
**Abstract**
The nutritional influence of zinc on markers of bone extracellular matrix resorption and mineralization was investigated in growing rats. Thirty male weanling rats were randomly assigned to consume AIN-93G based diets containing 2.5, 5, 7.5, 15 or 30 microg Zn/g diet for 24 days. Femur zinc increased substantially as zinc increased from 5 to 15 microg/g diet and modestly between 15 and 30 microg/g (P<.05). By morphological assessment, trabecular bone increased steadily as dietary zinc increased to 30 microg/g. Increasing dietary zinc tended to decrease Zip2 expression nonsignificantly and elevated the relative expression of metallothionein-I at 15 but not 30 microg Zn/g diet. Femur osteoclastic resorption potential, indicated by matrix metalloproteinases (MMP-2 and MMP-9) and carbonic anhydrase-2 activities decreased with increasing dietary zinc. In contrast to indicators of extracellular matrix resorption, femur tartrate-resistant acid and alkaline phosphatase activities increased fourfold as dietary zinc increased from 2.5 to 30 microg Zn/g. Likewise, 15 or 30 microg Zn/g diet resulted in maximum relative expression of osteocalcin, without influencing expression of core-binding factor alpha-1, collagen Type 1 alpha-1, or nuclear factor of activated T cells c1. In conclusion, increased trabecular bone with additional zinc suggests that previous requirement estimates of 15 microg Zn/g diet may not meet nutritional needs for optimal bone development. Overall, the up-regulation of extracellular matrix modeling indexes and concomitant decrease in resorption activities as dietary zinc increased from 2.5 to 30 microg/g provide evidence of one or more physiological roles for zinc in modulating the balance between bone formation and resorption.