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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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PLATELET-RICH PLASMA VERSUS CORTICOSTEROID IN THE TREATMENT OF KNEE OSTEOARTHRITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Abstract.

Objective: The aim of this meta-analysis is to evaluate the clinical effectiveness of intra-articular injections of platelet-rich plasma (PRP) versus corticosteroid (CS) in treating knee osteoarthritis (KOA).

Methods: A comprehensive search of the PubMed, Embase, and Web of Science databases was conducted for literature on intra-articular PRP and CS injections for the treatment of knee osteoarthritis, with the search period extending to December 2023. The risk of bias was assessed using the Cochrane Risk of Bias tool, and statistical analysis was subsequently carried out using Review Manager 5.4.1 software. The efficacy of PRP versus CS injections across various studies was compared based on the weighted mean difference and 95% confidence interval for scores from the Visual Analogue Scale (VAS), Knee Osteoarthritis Outcome Score (KOOS), and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

Results: In our analysis, we incorporated twelve studies encompassing a total of 801 joints, of which 404 were in the PRP group and 397 in the CS group. PRP group was significantly reduced the VAS score than CS group in 3-month (P=0.003), 6-month (P=0.007) and 9-month (P<0.00001); PRP group was significantly reduced the WOMAC total score compared to CS group in 1-month (P=0.01), 6-month (P=0.003), 9-month (P=0.005) and 12-month (P<0.00001); In 3-month and 6-month, PRP group were significantly increased the KOOS pain relief score (3-month: P=0.002, 6-month: P<0.00001), the KOOS activities of daily living scores (3-month: P<0.00001, 6-month: P<0.00001) and the KOOS quality of life score (3-month: P=0.003, 6-month: P<0.00001) compared to CS group; PRP group also were significantly increased the KOOS sports score in 3-month compared to CS group (P=0.04). The leukocyte-poor PRP (LP-PRP) group was significantly reduced the VAS score compared to CS group (P=0.04).

Conclusion: Recent findings indicate that intra-articular injections of PRP yield superior results in alleviating pain and enhancing functionality in individuals with knee osteoarthritis, as opposed to CS injections. During short-term follow-up, no significant difference was observed between knee injections of PRP and CS. However, the benefits of PRP injections primarily become apparent in the medium to long-term management of clinical symptoms, including pain relief, enhancing patients' quality of life, increasing activities of daily living, and improving sports capabilities.

Key words. Osteoarthritis, knee joint, Platelet-rich plasma, Corticosteroid.

Introduction.

Osteoarthritis (OA) is a degenerative joint disease characterized by articular cartilage damage, restructuring of the subchondral bone, and chronic synovitis, leading to pain, stiffness, and reduced mobility [1]. It can occur in various joints of the body, primarily including weight-bearing joints such as the knee, hip, and ankle joints, as well as non-weight-bearing joints including the hand and temporomandibular joints [2]. Among these, the knee joint is the most commonly affected [1], with research reports indicating that 16% of the global population suffers from knee osteoarthritis [3]. The prevalence rate is between 6% to 17%, accounting for about 10% in people over the age of 55 [1], of which 25% may become severely disabled [4]. This condition can severely affect patients' mental and emotional health and quality of life, negatively impacting their family life and social interactions. It also has a significant impact on societal economic costs. The treatment of knee osteoarthritis (KOA) often adopts a comprehensive approach, including pharmacotherapy, biomechanical interventions, intra-articular injections, physical therapy, self-education and management, muscle strength training, and weight loss [5].

Corticosteroid (CS) is commonly used medication for intra-articular injection treatments, and their traditional status is supported by the guidelines established by the National Institute for Health and Care Excellence (NICE) in 2019 [6]. Corticosteroid injections are used for treating both acute and chronic inflammation, recommended for short-term treatment of acute flare-ups of knee osteoarthritis. However, their efficacy appears to only last for about one month [7]. Increasing the number of corticosteroid injections may lead to systemic and local adverse reactions. And repeated use may lead to adverse effects, including joint damage and increased risk of infection [8]. This has led to a growing interest in alternative treatments that can offer sustained symptom relief and potentially modify disease progression.

Platelet-rich plasma (PRP) therapy has emerged as a promising option for the treatment of KOA, owing to its potential to promote tissue healing and regeneration [9]. PRP is an autologous blood product with a concentration of platelets higher than that of baseline blood levels [10]. These platelets release growth factors and cytokines that can stimulate the repair of soft tissue and modulate the inflammatory response [11].

CS and PRP are widely used for the treatment of KOA. Their injections are considered safe and effective options for KOA treatment. Even though some studies showed that PRP injections were superior to CS, the efficacy of PRP in comparison to

corticosteroids remains a subject of debate [12].

Therefore, the purpose of this meta-analysis is to evaluate the clinical efficacy of intra-articular PRP injections and CS injections in patients with KOA in terms of knee function recovery and pain relief.

Materials and Methods.

The meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2020 guidelines [13]. The protocol of the current meta-analysis has been registered with PROSPERO (CRD42024506576).

Search strategy:

We conducted a comprehensive search of PubMed, Embase, and Web of Science databases for pertinent publications through December 2023. The search terms and keywords include "Osteoarthritis" "Platelet-Rich Plasma" "Platelet-Rich Fibrin" "Platelet Rich Plasma" "Corticosteroid" "Steroids" "Adrenal Cortex Hormones" "PRP" "PRF". Search keywords are provided in Supplementary Table 1. Furthermore, reference lists of chosen articles were manually examined to identify additional germane studies.

Inclusion and exclusion criteria:

We considered studies for this review based on the following inclusion criteria: (1) patients diagnosed with KOA using IA PRP injections and comparing this treatment to IA CS injections; (2) randomized controlled trials (RCTs).

Exclusion criteria encompassed duplicate articles, abstracts without full text, letters, case reports, reviews, meta-analyses, and irrelevant titles or abstracts. Studies presenting incomplete or ambiguous data precluding outcome calculation were also excluded.

Two investigators independently assessed article titles and abstracts according to the established inclusion and exclusion criteria. Subsequently, they examined the full text to verify study eligibility. Disagreements were resolved through discussion until a consensus was reached.

Quality assessment:

Utilizing the Cochrane Risk of Bias Tool for randomized trials, two independent researchers evaluated the quality levels of the included studies. Factors such as random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete data (attrition bias), selective reporting (reporting bias), and other biases were examined by both reviewers. In case of any discrepancies, a third researcher was consulted for resolution.

Data extraction:

Two researchers independently performed data extraction for each included article, encompassing author, year, country, comparison, age, number of joints, follow-up period, outcome, dose, leukocyte content and location.

Discrepancies among the researchers were resolved through discussion, ultimately reaching a consensus.

Outcome measures:

Outcome measures encompassed the Visual Analogue Scale (VAS) [14], Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [15], Knee Osteoarthritis Outcome Score (KOOS) [16]. Unlike the VAS and WOMAC scores, the higher the score of the KOOS represents knee pain relief and functional improvement. The primary outcome measure is VAS score, while the secondary outcome measures are WOMAC and KOOS scores.

Statistical analysis:

For this analysis, continuous outcomes were evaluated using the weighted mean difference (WMD). Corresponding 95% confidence interval (CI) were also calculated to provide an estimation of the range. To assess the heterogeneity among the included studies, Cochran's I^2 and Q statistics were employed. Based on I^2 values, heterogeneity was categorized as low (25%), moderate (50%), or high (75%). A fixed-effects model was employed when the I^2 value was below 50%; otherwise, a random-effects model was utilized. In cases of substantial heterogeneity ($I^2 \geq 50\%$). Subgroup analysis in different white blood cell levels was performed.

For all statistical tests, a two-tailed P value below 0.05 was considered statistically significant. Statistical analyses were conducted using Revman 5.4.1 software.

Results.

Literature search and study selection.

The initial search yielded 797 publications. Of these, 169 were identified as duplicates, and 610 did not meet the eligibility criteria, thus were excluded from further consideration. A thorough evaluation of the full texts of the remaining 18 articles resulted in the exclusion of an additional 6 studies, due to insufficient data (n = 2), non- randomized controlled trial (n = 1) or non- knee joints (n = 3). Ultimately, 12 randomized controlled trials assessing the efficacy of two methods of intra-articular injection of PRP and corticosteroid for the treatment of knee osteoarthritis were included in the analysis [17-28]. Figure 1 illustrates the PRISMA flow diagram in the study selection process.

Study description and quality assessment.

The 12 eligible studies encompassed a total of 801 joints, with 404 in the PRP group and 397 in the CS group. The number of joints studied in each research varied from 15 to 52. The mean age of patients ranged from 50.9 to 70.2 years. The study characteristics are concisely summarized in Table 1.

Figure 2 displays the risk of bias for each study, as determined by the Cochrane Risk of Bias Tool. Overall, the included studies exhibited acceptable quality.

Quantitative analysis of visual analogue scale scores in different months in knee osteoarthritis treatment.

Considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the VAS score (WMD: 0.16, 95% CI: -0.37 to 0.70, P=0.56) compared to the CS group in 1-month. However, PRP group was significantly reduced the VAS score compared to the CS group in 3-month (WMD: -0.67, 95% CI: -1.11 to -0.23, P=0.003), 6-month (WMD: -1.37, 95% CI: -2.37 to -0.37, P=0.007) and 9-month (WMD: -1.33, 95% CI: -1.79 to -0.87, P<0.00001) (Figure 3).

Table 1. *The study characteristics of the included studies.*

Author	Year	Country	Study design	Outcome	Com-parison	Mean age±SD	Number of joints	Follow-up period	Dose	Leukocyte Content	Location
Forogh et al.	2016	Iran	Randomized controlled trial	①③	PRP	59.13±7.03	24	6 months	5 mL PRP	leukocyte-rich PRP	Knee
					CS	61.13±6.7	24	6 months	1 mL (40mg) metryprednisolone		
Jubert et al.	2017	Spain	Randomized controlled trial	①③	PRP	65.56 ± 8.6	35	6 months	4 mL PRP	leukocyte-poor PRP	Knee
					CS	68 ± 7.17	30	6 months	2 mL betamethasone		
Khan et al.	2018	Pakistan	Randomized controlled trial	①②	PRP	50.912±13.07	52	6 months	5 mL PRP	leukocyte-rich PRP	Knee
					CS	52.089±12.1	51	6 months	1 mL (40 mg) triamcinolone		
Nabi et al.	2018	Iran	Randomized controlled trial	①③	PRP	59.09 ± 7.79	36	6 months	5 mL PRP	leukocyte-rich PRP	Knee
					CS	58.55 ± 8.79	36	6 months	40 mg Triamcinolone		
Phul et al.	2018	Pakistan	Randomized controlled trial	①	PRP	54.45±4.54	40	3 months	NA	leukocyte-rich PRP	Knee
					CS	57.65±10.36	40	3 months	2 mL (40 mg) Triamcinolone		
Güvendi et al.	2018	Turkey	Randomized controlled trial	①②	PRP	60.4±1.7	19	6 months	NA	leukocyte-rich PRP	Knee
					CS	62.8±1.7	19	6 months	7 mg betamethasone		
Huang et al.	2019	China	Randomized controlled trial	①②	PRP	54.5 ± 1.2	40	12 months	NA	leukocyte-poor PRP	Knee
					CS	54.3 ± 1.4	40	12 months	1 mL		
Elksniņš-Finogejevs et al.	2020	Latvia	Randomized controlled trial	①	PRP	66.4 ± 8.4	20	12 months	8 mL PRP	leukocyte-rich PRP	Knee
					CS	70.2 ± 9.2	20	12 months	1 mL (40 mg) Triamcinolone		
Nunes-Tamashio et al.	2022	Brazil	Randomized controlled trial	①②	PRP	65.8 ± 6.1	34	52 weeks	NA	leukocyte-rich PRP	Knee
					CS	67.6 ± 7.4	33	52 weeks	2 mL (40 mg) Triamcinolone		
Pretorius et al.	2022	Ireland	Randomized controlled trial	①②	PRP	63.8 ± 9.7	31	26 weeks	5 mL PRP	leukocyte-rich PRP	Knee
					CS	63.8 ± 9.7	31	26 weeks	2 mL (80 mg) methylpredniso-lone		
Freire et al.	2020	Brazil	Randomized controlled trial	②	PRP	64.15 ± 8.02	25	6 months	5 ml PRP	leukocyte-rich PRP	Knee
					CS	60.21 ± 5.92	25	6 months	2.5 mL		
Arora et al.	2023	India	Randomized controlled trial	①②	PRP	54.11 ± 9.56	48	9 months	3 mL PRP	leukocyte-poor PRP	Knee
					CS	54.54 ± 8.19	48	9 months	80 mg methylpredniso-lone		

NA not available; ①Visual Analogue Scale (VAS); ②McMaster Universities Osteoarthritis Index (WOMAC); ③ Osteoarthritis Outcome Score (KOOS).

