

Title: Effect of high impact exercise on femoral neck bone mineral density and T<sub>2</sub> relaxation times of articular cartilage in postmenopausal women

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Unilateral, high impact exercise has been found to increase femoral neck bone mineral density (BMD) in older men and premenopausal women. Postmenopausal women are at increased risk of osteoporotic fracture and could benefit from an intervention to increase BMD but may be reluctant to participate in high impact exercise due to concern about knee joint damage. The aim of the current study was to evaluate the effects of high-impact exercise on femoral neck BMD and knee articular cartilage properties in postmenopausal women.

Postmenopausal women were recruited into a six-month, unilateral exercise intervention. This progressed to 50 multidirectional hops each day, using a randomly assigned exercise leg for comparison with the contralateral control leg. Dual energy X-ray absorptiometry provided information on the BMD of both femurs. Coronal T<sub>2</sub> maps using a 3.0T MRI scanner provided T<sub>2</sub> relaxation times of knee articular cartilage in 12 regions of interest (ROIs) from a single slice in the weight bearing region. Scans were taken of both legs, pre and post intervention. Repeated measures ANOVA were carried out to analyse effects of leg, time and interaction.

To date, 29 of the 43 participants have completed the study (age  $61.1 \pm 4.4$  years; BMI  $24. \pm 3.7$  kg/m<sup>2</sup>). Of these, 4 participants withdrew due to exercise related injury or discomfort (knee pain that resolved upon cessation of exercise [n=3], Achilles tendonitis [n=1]), 2 due to other injury or illness and 2 were lost to follow up. Femoral neck BMD increased by 0.73% in the exercise leg and decreased by 0.74% in the control leg, but this difference between legs did not reach statistical significance (P=0.067). There were no significant exercise effects on T<sub>2</sub> relaxation times of knee cartilage ( $0.97 > P > 0.18$ ): across the 12 ROIs changes ranged from -3.2 to 2.7% in the exercise leg and -6.1 to 4.6% in the control leg.

The intervention was feasible but the incidence of withdrawal due to exercise related injury or discomfort suggests that modification may be desirable for postmenopausal women. That there were no significant changes in T<sub>2</sub> relaxation times in healthy women agrees with previous research, in women with mild osteoarthritis, that high impact exercise does not adversely affect knee articular cartilage. Although not statistically significant, this brief, high impact exercise had similar net effects on femoral neck BMD in postmenopausal women (1.5%) as reported in a group of 35 older men (1.6%).