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The relationship between muscle mass and function with bone remodelling markers in older adults: effects of acute aerobic and resistance exercise

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Background: Age-related muscle mass/strength loss affects independence and quality of life. Bone-muscle crosstalk is potentially mediated by bone remodelling markers (BRMs) including osteocalcin (OC). We tested the hypothesis that BRMs are correlated with baseline muscle mass/function which would predict BRM-responses after acute exercise. We also assessed the relationship between BRMs and insulin resistance (HOMA-IR).

Methods: Thirty-five older adults (25 women/10 men, 72±6 yrs) participated. Baseline assessments included body composition (DXA), muscle strength (grip and leg press) and physical performance (PPT, timed-up-and-go; gait speed, stair ascend/descend). Leg muscle quality (LMQ=leg press/leg lean mass) and stair climb power (SCP=force x velocity) were calculated. Participants performed (randomised) 30 mins aerobic (cycling 70%HR_{Peak}) and resistance exercise (leg press 70%RM, jumping). C-terminal telopeptide of type I collagen (CTX), procollagen of type I propeptide (P1NP), total (t)OC, undercarboxylated (uc)OC, glucose, insulin and HOMA-IR were assessed pre- and post-exercise. Data was analysed using linear mixed models and β-regressions.

Results: No difference in BRMs-responses to AE and RE, therefore data analysed together. Poorer PPT was related to lower baseline ß-CTX, P1NP and ucOC (all p<.05). Higher strength (LMQ, grip and leg) was related to higher baseline P1NP (all p<.05). Exercise decreased ß-CTX, tOC, insulin and HOMA-IR (all p<.05). ucOC remained unchanged. Participants with higher baseline muscle strength (SCP, LMQ, leg and grip) had lower post-exercise ß-CTX and tOC (all p <.05). Higher baseline ß-CTX, P1NP, tOC and ucOC was associated with lower post-exercise insulin resistance (HOMA-IR) (all p<.05).

Conclusions: Older adults with higher baseline BRMs are linked to greater muscle function and lower insulin resistance. Acute exercise decreases ß-CTX and tOC, and higher baseline muscle strength was related to lower responses of these specific BRMs. Despite mechanisms behind the specific component of bone-muscle crosstalk remaining unclear, BRMs may be used to identify individuals with poorer muscle function and insulin sensitivity.