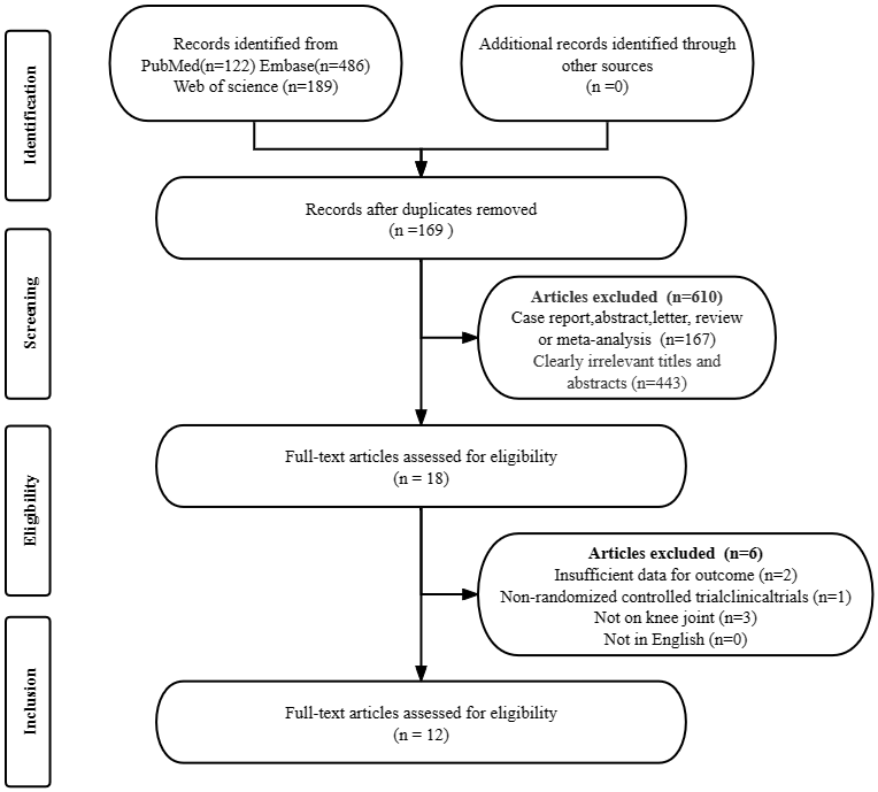

Figure 1. *Literature screening flowchart.*

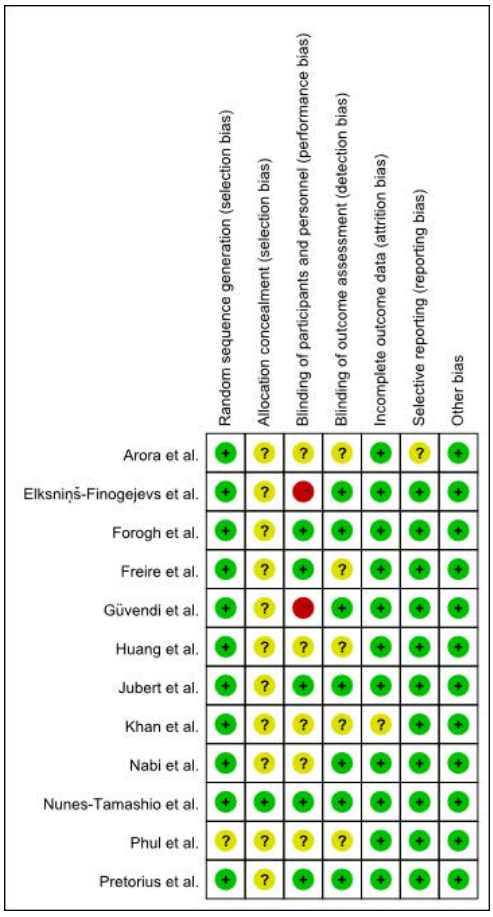

Figure 2. *Risk of bias graph.*

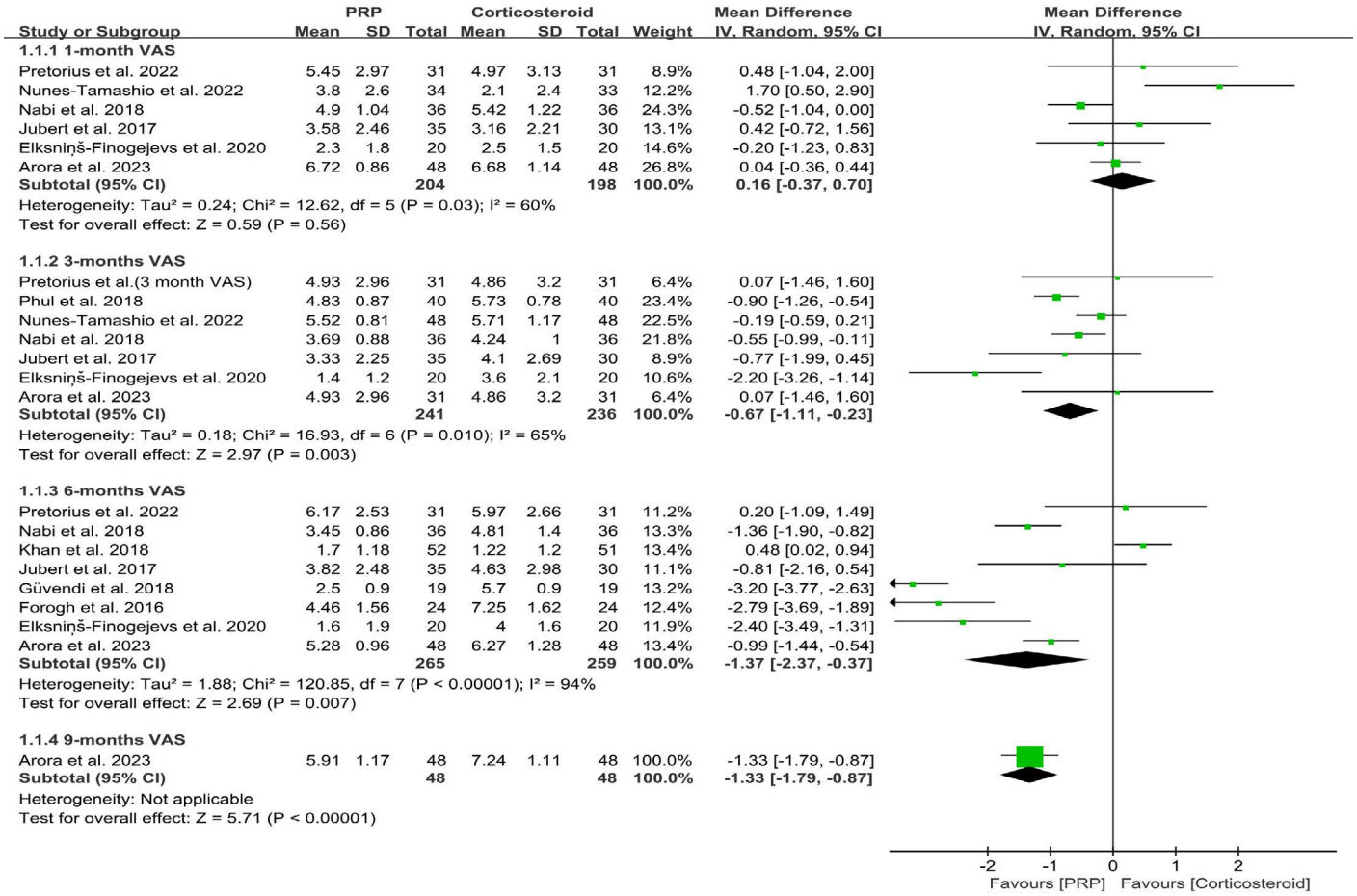

Figure 3. *Forest plot of VAS scores in different months.*

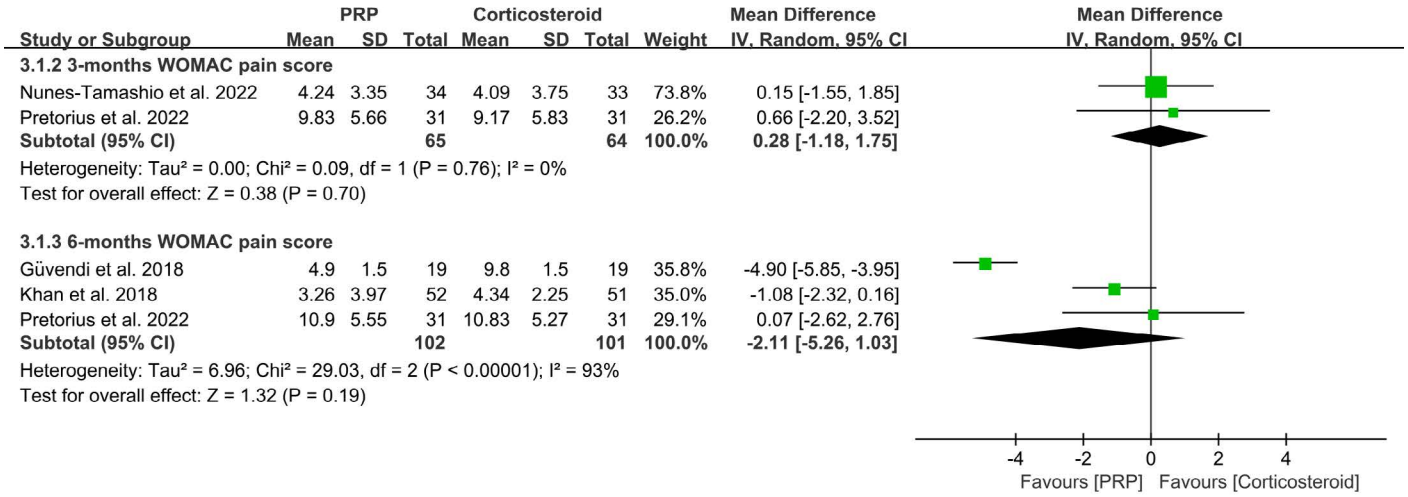

Figure 4. *Forest plot of WOMAC pain scores in different months.*

Quantitative analysis of WOMAC scores in different months.

For WOMAC pain scores, considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the WOMAC pain score (WMD: 0.28, 95% CI: -1.18 to 1.75, P=0.70) compared to the CS group in 3-month. PRP group were also no significant differences in the WOMAC pain score (WMD: -2.11, 95% CI: -5.26 to 1.03, P=0.19) compared to the CS group in 6-month (Figure 4).

For WOMAC stiffness scores, considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the WOMAC stiffness score compared to the CS group in 3-month (WMD: 0.21, 95% CI: -0.41 to 0.83, P=0.51) and 6-month (WMD: -0.59, 95% CI: -2.20 to 1.02, P=0.47). However, CS group significantly reduced the WOMAC stiffness score (WMD: 0.86, 95% CI: 0.22 to 1.50, P=0.008) compared to PRP group in 1-month (Figure 5).

