

# Efficacy of High-Intensity High-Velocity Resistance Training in Young Adults with Knee Osteoarthritis: A Pilot Randomized Controlled Trial

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**Abstract:** ***Background:** Knee osteoarthritis is one of the most common musculoskeletal disorders that affects mobility and quality of life. Although it is generally associated with older adults, recent clinical observations show an increasing prevalence among individuals between 35 and 45 years of age. Early-stage osteoarthritis often leads to reduced muscle strength, impaired neuromuscular control, and limitations in daily functional activities. Exercise-based rehabilitation plays a vital role in conservative management of the condition. High-Intensity High-Velocity (HIHV) resistance training is a progressive strengthening approach that emphasizes rapid force generation under high loads. The present study explored the effectiveness of HIHV resistance training for improving muscle strength and functional performance in young adults with knee osteoarthritis. **Objective:** To evaluate the impact of a 12-week High-Intensity High-Velocity resistance training program on muscle strength, functional mobility, and patient-reported outcomes among young adults diagnosed with mild knee osteoarthritis. **Methods:** Sixteen individuals aged between 35 and 45 years with clinically diagnosed mild knee osteoarthritis participated in the study. Participants performed a supervised HIHV resistance training program three times per week for twelve weeks. Outcome measures included the Ten-Repetition Maximum (10RM) test for muscle strength, the Timed Up and Go (TUG) test for functional mobility, and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for pain and functional limitations. Assessments were conducted before and after the intervention. **Results:** The training program demonstrated excellent adherence with more than ninety percent of sessions completed. Participants showed a significant increase in muscle strength with an average improvement of 15.6 kg in the 10RM test. Functional mobility improved with a reduction of 1.2 seconds in TUG time. WOMAC scores decreased notably, reflecting reduced pain and improved physical function. **Conclusion:** High-Intensity High-Velocity resistance training appears to be a safe and beneficial exercise intervention for improving muscular performance and functional ability in young adults with knee osteoarthritis.*

**Keywords:** Knee osteoarthritis, High intensity resistance training, Muscle strength improvement, Functional mobility, Young adults rehabilitation

## 1. Introduction

Knee osteoarthritis (KOA) is a chronic degenerative joint condition characterized by cartilage deterioration, subchondral bone remodeling, and synovial inflammation. It represents one of the leading causes of disability worldwide and is associated with considerable healthcare costs and functional limitations. Traditionally, osteoarthritis has been viewed as a disease primarily affecting older adults. However, recent epidemiological studies have indicated an increasing prevalence of knee osteoarthritis among younger individuals, particularly those between the ages of 35 and 45 years.

The development of knee osteoarthritis in younger populations may be attributed to several factors including previous knee injuries, excessive body weight, repetitive mechanical stress, and sedentary lifestyle behaviors. Early-onset osteoarthritis can significantly interfere with work productivity, recreational activities, and overall quality of life. Pain, joint stiffness, and reduced physical performance are common symptoms that limit the ability to perform everyday activities.

Muscle weakness, particularly of the quadriceps, is widely recognized as a major contributor to functional decline in individuals with knee osteoarthritis. Reduced muscle strength compromises joint stability and may increase mechanical

stress on articular structures. Strengthening the muscles surrounding the knee joint is therefore considered an essential component of rehabilitation programs.

Conventional resistance training protocols generally involve moderate loads performed at controlled movement speeds. While such approaches improve muscle strength, functional activities often require the rapid generation of force. Muscle power, defined as the product of force and velocity, plays a critical role in tasks such as rising from a chair, walking quickly, or climbing stairs.

High-Intensity High-Velocity resistance training is designed to improve both strength and power by combining heavy loads with rapid concentric muscle contractions. This approach enhances neuromuscular activation, motor unit recruitment, and rate of force development. Studies in older adults have demonstrated that high-velocity resistance training can significantly improve mobility and functional performance.

Despite growing interest in this training method, limited research has examined its application in young adults with knee osteoarthritis. Understanding the potential benefits of HIHV training in this population may help physiotherapists design more effective rehabilitation strategies aimed at

restoring strength, improving mobility, and reducing disability.

## 2. Aim

To evaluate the efficacy of High-Intensity High-Velocity resistance training in improving muscle strength and functional mobility in young adults with knee osteoarthritis.

## 3. Objectives

- To assess lower limb muscle strength using the Ten-Repetition Maximum (10RM) test.
- To evaluate functional mobility using the Timed Up and Go test.
- To measure changes in pain and functional limitations using the WOMAC index.
- To determine the feasibility and adherence of a High-Intensity High-Velocity training program.

## 4. Methodology

Study Design: Pilot randomized controlled trial.

Participants: Sixteen individuals aged 35–45 years with mild knee osteoarthritis.

Intervention: Participants completed a twelve-week High-Intensity High-Velocity resistance training program performed three times per week. Exercises included squats, leg press, and knee extension with heavy resistance loads and rapid concentric movement.

