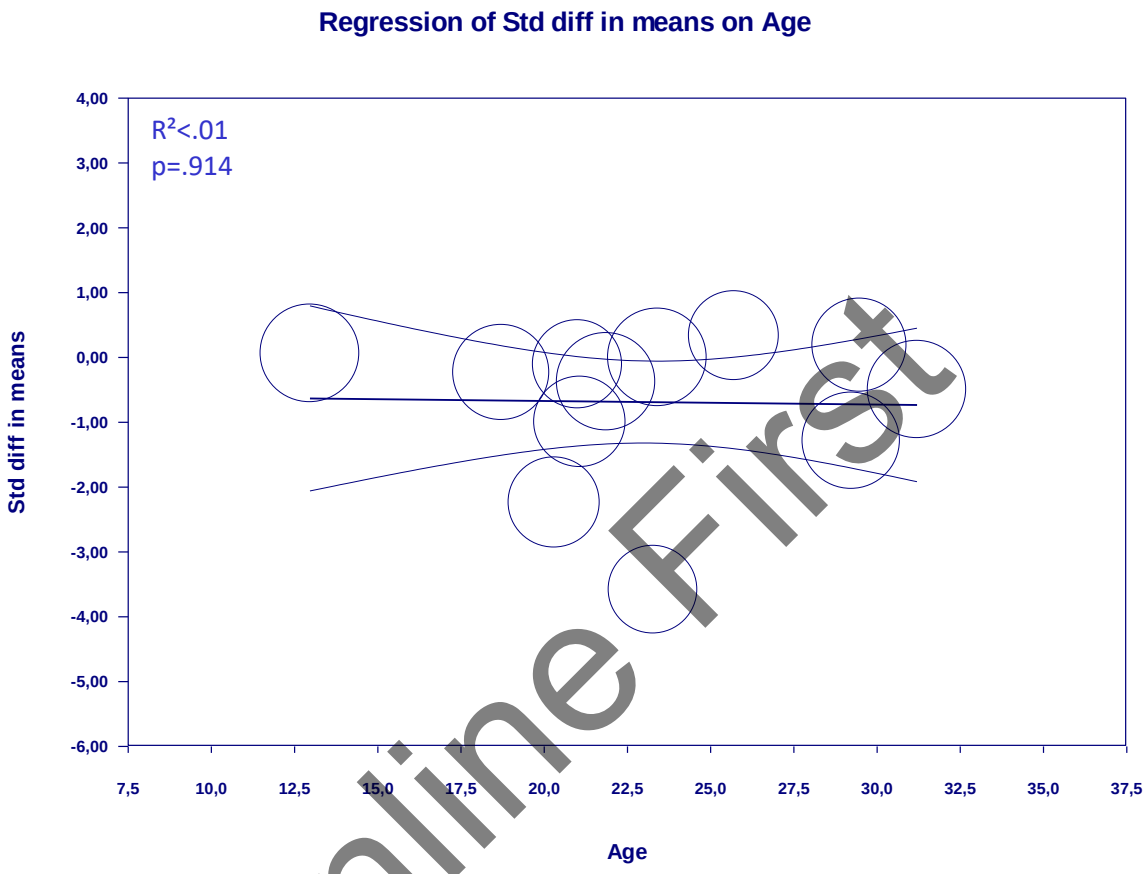
Abbreviations: STD = Standardized differences.

FIGURE I4. Meta-regression for self-reported function measured with Anterior Knee Pain Scale and self-reported pain.



Abbreviations: STD = Standardized differences.

FIGURE I5. Meta-regression for performance-based function measured with balance tests and age.



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			Page
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	5-8 / Table 1
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	4-5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	4 -5/ Supplemental material B
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	5 / Table 1
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	5-6 / Supplemental material C
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	5-6 / Supplemental material C
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	5-6 / Supplemental material C
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	6-7 / Supplemental material D
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	7-8
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	7-8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7-8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7-8
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	7-8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	7-8
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA

Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	8

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	9 / Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	9/ Supplemental material E
Study characteristics	17	Cite each included study and present its characteristics.	9/ Supplemental material F
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	9 -10/ Supplemental material D
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	10-14 / Figure 2,3 and 4
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	10-14 / Supplemental material D
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	10-14 / Figure 2,3 and 4
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	10-14/ Table 2
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	14-19
	23b	Discuss any limitations of the evidence included in the review.	18-19
	23c	Discuss any limitations of the review processes used.	18-19
	23d	Discuss implications of the results for practice, policy, and future research.	14-19
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Title page
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Title page
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Supplemental material A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Title page
Competing interests	26	Declare any competing interests of review authors.	Title page

Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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