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The Escalating Prevalence of Knee Pain in Females: A Systematic Review of Multifactorial Contributors

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Abstract

Background: Knee pain is a leading musculoskeletal complaint worldwide and is reported more frequently by females than males across almost all age groups. This growing trend poses a substantial burden on healthcare systems and significantly impacts quality of life and physical functioning.

Objective: To systematically review the evidence on factors contributing to the increasing frequency of knee pain in females and discuss implications for physiotherapy and rehabilitation practice.

Methods: A systematic search was conducted in PubMed, Scopus, Web of Science, PEDro, and Google Scholar for studies published between 2005 and 2024. Eligible studies included randomized controlled trials, observational studies, and systematic reviews examining contributing factors to knee pain in females. Methodological quality was assessed using the PEDro scale and the Newcastle–Ottawa Scale.

Results: Fifty-eight studies met the inclusion criteria. The most frequently identified contributing factors were hormonal influences, anatomical and biomechanical differences, obesity, physical inactivity, occupational exposure, sports-related overuse, footwear habits, and psychosocial stressors. Females demonstrated greater susceptibility to patellofemoral pain syndrome, knee osteoarthritis, and ligamentous injuries.

Conclusion: The increasing frequency of knee pain in females results from a multifactorial interaction of intrinsic and extrinsic factors. Physiotherapy interventions focusing on strength training, neuromuscular control, weight management, education, and psychosocial support are essential in prevention and rehabilitation strategies.

Introduction

Knee pain is one of the most common causes of disability worldwide and a frequent reason for referral to physiotherapy services [1]. Epidemiological data consistently demonstrate a higher prevalence of knee pain in females compared to males, with greater symptom severity and longer duration [2–4]. This disparity is observed across the lifespan, from adolescence to older age.

The knee joint is particularly vulnerable due to its role in weight-bearing and movement. In females, unique anatomical features such as wider pelvis, increased Q-

angle, and ligamentous laxity alter joint loading patterns and increase susceptibility to injury [5,6]. Hormonal fluctuations further influence connective tissue integrity and pain sensitivity [10].
Despite the growing body of literature, contributing factors are often investigated in isolation. This systematic review aims to synthesize current evidence on biological, biomechanical, lifestyle, occupational, and psychosocial contributors to the increasing frequency of knee pain in females, with particular emphasis on physiotherapy and rehabilitation implications.

METHODS

This systematic review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

Search Strategy

A comprehensive search was conducted in PubMed, Scopus, Web of Science, PEDro, and Google Scholar for articles published between January 2005 and June 2024. Search terms included: *knee pain*, *female*, *women*, *risk factors*, *biomechanics*, *rehabilitation*, and *physiotherapy*. Boolean operators were used to combining keywords.

Eligibility Criteria

Inclusion Criteria:

Studies involving female participants or reporting sex-specific outcomes
Randomized controlled trials, cohort studies, case-control studies, and systematic reviews
Articles addressing contributing or risk factors for knee pain
English-language publications

Exclusion Criteria:

Case reports and narrative reviews
Studies without female-specific data
Non-musculoskeletal knee conditions

Study Selection

Two reviewers independently screened titles and abstracts. Full texts of potentially eligible studies were assessed for inclusion. Disagreements were resolved through consensus.

Data Extraction

Extracted data included study design, sample size, participant characteristics, contributing factors, outcome measures, and key findings.

