

Resistive exercise with or without super-imposed whole-body vibration acutely effects bone turnover

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ABSTRACT

[Background] Exercise is one of the well-known constituents to improve bone mass and to retain bone strength. Only few studies have reached the effects of resistive exercise on sclerostin levels, a protein that is thought to play a key role in orchestrating bone's mechanical adaptation. Sclerostin is produced and released by osteocytes and acts as an inhibitor of bone formation through inhibition of the Wnt/ β -catenin-signaling pathway. The objective of this study was to evaluate acute and long-term effects of exercise on bone biochemical marker expression. More specifically, we aimed to understand differences in the responses to resistance exercise with or without whole-body vibration. [Methods] A six week training intervention was performed including 26 healthy males (26 years, SD=4) in a randomized parallel design. Performing either resistive exercise (RE, n=13) or resistive vibration exercise (RVE, n=13) training, with weekly increasing vibration frequencies 20-40 Hz. Serum samples were collected both at the initial and final exercise session. Changes in carboxy-terminal cross-linked telopeptide of type I collagen (sCTX-I), as a marker of bone resorption, and of procollagen type I amino terminal propeptide (P1NP) as a specific marker of bone formation as well as serum sclerostin concentrations were measured via ELISA (sCTX-I and sclerostin) or RIA (P1NP) measurements. [Results] Serum markers of sCTX-I decreased by 15% within the first minutes following either training intervention, both regarding the initial and final training session. Subsequently, levels of sCTX-I returned back to pre-bout baseline after RE (time effect: $P<0.001$), and they depicted an overshoot by 18% after 75min. Serum levels of P1NP depicted an acute increase by 15% to exercise ($P<0.001$). P1NP levels were non-substantially increased in RE at the end of the 6 week intervention ($P<0.001$), but decreased by 10% in RVE, as compared to baseline ($P<0.001$). Pre-bout levels of sclerostin were marginally lowered at the end of the 6 week training phase. After the exercise bouts, sclerostin levels increased within the first minutes both RE and RVE (time effect: $P<0.001$). Notably, sclerostin responses to the initial exercise bouts differed significantly between RE and RVE $P=0.029$. [Conclusion] The present findings suggest that in young healthy adults both conditions RE and RVE elicited an acute exercise-induced bone resorption without any acute change in bone formation. Results are compatible with the idea that this response was mediated by sclerostin.

Keywords: resistive exercise, resistive vibration exercise, sclerostin, osteokine, sCTX, P1NP