

Low back pain (LBP) is a leading cause of global disability. Individuals with LBP often exhibit impaired proprioceptive postural control, which may contribute to the persistence of their condition. The effectiveness of targeted proprioceptive training in addressing these deficits and alleviating pain and disability remains unclear. This study aimed to evaluate the impact of proprioceptive training on (1) proprioceptive postural control and (2) associated pain and disability in individuals with LBP.

Twenty-five individuals with recurrent LBP (14 men, 11 women; mean age  $47 \pm 10$  years; BMI  $24.1 \pm 2.3$ ) participated in an 8-week proprioceptive training program focusing on sensing, differentiating, and localizing lumbar postures, movements, and muscle activation. Participants integrated these exercises into their daily routines.

Postural control assessments were performed on stable and unstable surfaces with visual input occluded. Muscle vibration stimulated ankle and back muscle spindles to induce center of pressure (COP) displacements, measured using a force plate. A ratio of COP displacement in response to ankle versus back muscle vibration was calculated. Clinical outcomes were assessed with the Modified Low Back Pain Disability Questionnaire (MDQ) and self-reported percentage improvements in pain and disability (0–100%). Non-parametric statistical methods were used.

Proprioceptive training led to increased COP displacement in response to back muscle vibration on stable ( $p = 0.036$ ) and unstable surfaces ( $p = 0.043$ ). The ratio of ankle-to-back muscle vibration indicated greater reliance on lumbar proprioception under unstable conditions ( $p = 0.034$ ). Clinically, MDQ scores improved significantly (pre-training:  $27 \pm 10$ ; post-training:  $14 \pm 10$ ,  $p < 0.001$ ), alongside substantial reductions in disability (51%) and pain (49%).

Proprioceptive training improved lumbar proprioception and postural control, likely through enhanced muscle spindle sensitivity and segmental control. Participants shifted from rigid ankle strategies to adaptive lumbar proprioceptive reliance, improving adaptability to unstable conditions. These benefits were accompanied by significant reductions in pain and disability, underscoring the clinical value of proprioceptive training for individuals with LBP.