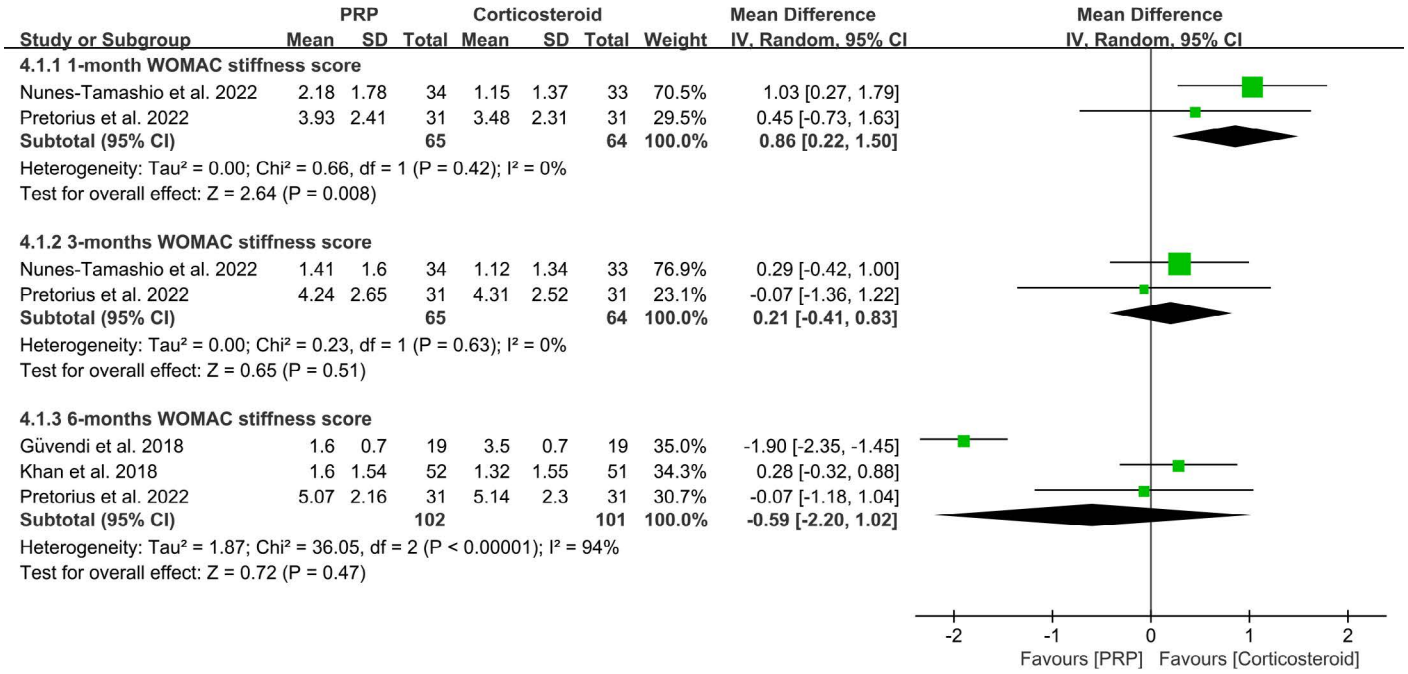

Figure 5. *Forest plot of WOMAC stiffness scores in different months.*

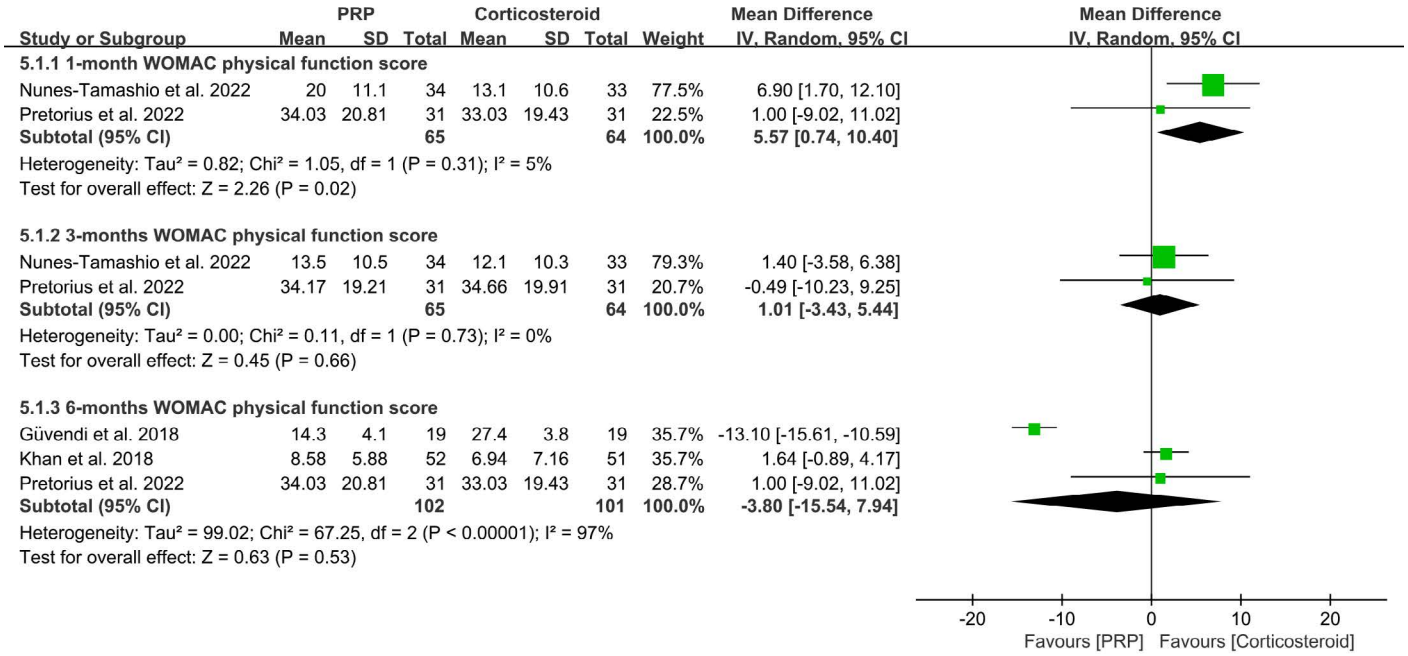

Figure 6. *Forest plot of WOMAC physical function scores in different months.*

For WOMAC physical function scores, considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the WOMAC physical function score in 3-month (WMD: 1.01, 95% CI: -3.43 to 5.44, P=0.66) and 6-month (WMD: -3.80, 95% CI: -15.54 to 7.94, P=0.53) compared to the CS group. However, CS group significantly reduced the WOMAC physical function score (WMD: 5.57, 95% CI: 0.74 to 10.40, P=0.02) compared to PRP group in 1-month (Figure 6).

For WOMAC total scores, considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the WOMAC total score in 3-month (WMD: -7.35, 95% CI: -24.27 to 9.57, P=0.39) compared to the CS group. However, PRP group was significantly reduced the WOMAC total score compared to the CS group in 1-month (WMD: -9.39, 95% CI: -16.70 to -2.08, P=0.01), 6-month (WMD: -9.20, 95% CI: -15.34 to -3.05, P=0.003), 9-month (WMD: -11.98, 95% CI: -20.41 to -3.54, P=0.005) and 12-month (WMD: -16.08, 95% CI: -19.17 to -12.99, P<0.00001) (Figure 7).

Quantitative analysis of KOOS scores in different months.

For KOOS pain relief scores, considering the low heterogeneity,

the fixed-effect model was performed. Meta-analysis found that PRP group were no significant differences in the KOOS pain relief score in 1-month (WMD: 0.60, 95% CI: -4.12 to 5.32, P=0.80) compared to the CS group. However, PRP group were significantly increased the KOOS pain relief score compared to the CS group in 3-month (WMD: 6.30, 95% CI: 2.27 to 10.32, P=0.002) and 6-month (WMD: 18.18, 95% CI: 14.27 to 22.08, P<0.00001) (Figure 8).

For KOOS symptom relief scores, considering the high heterogeneity, the random-effect model was performed. Meta-analysis found that PRP group were no significant differences in the KOOS symptom relief score in 1-month (WMD: 0.94, 95% CI: -4.53 to 6.41, P=0.74) , 3-month (WMD: 3.72, 95% CI: -6.25 to 13.69, P=0.46) and 6-month (WMD: 10.30, 95% CI: -2.79 to 23.38, P=0.12) compared to the CS group (Figure 9).

For KOOS activities of daily living (ADL) scores, considering the low heterogeneity, the fixed-effect model was performed. Meta-analysis found that PRP group were no significant differences in the KOOS ADL score in 1-month (WMD: 1.29, 95% CI: -1.52 to 4.11, P=0.37) compared to the CS group. However, PRP group were significantly increased the KOOS ADL score compared to the CS group in 3-month (WMD: 7.65, 95% CI: 4.66 to 10.65, P<0.00001) and 6-month (WMD: 17.38, 95% CI: 14.49 to 20.28, P<0.00001) (Figure 10).

For KOOS sports scores, considering the low heterogeneity, the fixed-effect model was performed. Meta-analysis found that PRP group were no significant differences in the KOOS sports score in 1-month (WMD: -3.66, 95% CI: -14.90 to 7.57, P=0.52) and 6-month (WMD: 5.79, 95% CI: -4.97 to 16.55, P=0.29) compared to the CS group. However, PRP group were significantly increased the KOOS sports score compared to the CS group in 3-month (WMD: 5.54, 95% CI: 0.14 to 10.95, P=0.04) (Figure 11).

For KOOS quality of life (QoL) scores, considering the low heterogeneity, the fixed-effect model was performed. Meta-analysis found that PRP group was no significant differences in the KOOS QoL score in 1-month (WMD: -0.36, 95% CI: -5.61 to 4.88, P=0.89) compared to the CS group. However, PRP group were significantly increased the KOOS QoL score compared to the CS group in 3-month (WMD: 6.93, 95% CI:

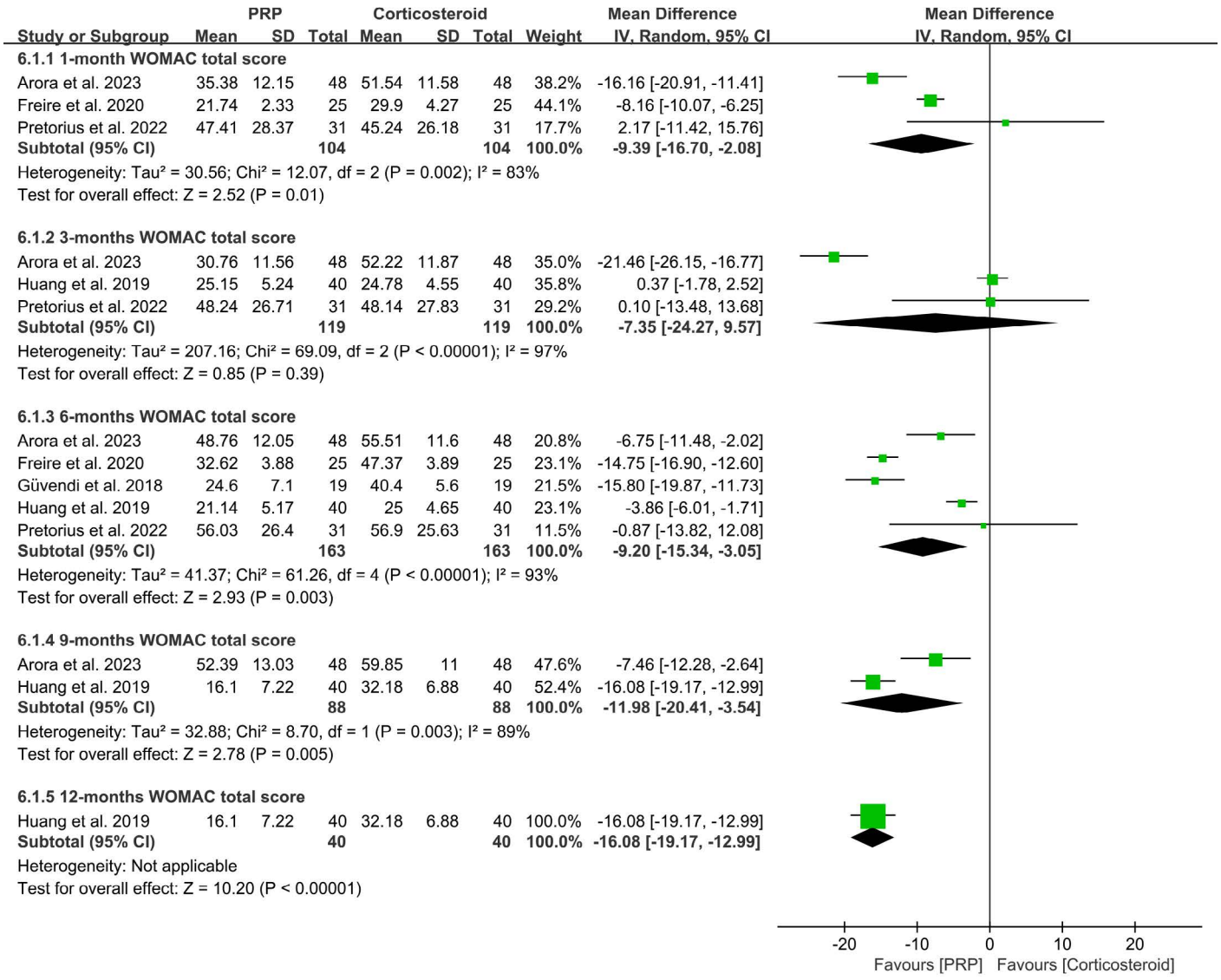

Figure 7. *Forest plot of WOMAC total scores in different months.*

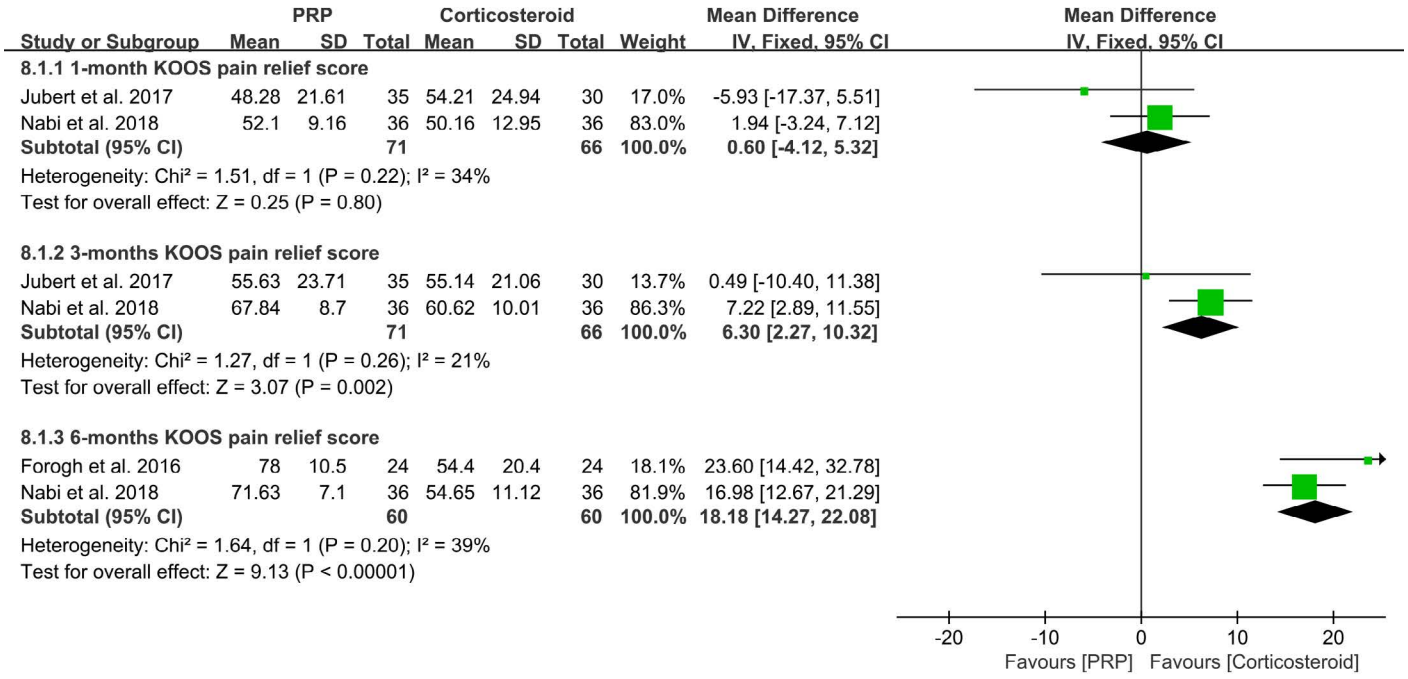

Figure 8. *Forest plot of KOOS pain relief scores in different months.*

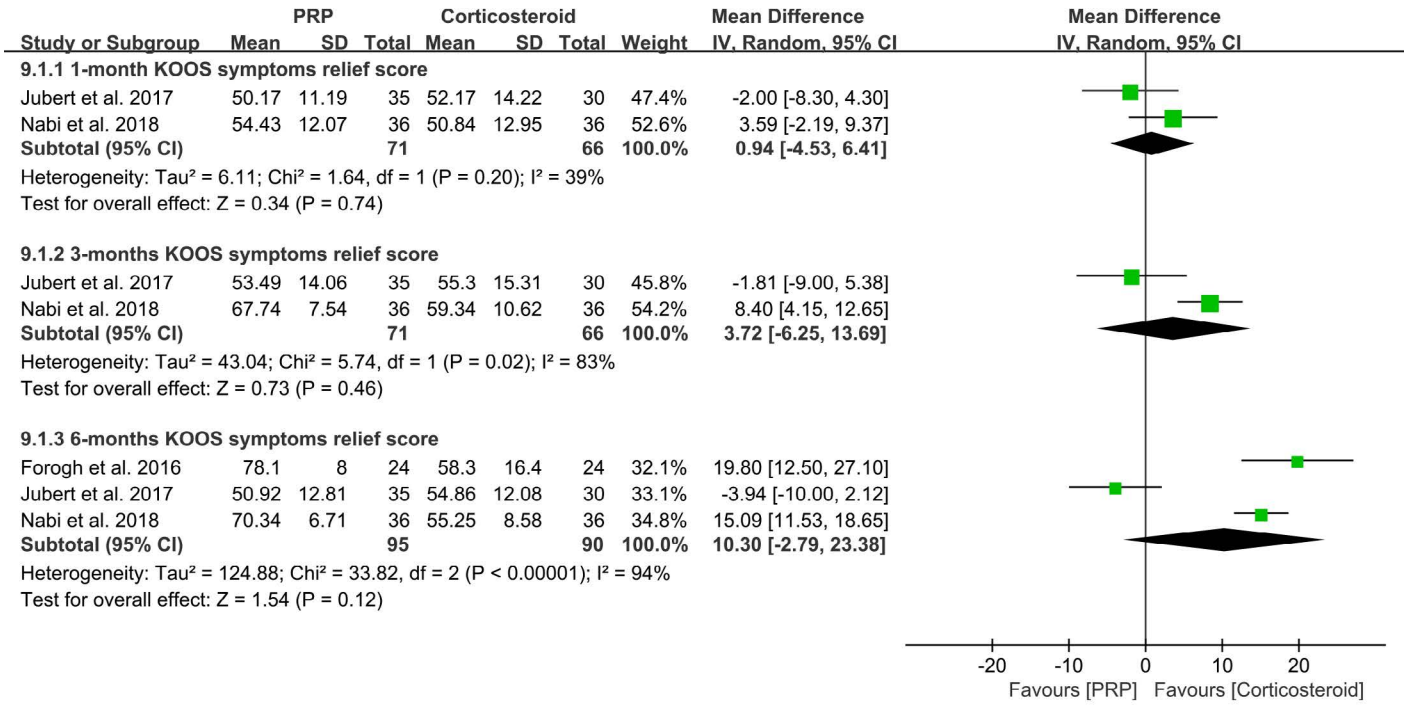

Figure 9. *Forest plot of KOOS symptom relief scores in different months.*

2.34 to 11.53, P=0.003) and 6-month (WMD: 10.98, 95% CI: 7.12 to 14.83, P<0.00001) (Figure 12).