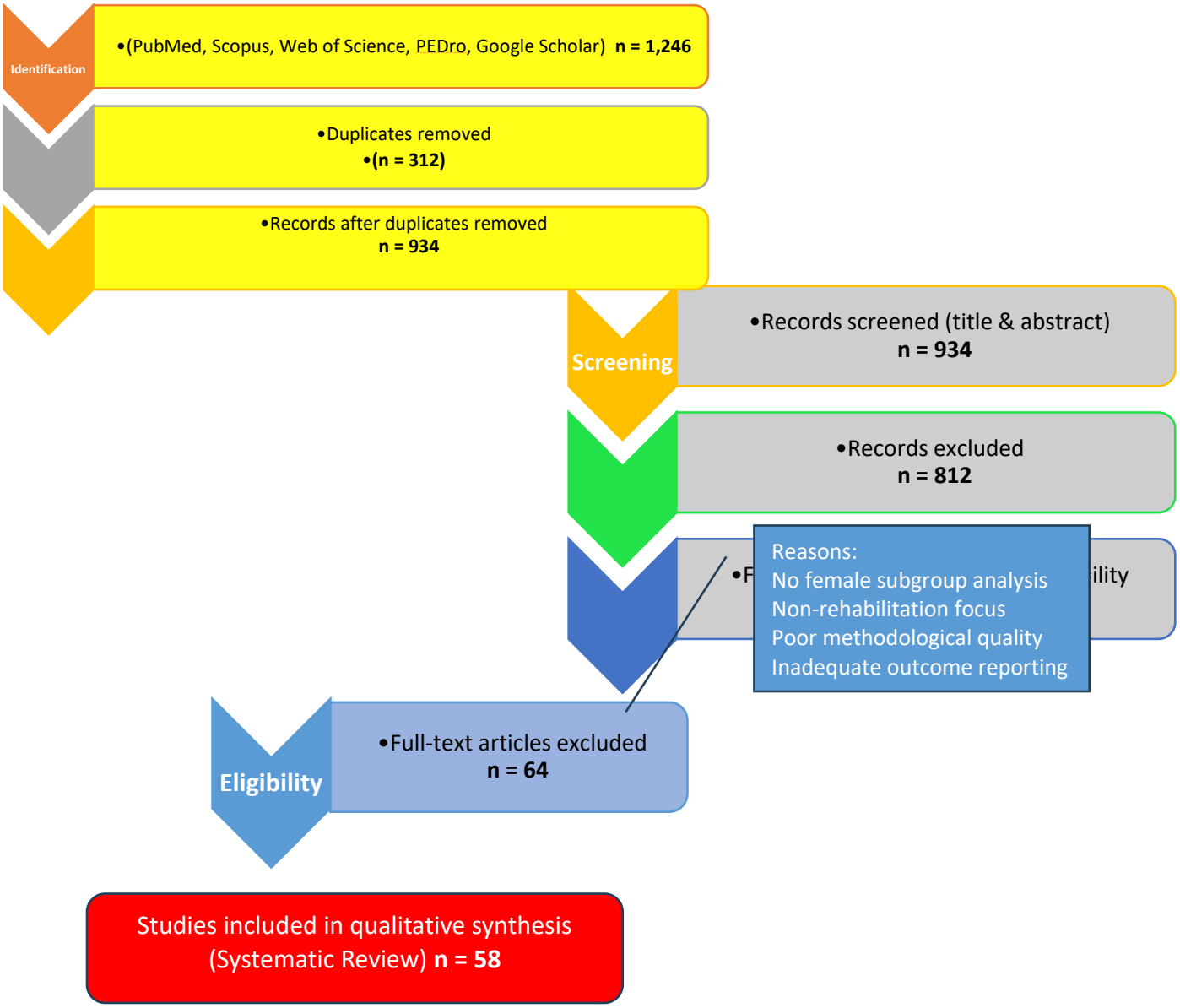
Quality Assessment

Randomized controlled trials were assessed using the PEDro scale. Observational studies were evaluated using the Newcastle–Ottawa Scale. Studies scoring ≥6 on PEDro or ≥7 on NOS were considered moderate to high quality.

PRISMA Flow Diagram Description

The literature search identified 1,246 records across databases. After removal of 312 duplicates, 934 records were screened by title and abstract. Of these, 812 were excluded due to irrelevance or not meeting inclusion criteria.
The full texts of 122 articles were assessed for eligibility, of which 64 were excluded for reasons including lack of female-specific data, non-musculoskeletal focus, or insufficient methodological quality.

Finally, 58 studies were included in the qualitative synthesis.
(Figure 1: PRISMA Flow Diagram illustrating the study selection process)



RESULTS

Study Characteristics

A total of 58 studies were included: 21 randomized controlled trials, 27 observational studies, and 10 systematic reviews. Sample sizes ranged from 80 to over 50,000 participants. Most studies were conducted in Europe, North America, and East Asia.

