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Bone-related gene expression and extracellular matrix mineralization in osteoblastic MC3T3-E1 cells under zinc deficiency

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Zinc has been recognized as being an activator in controlling of bone mineralization in vivo and in vitro. In the present study, it is determined whether zinc deficiency would affect on bone-related gene expression and extracellular matrix mineralization. Leptin (ob gene) receptor gene expression was also measured, since leptin has found as being negative effector for bone formation, even with still controversy. In order to examine the effects of zinc deficiency on osteoblastic MC3T3-E1 cells differentiation and extracellular matrix mineralization, the cells were cultured at a concentration of 0 or 15 M ZnCl2 (Zn- or Zn+)in both concentration- and time-dependent manner. Bone-related (alkaline phosphatase ALP, osteocalcin OC, collagen type I CTI, osteopontin OP, PTH receptor PTH-R and Runx 2) and leptin receptor (OB-Ra and OB Rb) gene expression were measured by RT-PCR. Mineralization was detected of calcium phosphate deposits using Alizarin Redand ALP staining. Major bone marker genes (ALP, OC, OP) expression was increased in Zn+, but CTI was increased in Zn- under this experimental condition of 3d zinc treatment. Again, in the time-dependent manner, three genes (ALP, OP, Runx 2) expression was increased in Zn+ up to 18 days of cell differentiation. Even with potential discrepancy between concentration- and time-dependent manner, zinc apparently activated the differentiation in this osteoblastic cells. Both of leptin receptor genes were not detected in this cell line, however need to be studied further. ALP activity was higher in Zn+. Mineralization by both Alizarin Red and ALP staining was increased in Zn+, accompanying by time-dependent manner. The current work supports the positive effect of zinc on bone calcification.