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Effects of Blood Flow Restriction Training on Knee Injury Rehabilitation in Athletes: A Systematic Review

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ABSTRACT

Introduction: Blood Flow Restriction (BFR) training, when combined with low-intensity resistance exercises, has been shown to induce physiological adaptations comparable to high-intensity training. BFR creates a localized hypoxic environment, facilitating the release of growth hormone, activation of myogenic stem cells, and suppression of myostatin, thereby promoting muscle hypertrophy. Knee injuries in athletes range from ligamentous and meniscal injuries to patellofemoral pain syndrome. BFR is emerging as a promising adjunct in knee injury rehabilitation, offering a potential alternative to traditional high-intensity strength training.

Aim: To evaluate the effects of BFR training in combination with low-intensity resistance exercises compared to conventional high-intensity strength training in the rehabilitation of knee injuries in athletes.

Materials and Methods: A systematic review was conducted using databases such as PubMed, MEDLINE, Embase, CINAHL Plus, pedro, and ERIC, covering the period from January 1, 2014, to January 1, 2025. The search focussed on studies investigating the efficacy of BFR in individuals unable to perform high-intensity exercises, particularly within the context of knee injury rehabilitation. Of the 85 initially identified studies, 11 met the inclusion criteria based on relevance, language, and study duplication. Primary outcomes included "Blood Flow Restriction Training in Clinical Musculoskeletal Rehabilitation," while secondary outcomes focussed on "The Role of Blood Flow Restriction Therapy Following Knee Surgery."

Results: The findings suggest that BFR training, when combined with low-intensity resistance exercises, provides physiological benefits similar to high-intensity strength training. This approach facilitates early-stage rehabilitation, muscle hypertrophy, and strength development, enabling a faster return to sports for athletes recovering from knee injuries.

Conclusion: BFR training presents a viable and effective rehabilitation strategy for knee-injured athletes, particularly when high-intensity training is not feasible. It accelerates muscle adaptation and functional recovery, making it a valuable adjunct to conventional rehabilitation protocols. Further research with larger sample sizes and randomised controlled trials is warranted to optimize BFR applications in clinical settings.

Keywords: High-intensity strength training, Low-intensity strength training, Sports medicine

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