

Feature article: Lack of sleep affects bone health and bone marrow activity

Scientists at the Medical College of Wisconsin, in a team led by Carol Everson, PhD, Professor of Neurology, Cell biology, Neurobiology and Anatomy, have discovered abnormalities in bone and bone marrow in rats undergoing chronic lack of sleep. They discovered abnormalities in serum markers of bone metabolism in sleep-deprived rats, which led them to conduct direct measurements of bone parameters; this time in rats experiencing recurrent sleep restriction during a large portion of their young adulthood.

The results show a dramatic imbalance between bone apposition and reabsorption, marked by an arrest in bone formation without reduced absorption. Furthermore, fat in the red marrow is greatly diminished and platelet-generating cells are doubled in number, indicating changes to marrow plasticity. 'If the same processes are evoked in humans,' said Dr Everson, 'the potential medical implications are far-reaching and may include poor repair of microdamage from activities of daily living, introduction of osteoporotic processes, and changes to progenitor cells that may affect disease predisposition and disease resistance.'

The results appear on page 1101 of this issue of *Experimental Biology and Medicine*. Co-authors of the paper are Jeffrey M Toth, PhD, Professor of Orthopaedic Surgery at the Medical College of Wisconsin, and Anne Folley, now a graduate student at George Washington University.

The researchers observed changes in intramembranous ossification and marrow hypercellularity resulting from chronic sleep loss. 'Marrow fat was greatly diminished and reflected increased blood cell production and differentiation. Our findings of increased megakaryocyte numbers, for example, suggest that there is an increased demand for cell delivery to the circulation consistent with an inflammatory response, and conceivably the promotion of thrombocytosis,' said Dr Everson.

Dr Steven R Goodman, Editor-in-Chief of *Experimental Biology and Medicine* said 'With increased life stress due to work-related, financial and other issues, a large percentage of us are experiencing difficulties in sleeping. While we know that chronic sleep loss can affect our health, little specific information has been available on how it may impact bone formation or loss. Drs Everson and Toth, together with Anne Folley present exciting results indicating that sleep deprivation in rats arrests bone formation, decreases fat within the red marrow and increases platelet levels. If true in humans, and I expect that it may be, this work will have great impact on our understanding of the impact of sleep deprivation on osteoporosis and inability to repair bone damage as we age'.

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