Quantitative analysis of LP-PRP versus LR-PRP in visual analogue scale scores.

There is currently no standard treatment protocol for knee osteoarthritis using PRP, and based on the preparation method of PRP, it can be classified into leukocyte-poor platelet-rich plasma (LP-PRP) and leukocyte-rich platelet-rich plasma (LR-PRP). At present, there is insufficient evidence to conclusively support the absolute superiority of either LR-PRP or LP-PRP in the treatment of knee osteoarthritis [29]. The leukocyte content in PRP (leukocyte-poor and leukocyte-rich) may influence its therapeutic effects; therefore, we conducted a subgroup analysis based on leukocyte. The VAS scores in the LR-PRP group showed no statistical difference compared to the CS group (WMD: -0.34, 95% CI: -1.05 to 0.37, P=0.35). However, the LP-PRP group was significantly reduced the VAS scores compared to the CS group (WMD: -0.52, 95% CI: -1.02 to -0.02, P=0.04) (Figure 13).

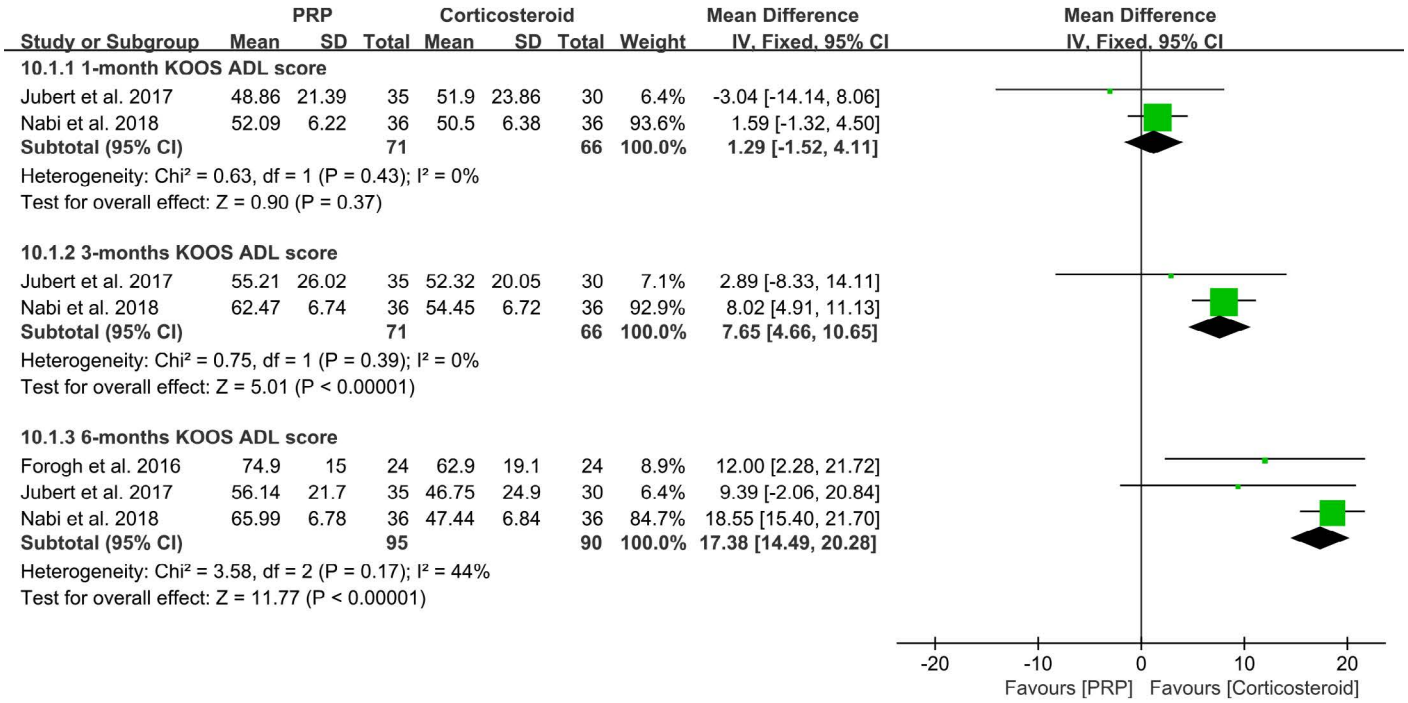

Figure 10. *Forest plot of KOOS scores for activities of daily living in different months.*

