

## Acute Effects of Anaerobic Exercise on Bone Turnover in Healthy Post-menopausal Women

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### Introduction

Skeletal tissue is in a constant state of flux, remodelling itself to changing physical demands via the bone multicellular unit (BMU). At any one time there are approximately 2m BMUs active on the mature skeleton that individually remodel over a time-course of about 3 months. Physical activity is a known prophylactic to many bone disorders and can perturb the remodelling process, either mechanically<sup>1</sup> or metabolically<sup>2</sup>. Using specific biochemical markers for bone resorption and renewal, this study sought to investigate whether acute (9 days) changes in bone turnover could be observed following a discrete anaerobic exercise challenge.

### Methodology

With ethical approval and informed consent, 10 healthy, post-menopausal women, who were not on HRT were recruited (age; 54±1.5; height, 1.64±1.5; weight, 67.0±2.6; BMI, 25.1±1.2, mean ± SE). Following a 5 consecutive day baseline period, subjects completed an anaerobic (20mins @ >AnT) cycle ergometry exercise challenge. The exercise period was 10-days in duration comprising 3 days of anaerobic exercise followed by 7 days of recovery. Blood (venepuncture 8am-9am) samples were collected following an overnight fast (22h00) for both the control and the exercise period of the study. Samples were analysed for N-MID osteocalcin, a marker of bone renewal, and C-terminal fragment of pyridinium crosslinks (CrossLaps™), a marker of bone resorption, by electrochemiluminescence (*Roche Diagnostics*). The within-subject biological variation (CV<sub>I</sub>) and individual critical difference (CD<sub>I</sub>) for the baseline period were calculated for each subject according to Fraser and Harris (1989)<sup>3</sup>. Relative changes of post exercise data from the baseline mean concentration were normalised for CD<sub>I</sub> and any deviation greater than ±1.81 (P<0.10) was considered to reflect a significant perturbation in cellular function.

### Discussion

Mean circulating values of serum CrossLaps™ and N-MID osteocalcin were 0.60±0.18 ng/ml and 30.65±8.20 ng/ml respectively for this population. The mean intra-individual CV<sub>I</sub> of N-MID osteocalcin was approximately 2 fold lower (5.5±4.8%) than that for serum CrossLaps™ (11.9±10.1%). As CD<sub>I</sub> is predominantly influenced by CV<sub>I</sub>, the CD<sub>I</sub> was greater for the marker of bone resorption also (19.6±8.3% v 8.8±3.8%). The inter-subject variation in CD<sub>I</sub> for both markers was quite large (OC, 3.6%-33.6%; CrossLaps™, 6.7% - 37.8%: CD<sub>I</sub>) which would indicate that a group mean CD cannot be applied to each individual within that group. In response to the exercise bout, a biologically significant change occurred in 40% of the N-MID OC data. Notably 70% of the observed changes were in a positive direction, which would suggest that osteoblast activity, increased in this population in response to the anaerobic challenge. Changes were demonstrated on at least 3 occasions in 7 of the 10 subjects studied although there was no consistency between subjects with respect to the timing, the magnitude and the direction of the responses observed. The anaerobic exercise intervention significantly perturbed the rate of bone resorption as evidenced by a significant change in 27% of the data. The predominant response was a reduction in bone resorption in this population in response to this exercise challenge. As for N-MID osteocalcin, there was no uniformity in the nature of the response between subjects.

## Conclusion

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It is evident from the current study that anaerobic exercise significantly perturbs the bone remodelling cycle over an acute period. Based upon the frequency and direction of responses it would appear that the net effect of this exercise challenge was an uncoupling of the remodelling cycle in favour of formation. This interpretation should be viewed with caution as the between subject variation in the data was large. It is the author's opinion that while biochemical markers can detect acute changes in bone turnover, the physiological relevance of those changes cannot be resolved in such a short time period. Future work should focus on assessing long-term (3-6 months) changes in biochemical markers (k~5) and equating these changes to modifications in BMD.

## Presented

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## References

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