

## Background and Aim

Low back pain (LBP) is the leading cause of disability worldwide. Impaired proprioception during postural control might be a contributing factor to LBP, but it remains unknown if this relates to structural changes in spine-controlling muscles such as the lumbar multifidus.

Therefore, this study aimed (1) to investigate potential differences in lumbar proprioceptive use during standing as well as multifidus size and echo-intensity between people with and without LBP, and (2) to determine the association between proprioceptive use during standing and multifidus size and echo-intensity.

## Methods

In 36 participants with recurrent LBP (19 men, 17 women; Age=  $44 \pm 11$  years; BMI=  $25.3 \pm 3.7$ ) and 32 healthy controls (11 men, 21 women; Age=  $38 \pm 11$  years ; BMI=  $22.2 \pm 2.4$ ), proprioceptive use was evaluated by applying muscle vibration to ankle and back muscles during standing on stable and unstable ground. Center of pressure displacements in response to vibration were measured with a force plate (Kistler). Multifidus volume was measured from lumbar level L2 to L5, cross-sectional area and echo-intensity were measured at lumbar level L5 with three-dimensional freehand ultrasound (SonixTouch Q+ with Optitrack V120:Trio, NaturalPoint, USA). Between-group differences were assessed using non-parametric tests. Spearman correlations were calculated and Bonferroni corrections were applied for multiple comparisons ( $p= 0.013$ ).

## Results

Compared to healthy controls, people with LBP showed a more ankle-steered postural control ( $p= 0.019$ ), decreased lumbar proprioceptive reliance on unstable ground ( $p= 0.04$ ) and increased multifidus echo-intensity ( $p < 0.002$ ), without reduction in multifidus size ( $p > 0.60$ ). After Bonferroni correction, only center of pressure displacement during back muscle vibration on stable ground showed a small negative correlation with multifidus echo-intensity ( $r = -0.38$ ,  $p = 0.015$ ).

## Conclusions

This study confirmed that compared to healthy controls, people with LBP showed impaired ability to up-weight lumbar proprioceptive use during more challenging postural conditions. This decreased proprioceptive acuity could perhaps be related to impaired multifidus quality, but not to multifidus size. However, there was only a moderate correlation on stable ground, and a few trends for significance after Bonferroni correction, but no associations in more complex postural conditions. Future studies could use larger samples with more advanced measurement techniques to determine muscle quality, such as muscle biopsies, or texture analysis for echo-intensity. This further clarify the relation between muscle quality and proprioceptive postural control in people with LBP.