IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medicine in Space and Extreme Environments (4)

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IMPACT OF AN EXTENDED STAY IN ANTARCTICA ON MUSCLE AND BONE HEALTH – FIRST RESULTS FROM THE CONCORDIA RESEARCH STATION

Abstract

Purpose: Previous research has shown that bone loss can occur during a prolonged stay in Antarctica. It is assumed that this results from changes in vitamin D metabolism due to low sunlight exposure with subsequent changes in bone metabolism. However, a number of factors that are important for bone metabolism such as physical activity, neuromuscular function or hormonal status have not been considered, so far. Furthermore, as all studies on bone health in Antarctica were conducted on sea level, the additional effect of hypobaric hypoxia on muscle and bone metabolism is unknown.

Methods: Bone mineral density (aBMD) of the femur and the lumbar spine will be assessed pre and post overwintering by dual x-ray absorptiometry (DXA). During overwintering peripheral computer tomography (pQCT) at the distal tibia and radius (4%, 66%) as well as the analysis of bone metabolism markers in blood, urine and saliva will be conducted. Actigraph accelerometry, the international questionnaire of physical activity (IPAQ), countermovement jumps and chair-rise test on a forceplate, muscle cross sectional area of the lower limb (pQCT) and body composition with bio impedance will be used to monitor neuromuscular function and physical activity.

Results: Data of two campaigns overwintering on Concordia Research Station are almost completed (n=16 males). Preliminary analysis (campaign WO16 n=5) shows an unexpected decrease of aBMD after overwintering (mean change: spine -4.25%, total hip -1.84%, femoral neck -3.18%) which exceeds the data published at sea level (post measurements of campaign WO17 n=11 are expected in June 2018). A trend for loss of total BMD at 4% of the tibia and the radius starting around day 90-150 with an increase of bone diameter at 66% at radius and tibia and an increase of bone marrow area without change in cortical thickness was observed. In addition, overwintering at Concordia was accompanied by a decrease of physical activity especially for moderate to vigorous tasks with a loss of lean and fat mass. (Data on blood, urine and saliva from WO17 are expected to arrive in Berlin for further analysis in Mai 2018.)

Conclusions: Once it has been better established what leads to bone loss in Antarctica it will be possible to develop appropriate countermeasures. Furthermore, the extreme environment of Antarctica, such

as in spaceflight or prolonged bed-rest, can help to gain greater insight into bone metabolism conditions and enhance our ability to manage bone disorders.