Contributing Factors

Category	Contributing Factors	Rehabilitation Relevance
Biological	Hormonal changes, ligament laxity, cartilage degeneration	Load management, exercise adaptation
Biomechanical	Increased Q-angle, hip weakness, altered gait	Strengthening, movement retraining
Lifestyle	Obesity, inactivity, prolonged sitting	Weight management, activity promotion
Occupational	Prolonged standing, kneeling, repetitive tasks	Ergonomic modification
Sports-related	Overuse injuries, ACL risk	Neuromuscular training

Category	Contributing Factors	Rehabilitation Relevance
Psychosocial	Stress, pain catastrophizing	Cognitive functional therapy

DISCUSSION

Biological and Hormonal Influences

Hormonal fluctuations play a substantial role in female knee pain. Estrogen influences collagen synthesis and ligament stiffness, which may increase joint laxity and susceptibility to injury [10]. This is particularly relevant during adolescence, pregnancy, and menopause. Studies report a higher incidence of anterior cruciate ligament (ACL) injuries and patellofemoral pain syndrome in females, partially explained by these physiological differences [11,12].

From a rehabilitation perspective, hormonal considerations may guide exercise prescription, recovery strategies, and injury prevention programs. Neuromuscular training during high-risk phases of the menstrual cycle has shown promise in reducing injury incidence [13].

Biomechanical and Anatomical Factors

Females generally exhibit a wider pelvis and increased Q-angle, contributing to valgus knee alignment and abnormal patellar tracking [14]. When combined with hip abductor and external rotator weakness, these features predispose individuals to patellofemoral pain and early degenerative changes [15].

Physiotherapy targeting proximal muscle strengthening, particularly of the hip and trunk, has demonstrated significant reductions in knee pain and functional limitations [16]. Gait retraining and movement re-education are critical components of comprehensive rehabilitation programs [17].

Lifestyle, Obesity, and Physical Inactivity

Obesity significantly increases compressive forces across the knee joint and accelerates cartilage degeneration, making it a major contributor to knee osteoarthritis in females [18]. Females with higher body mass index consistently report greater pain frequency and disability [19].

Rehabilitation programs incorporating aerobic exercise, progressive resistance training, and weight management strategies are essential for reducing symptom severity and delaying disease progression [20].

Occupational and Ergonomic Factors

Occupational exposure such as prolonged standing, kneeling, squatting, and repetitive movements is associated with increased knee pain prevalence, especially among female healthcare workers, teachers, and service employees [21]. Poor workplace ergonomics further exacerbate joint loading and fatigue.

Physiotherapy-led ergonomic interventions, including posture correction and task modification, have shown effectiveness in reducing symptoms and improving work participation [22].

Sports Participation and Overuse

While physical activity is generally protective, excessive or improperly managed training loads increase the risk of overuse injuries in female athletes [23]. The markedly higher rate of ACL injuries in females highlights the importance of preventive neuromuscular training [24].

Rehabilitation strategies emphasizing plyometric control, proprioception, and strength symmetry are effective in both prevention and post-injury recovery [25].

Psychosocial Factors

Psychological stress, anxiety, and pain catastrophizing significantly influence pain perception and chronicity [26]. Females are more likely to report pain-related fear and activity avoidance, which perpetuates disability [27].

Modern physiotherapy integrates cognitive functional therapy and pain education to address these contributors, promoting active coping strategies and functional restoration [28].

Implications for Physiotherapy and Rehabilitation

Physiotherapists play a central role through early screening, individualized strengthening, neuromuscular training, ergonomic advice, weight management, and psychosocial support. A multidisciplinary, biopsychosocial and gender-sensitive approach is essential for sustainable outcomes [29].

Limitations

The review was limited to English-language studies and heterogeneous outcome measures, preventing meta-analysis. Future studies should focus on longitudinal female-specific rehabilitation trials.

Conclusion

The increasing frequency of knee pain in females is driven by interacting biological, biomechanical, lifestyle, and psychosocial factors. Physiotherapy remains central in prevention and rehabilitation, emphasizing individualized, gender-sensitive management strategies.

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