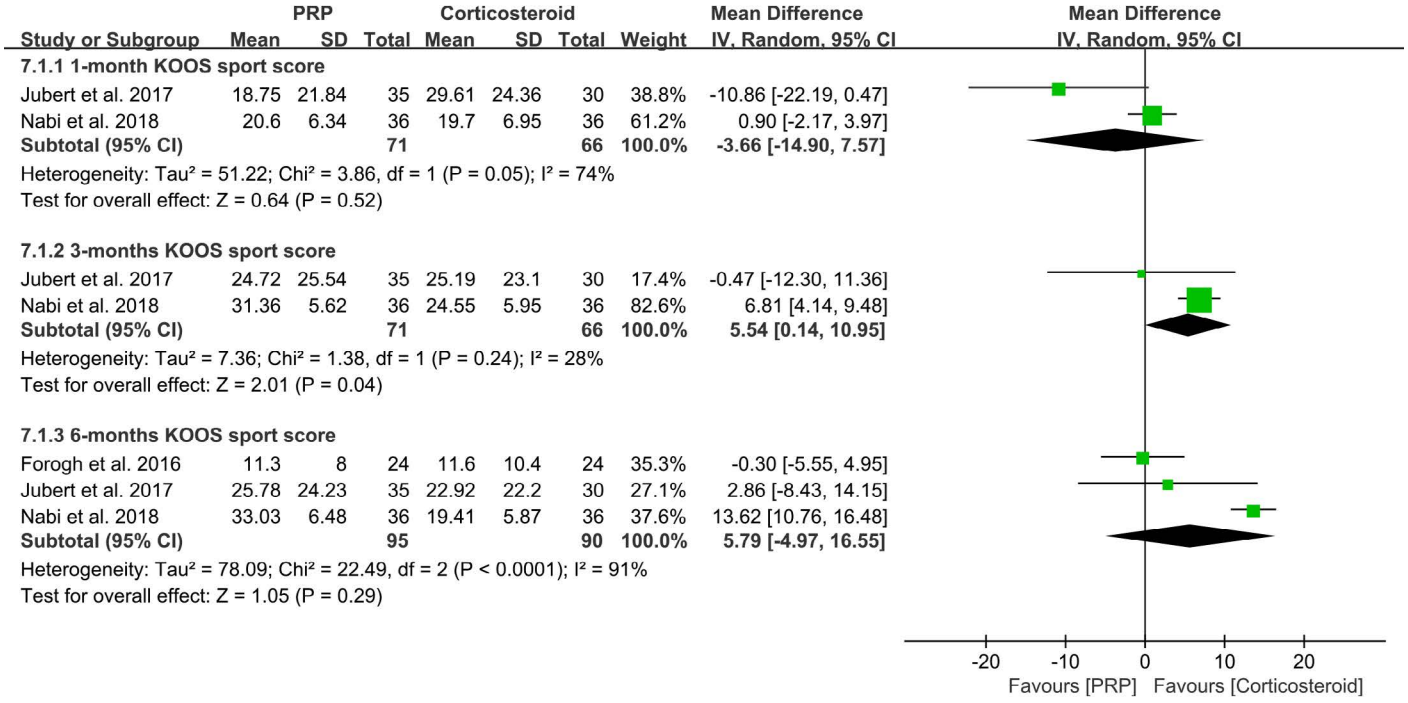

Figure 11. *Forest plot of KOOS sports scores in different months.*

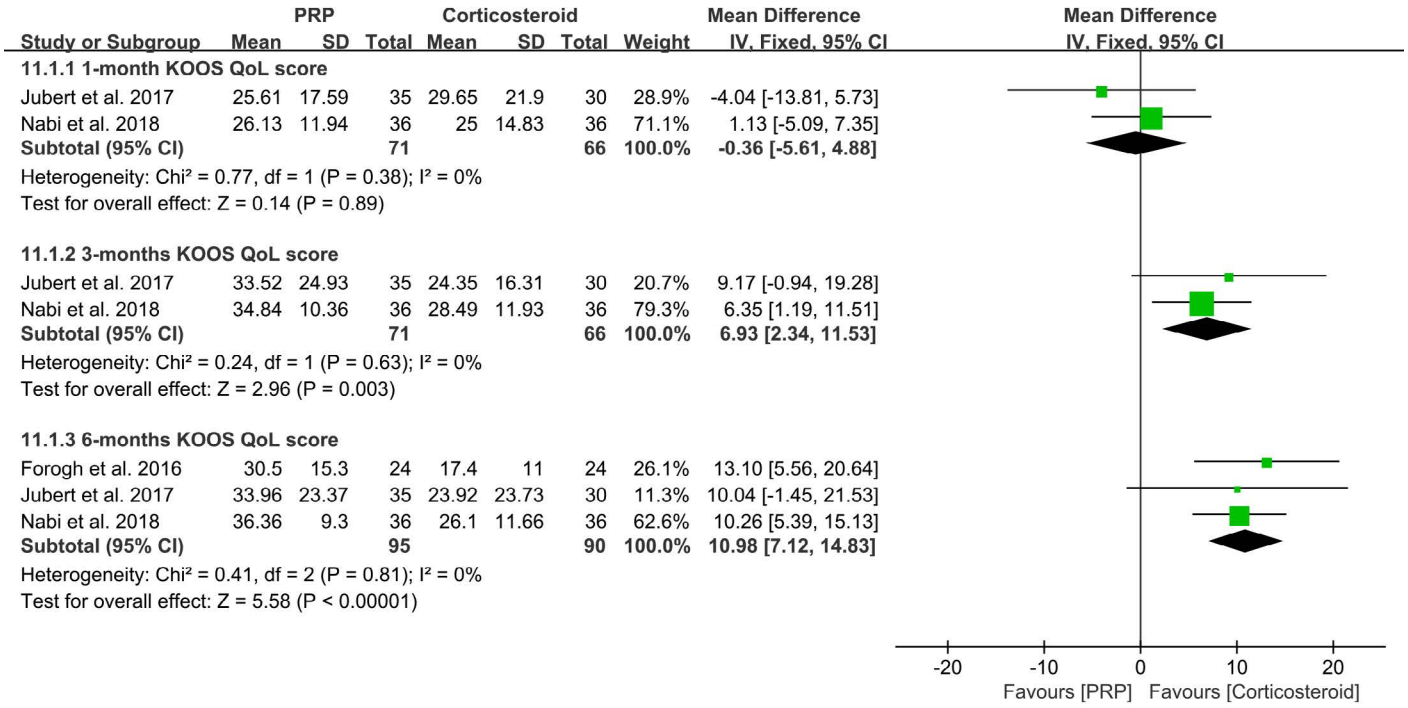

Figure 12. *Forest plot of KOOS quality of life scores in different months.*

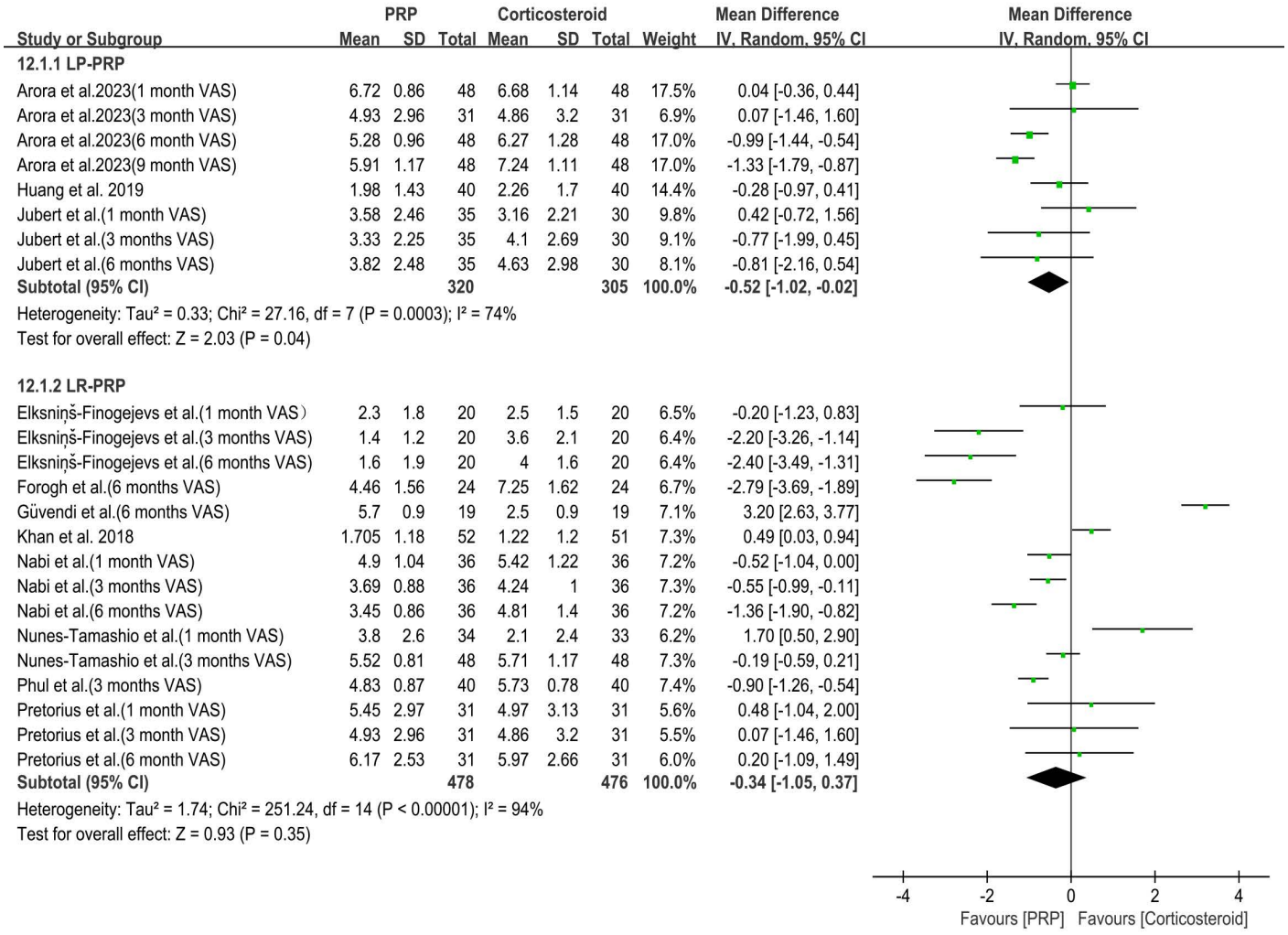

Figure 13. *Forest plot of VAS scores with different leukocyte contents in PRP.*

Publication bias.

Due to the small number of articles included for each outcome measure in this study, all less than ten, it is challenging to assess the symmetry of the funnel plot due to insufficient power. Consequently, we did not evaluate publication bias using funnel plots [30].

Discussion.

A total of 12 RCTs were included in this meta-analysis. The meta-analysis revealed that the VAS scores in the PRP group were significantly reduced than those in the CS group at 3, 6, and 9 months. The PRP group showed significantly increased compared to the CS group in KOOS pain relief scores, KOOS quality of life scores, and KOOS activities of daily living scores at 3 and 6 months. Additionally, the KOOS sports scores in the PRP group were significantly increased than those in the CS group at 3 months. The WOMAC total scores in the PRP group were superior to those in the CS group at 1, 6, 9, and 12 months. These results demonstrate that PRP provides better mid-to-long-term pain relief and functional improvement compared to the CS group in patients with knee osteoarthritis. The CS group showed better WOMAC physical function scores and WOMAC stiffness scores than the PRP group in 1-month. This result suggests that corticosteroid may have better short-term efficacy in improving stiffness and physical function, or it could be due to the limited number of studies assessing WOMAC physical function and stiffness scores in 1-month, with only two items evaluated. The findings of the meta-analysis might change with an increase in the number of included studies, so conclusions obtained need verification from studies with larger sample sizes. Overall, we believe that using PRP intervention compared to intra-articular CS injections in patients with knee osteoarthritis can yield better clinical outcomes, particularly evident in mid-to-long-term pain relief. It can also improve patients' quality of life and enhance their activities of daily living.

These findings suggest that PRP may alleviate joint pain, improve joint function, and enhance overall quality of life in patients possibly through mechanisms involving promoting cartilage repair and suppressing inflammatory responses [31]. On the one hand, through PRP injection, platelets are activated, leading to the release of fibrinogen, cytokines, growth factors, platelet-derived growth factor, tissue growth factor, and vascular endothelial growth factor, thereby reducing chondrocyte apoptosis and matrix loss, counteracting inflammatory mediators and enzymes, and stimulating chondrocyte proliferation, angiogenesis, cartilage formation, and proliferation of mesenchymal stem cells [32]. Due to the continuous release of growth factors for an extended period, sustained clinical effects are achieved [33]. On the other hand, PRP contains certain white blood cells, which can reduce inflammatory markers and decrease the expression of inflammatory enzymes, thereby exerting anti-inflammatory effects [34].

