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An ultrasound evaluation of the relationship between changes in the lumbar perimuscular layer and Body Mass Index in people with non-specific lower back pain

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BACKGROUND Mechanisms underlying non-specific lower back pain are still poorly understood. In an ultrasound-based study, Langevin et al. [1] found differences in the lumbar connective tissue structures in people with non-specific lower back pain (LBP) compared to people without (no-LBP). The aim of this study is to extend the work of Langevin and colleagues, and evaluate the relationship between the lumbar perimuscular layer and Body Mass Index (BMI) in LBP and no-LBP people.

METHODS This study is a cross-sectional study design. Ultrasound imaging was used to investigate the echogenicity and thickness of the lumbar perimuscular layer in 45 participants (31 LBP, 14 no-LBP). The outcome measures were the thickness and echogenicity of the lumbar perimuscular layer. Longitudinal B-Mode ultrasound images were taken bi-laterally on an area 2 cm lateral to the midpoint between the spinous processes of L2-3, at a frequency of 18MHz, depth of 3 cm, (EsoateMyLab 25Gold, Firenze, Italy) using a 4 cm linear probe (Esaote LA435, Firenze, Italy). Images were converted to grey-scale in Matlab (Mathworks, USA). The borders of the perimuscular layer were identified by a blinded investigator. Thickness was calculated in pixels and echogenicity as the average grey-scale value. Data was analysed using ANCOVA and linear regression.

RESULTS The LBP and no-LBP groups did not significantly differ in age, sex, BMI or level of physical activity. Age ($r = .452$, $p = .002$) and BMI ($r = .374$, $p = .013$) showed significant positive correlations with perimuscular thickness, but not with perimuscular echogenicity. BMI significantly predicted perimuscular thickness (ANCOVA: $p = .016$), whereas group membership did not (ANCOVA: $p = .168$). Perimuscular echogenicity could be significantly predicted only by considering the interaction between group membership and BMI. The interaction between BMI and group membership accounted for 16% of the observed changes in perimuscular echogenicity (ANCOVA: $p = .006$). The interaction arose because in the no-LBP group, echogenicity significantly decreased as BMI increased (Regression: $p = .005$). In contrast, there was no systematic relationship between perimuscular echogenicity and BMI in the LBP group (Regression: $p = .391$).

CONCLUSIONS Measurements of echogenicity can only be accounted for by considering group membership (LBP and no-LBP) and BMI values jointly. The relationship between BMI and echogenicity (negative correlation) in the no-LBP group is not found in participants with LBP. Possible causes, which require further investigation, include: sub-failure, changes in movement patterns, chronic inflammation, fibrosis, and/or fatty tissue infiltration.

REFERENCES[1] Langevin, HM, Stevens-Tuttle, D, Fox, JR, Badger, GJ, Bouffard, NA, Krag, MH, Wu, J, Henry, SM. Ultrasound evidence of altered lumbar connective tissue structure in human subjects with chronic low back pain. BMC Musculoskeletal Disorders, 10:151–159,2009.