LONGITUDINAL STUDY OF THE FACTORS WHICH AFFECT THE DEVELOPMENT OF BONE MINERAL CONTENT, BONE WIDTH AND BONE MINERAL DENSITY THROUGH ADOLESCENCE

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Thesis submitted for the degree of
Doctor of Philosophy
in
The University of Adelaide
(Faculty of Medicine)

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SUMMARY

This thesis presents prospective data on forearm bone status in a group of Australian children. Bone mineral content (BMC), width (BW), areal density (aBMD) and volumetric density (vBMD) were determined at ages 11, 13, 15 and 17 years in 56 boys and 52 girls. Absolute values of all bone variables increased with age and sexual maturity. Velocities were dependent on age and sexual maturity. Maximal increases in all bone variables occurred earlier in girls than in boys due to girls' earlier sexual maturity, and earlier in BW than in the other bone variables. vBMD velocity was negative in boys from 11 to 13 years. At 17 years BMC, BW and aBMD were significantly greater in boys than girls but there was no difference in vBMD.

Between 11 and 17 years BMC and vBMD as percentages of the young same sex adult means increased from 45 and 71% respectively to 86% for both in boys, and from 55 and 71% to 93 and 94% respectively in girls. Values at 17 years and bone velocities from 15 to 17 years suggested that girls were near peak bone status by age 17 but significant gains were still occurring in boys. Comparison of bone status according to bone age indicated that at cessation of longitudinal growth girls were very near peak bone status (97%) but increases were likely to continue in boys.

Neither nutrient intake nor physical activity was detectably correlated with bone status or bone status velocity. However BMC, aBMD and vBMD velocities from 11 to 17 years were significantly greater in those girls with consistently high calcium intakes (>RDI) than those with consistently low intakes (<0.7RDI). The high degree of tracking in all bone variables suggested that there was limited opportunity for environmental factors to alter bone status.

Multiple regression analysis determined the ability of biological factors, environmental factors and genetic factors, to predict each bone variable and the change in each variable. 80%, 71% and 49% of the variance of BMC, BW, and BMD respectively was accounted for by a combination of up to eight variables. 52% of the variance in change in BMC, 55% for BW,

and 58% for BMD was accounted for by a combination of up to five factors. Neither calcium intake nor physical activity were significant variables in any equation.

The stronger correlation of bone variables between both sons and daughters and their mothers, compared with their fathers and the lower bone status velocity in girls with consistently low calcium intakes, identifies a target population (girls with poor calcium intake and daughters of osteoporotic mothers and grandmothers) for further investigation. Meanwhile the public health messages of the benefits of good nutrition and regular physical activity should be targetted at children before and during their period of rapid growth so that their genetic potential of peak bone status can be achieved.