Corticosteroids possess complex anti-inflammatory and immunosuppressive effects, disrupting immune and inflammatory cascade reactions at multiple levels [35-37]. Due to the potent anti-inflammatory effects of corticosteroids, they can provide short-term relief for clinical symptoms such as joint swelling, local heat, and tenderness in patients with knee osteoarthritis. However, frequent, or long-term use of corticosteroids may lead to structural damage in the joints, including meniscal injury and narrowing of the joint space [38]. Moreover, corticosteroids cannot prevent the progression of knee osteoarthritis or repair damaged joint structures [39]. Therefore, for long-term relief of knee osteoarthritis symptoms and repair of damaged cartilage, we may be inclined to use PRP intervention.

PRP treatment lacks standardization, and differences in preparation methods have been identified in current evidence [9]. The efficacy of PRP treatment for knee osteoarthritis is influenced by its preparation type [40], such as white blood cell content. Therefore, we also conducted subgroup analysis based on PRP types (LR-PRP or LP-PRP). The results revealed that there was no statistically significant difference in VAS scores between the LR-PRP group and the CS group (WMD: -0.34, 95% CI: -1.05 to 0.37, P=0.35). However, the LP-PRP group showed significantly reduced VAS scores compared to the CS group (WMD: -0.52, 95% CI: -1.02 to -0.02, P=0.04). There is debate regarding which type, LR-PRP containing more pro-inflammatory mediators or LP-PRP containing fewer pro-inflammatory mediators, has the advantage in the treatment of osteoarthritis [41]. On the one hand, some argue that the initial pro-inflammatory phase is crucial for tissue repair and regeneration [42]. On the other hand, others believe that LP-PRP, with fewer white blood cells, may reduce certain inflammatory responses, relying more on the growth factors in platelet-rich plasma to promote cell proliferation, tissue regeneration, and healing [43]. Our research results showed that subjects in the LP-PRP group performed better in pain relief compared to the CS group. However, there is no direct comparison between the LP-PRP group and the LR-PRP group, so it is not possible to evaluate which treatment for KOA is more advantageous, and further research is needed to confirm this.

Previously, scholars have used meta-analysis methods to compare the efficacy and differences between PRP and CS in the clinical application for patients with knee osteoarthritis. McLarnon et al. [44] included 7 RCTs and 1 cohort study, while Costa et al. [45] included 7 RCTs. McLarnon et al.'s meta-analysis showed that compared to CS injection, participants in the PRP group demonstrated better outcomes in WOMAC stiffness scores for knee osteoarthritis. This discrepancy may arise from the inclusion of additional literature in our study, leading to different results. They concluded that PRP injection showed better clinical efficacy compared to CS injection for knee osteoarthritis, particularly evident in pain relief and improved participation in physical activities. This aligns with our research findings. However, this study only analyzed the KOOS subscale for sports and did not analyze other subscales of the KOOS. Our study findings revealed that the PRP group significantly increased KOOS pain relief scores, KOOS quality of life scores, and KOOS activities of daily living scores compared to the CS group at 3 and 6 months. Additionally, the KOOS sports scores in the PRP group were superior to those in the CS group at 3 months. This could be attributed to the inclusion of a greater number of studies in our analysis, leading to obtaining more meaningful results. Unlike our meta-analysis,

which only included RCT studies, this study simultaneously included RCTs and cohort studies. This may introduce more bias and heterogeneity, thereby affecting the interpretation of the analysis results and potentially lowering the overall evidence grade of the meta-analysis [46]. Costa et al.'s meta-analysis results indicated that in midterm follow-up, PRP was more effective than CS in alleviating KOA pain and improving joint function. In long-term follow-up, PRP was superior to the CS group in improving joint function. Like our study findings, this article also affirms the mid-to-long-term efficacy of PRP treatment for knee osteoarthritis. This study utilized VAS, WOMAC pain scores, and KOOS pain relief scores to jointly assess the pain manifestation of knee osteoarthritis. Simultaneously, WOMAC scores and KOOS activities of daily living scores were used to evaluate functional performance, and these results were combined statistically. The use of different assessment scales may increase the heterogeneity of outcome measures. Although WOMAC, VAS, and KOOS can all assess pain, each assessment tool has its specific measurement range and method. Their scoring systems, scale lengths, and focus on details differ. When statistically combining these results, data from different assessment tools may increase the heterogeneity of the meta-analysis, thus affecting the stability and credibility of the conclusions [47]. Our study separately analyzed different scales and their subscales. We conducted combined analyses of results from studies using the same assessment scale. This approach can reduce result heterogeneity, enhance consistency and comparability of conclusions, thus contributing to improving the overall quality of the meta-analysis. Furthermore, compared to previous two meta-analyses, we included a greater number of RCT studies investigating PRP and CS interventions for KOA. This enables a more comprehensive evaluation of the clinical effectiveness of PRP and CS interventions for KOA, thereby providing better evidence-based support for clinical practice. McLarnon et al. conducted subgroup analysis on the white blood cell levels of PRP. They suggested that LR-PRP appeared to be more effective than LP-PRP in alleviating pain. This differs from our study findings, which showed that the VAS scores in the LP-PRP group were superior to those in the CS group, while there was no significant difference in VAS scores between the LR-PRP group and the CS group. This could be due to the inclusion of more updated studies in our analysis, resulting in different outcomes. In the future, it may be necessary to incorporate more high-quality studies for further investigation.

Additionally, besides the knee joint, we found three studies comparing the efficacy of PRP and CS treatment for osteoarthritis in other joints. Among them, two studies focused on the hand joints, and one study examined the temporomandibular joint. Kutuk et al. [48] randomized patients with temporomandibular joint osteoarthritis into PRP and CS groups and followed them up for 3 months. The study results showed that compared to the CS group, intra-articular PRP injection was more effective in alleviating palpation pain in the temporomandibular joint. Malahias et al. [49] randomized 33 patients with hand joint osteoarthritis into two groups: 16 patients received PRP injections, and 17 patients received CS injections. After a 12-month follow-up, they concluded that corticosteroids could provide short-term symptom relief, but PRP might achieve a lasting effect lasting up to 12 months. The findings from these two studies, consistent with our research results, affirm the clinical efficacy of PRP and its superior performance compared to CS. Sabah et al. [50] compared the efficacy of PRP and CS treatments for hand joint osteoarthritis. Although both groups showed improvement in various scores at the 1-month follow-up compared to before treatment, unfortunately, these positive effects did not persist for 3 months. There are fewer studies on the treatment of joints other than the knee with PRP and CS. Although PRP treatment for osteoarthritis in other joints shows some promise, its efficacy remains controversial. We look forward to more high-quality clinical studies investigating the efficacy of PRP and CS interventions in various joints such as the hip, shoulder, ankle, and hand joints in the future. When discussing the advantages and disadvantages of PRP and CS, it's essential to consider factors beyond efficacy, such as price, cost-effectiveness, and feasibility. Indeed, the preparation process for PRP requires special equipment and expertise, leading to higher treatment costs. However, in the long term, PRP may demonstrate higher cost-effectiveness due to reduced need for repeated treatments and improved quality of life [51]. In contrast, CS treatment is relatively low-cost and easy to administer. However, its short-term efficacy and potential side effects limit its long-term application. Therefore, from a clinical standpoint, PRP offers a more effective treatment option for specific patient populations, such as those who do not respond well to CS treatment, despite the higher initial cost.

Limitations of this study: The follow-up duration of the included studies in this meta-analysis was relatively short. Only one study evaluated the VAS scores for knee joint at 9-month follow-up, and only one study assessed the WOMAC total scores at 12-month follow-up. The studies included in this meta-analysis lacked detailed reporting on the composition, platelet concentration, and white blood cell count of PRP. The included studies exhibited variations in the preparation methods, processes, and injection dosages. Different types and dosages of corticosteroid also varied among the studies. These factors contribute to certain biases in the results of individual studies and exacerbate the heterogeneity of the meta-analysis results. Some outcome measures among the included studies exhibited high heterogeneity, and we did not thoroughly explore the factors contributing to this heterogeneity. This may introduce a certain degree of bias into the analysis results. Some conclusions are based on 1 or 2 studies. For example, we only included 2 studies evaluating WOMAC stiffness scores at the 1-month follow-up, which may lead to type II statistical errors.

Conclusion.

Recent findings indicate that intra-articular injections of PRP yield superior results in alleviating pain and enhancing functionality in individuals with knee osteoarthritis, as opposed to CS injections. During short-term follow-up, no significant difference was observed between knee injections of PRP and CS. However, the benefits of PRP injections primarily become apparent in the medium to long-term management of clinical symptoms, including pain relief, enhancing patients' quality of

life, increasing activities of daily living, and improving sports capabilities.

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Conflict of Interest.

The authors of this article have confirmed that they do not have any conflicts of interest to disclose.

Ethics approval.

Since our meta-analysis did not entail direct contact with patients or access to their personal data, ethical approval was not deemed necessary.

Data availability statement.

This article presents original findings that were generated through our study. For further details or inquiries, interested parties may contact the corresponding author.

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