

Antarctic expeditioners assist bone loss study

A new study by the AAD's Polar Medicine Unit and the Austin Hospital in Melbourne aims to determine whether Antarctic expeditioners have a greater risk of developing osteoporosis (brittle bones) in later life as a result of vitamin D deficiency.

Vitamin D deficiency is caused by a lack of exposure to sunlight, which can be due to latitude, sun protection practices, the cultural or religious practice of covering the body, or institutionalisation. In Antarctica, wintering expeditioners endure months of darkness or twilight; while in summer, the angle of the sun limits the amount of ultraviolet radiation reaching the ground. Then there's the cold, which forces expeditioners to cover up.

Without vitamin D the body cannot absorb as much calcium, so it turns to the supplies of calcium in bone. Under normal circumstances the body will naturally extract and replace calcium in the bone; digging small holes and then refilling them so that the total amount of bone remains the same. When vitamin D levels are low, however, the rate of digging and refilling increases, producing more holes in the bone. As people age, the body's ability to refill these holes decreases, resulting in bone loss. One of the key questions we hope to answer in the Antarctic study is whether this bone loss is transient or irreversible.

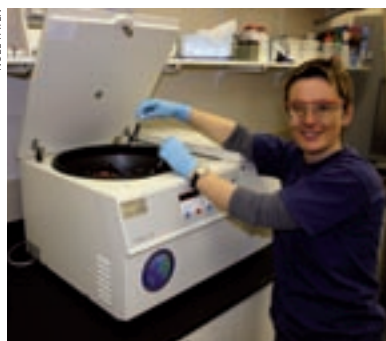
As people over 40 naturally experience a degree of bone loss we hypothesise that older expeditioners, particularly menopausal women, will experience accelerated bone loss in Antarctica and that this bone loss will be irreversible. Younger expeditioners, however, are likely to experience a smaller degree of bone loss, which will be remedied on their return to Australia.

Our two year pilot study, which began in the 2003–04 Antarctic summer, involved 53 expeditioners departing for a year in Antarctica. Before departure, we took blood samples to determine normal vitamin D levels and bone turnover rates (how quickly holes are being dug and refilled). Every three months, doctors at Australia's Antarctic stations collected blood samples. These were returned to us in April and are now being analysed for vitamin D levels and bone turnover rates. We also had expeditioners complete three-day diaries, which recorded their diet and possible exposure to other light sources such as those used to grow hydroponic vegetables at the stations.

A small number of blood samples were returned to us earlier in the year and these have revealed some interesting preliminary results. While the normal concentration of vitamin D in the blood is 30–100 nmol/l, after three months the mean vitamin D concentration in the expeditioners' blood was 29 nmol/l. After six months, this had dropped to 24 nmol/l, which was significantly lower than when they arrived in Antarctica. The rate of bone turnover was also found to have



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Macquarie Island doctor, Andy Williams, takes blood from station chef, Meredith Nation, for the vitamin D study.

Casey Station doctor, Eve Merfield, demonstrates the final steps in the preparation of blood for the vitamin D study. The blood is spun in a centrifuge at 4°C to separate the serum and red blood cells. The serum is then stored in 'cryotubes' at -80°C for return to Australia and analysis of bone metabolites (to establish turnover rates) and vitamin D levels.

increased at six months. Analysis of the remaining blood samples will confirm whether the rates of bone turnover are significantly elevated. We will also collect blood from expeditioners, six months and 12 months after their return to Australia, to see how quickly they return to their pre-departure bone turnover rate.

In the next phase of the study we have enlisted the help of Professor Graeme Jones of the Menzies Centre for Population Health Research in Hobart, to conduct bone density testing on expeditioners before they depart for Antarctica, when they return, and one year after their return. This will provide a definitive answer on changes in bone density.

This research will help not only future Antarctic expeditioners, but other people at risk of vitamin D deficiency, particularly nursing home residents. If the study shows bone loss is an issue in Antarctica, we will again enlist expeditioners' help to identify the most effective and least time-consuming combination of preventative measures. In the case of expeditioners, this could include vitamin D supplementation, weight bearing exercise, time spent under an ultraviolet lamp or tending hydroponic crops and/or a megadose injection of vitamin D before departure. For the elderly and other at-risk individuals in Australia, it could include vitamin D supplements or time in the sun.

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