Outcome Measures:

- Ten-Repetition Maximum (10RM)
- Timed Up and Go Test (TUG)
- WOMAC Index

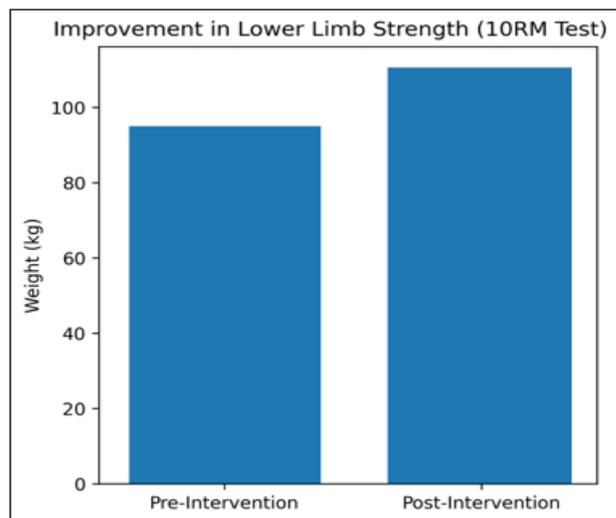
### Statistical Analysis:

Descriptive statistics including mean values were calculated. Pre- and post-intervention differences were examined using paired t-tests with significance set at  $p < 0.05$ .

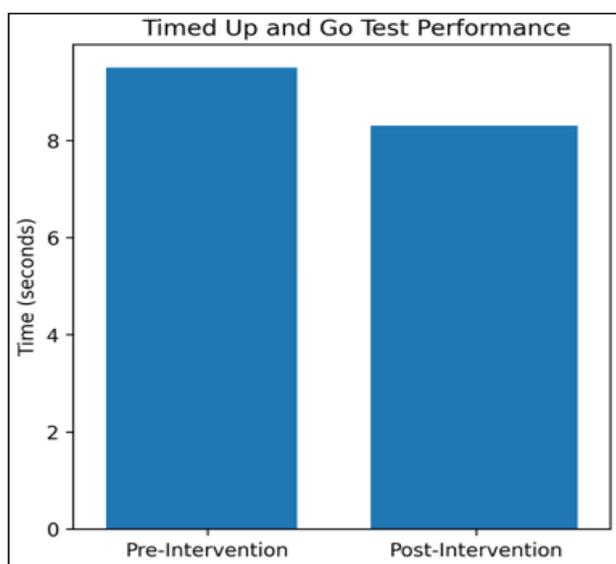
## 5. Results

**Table 1:** Comparison of outcome measures before and after intervention

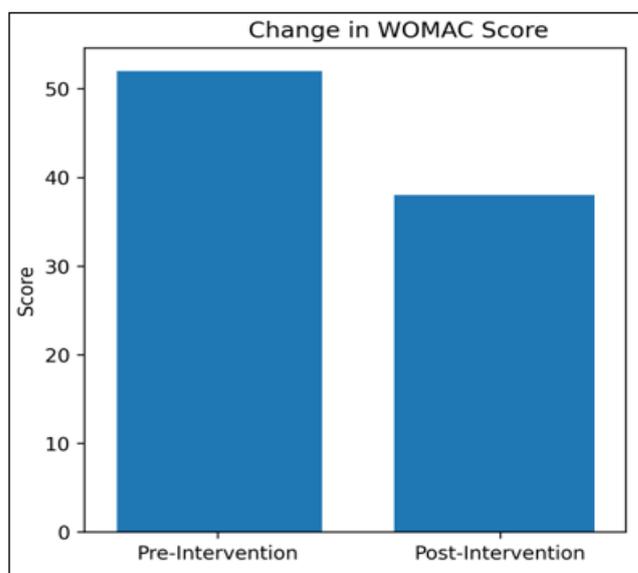
Outcome Measure	Pre-Intervention	Post-Intervention
10RM Strength (kg)	95.0	110.6
Timed Up and Go (sec)	9.5	8.3
WOMAC Score	52	38



**Figure 1:** Improvement in lower limb strength measured using the 10RM test



**Figure 2:** Reduction in Timed Up and Go test duration indicating improved mobility



**Figure 3:** Decrease in WOMAC score reflecting reduced pain and improved physical function

## 6. Discussion

The findings of the present study indicate that High-Intensity High-Velocity resistance training can lead to meaningful improvements in muscle strength and functional mobility among young adults with knee osteoarthritis. Participants demonstrated substantial gains in lower limb strength following the twelve-week intervention. Improvements in strength may be attributed to neuromuscular adaptations, including enhanced motor unit recruitment and increased rate of force production.

Functional mobility also improved significantly as reflected by reduced TUG times. These improvements suggest better coordination, balance, and muscular power. Such adaptations are essential for performing everyday activities efficiently and safely.

The reduction in WOMAC scores indicates that participants experienced improvements in pain and physical function. Strengthening the muscles surrounding the knee joint may reduce joint loading and improve stability, thereby decreasing discomfort during movement.

Overall, the results of this pilot study support the use of progressive resistance training strategies in the rehabilitation of individuals with early-stage knee osteoarthritis.

## 7. Conclusion

High-Intensity High-Velocity resistance training appears to be a feasible and effective intervention for improving muscular strength, mobility, and functional outcomes in young adults with knee osteoarthritis. The program demonstrated high adherence and produced positive clinical outcomes after twelve weeks of training. Future research involving larger samples and longer follow-up periods is recommended to confirm these findings.

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