FIGURES

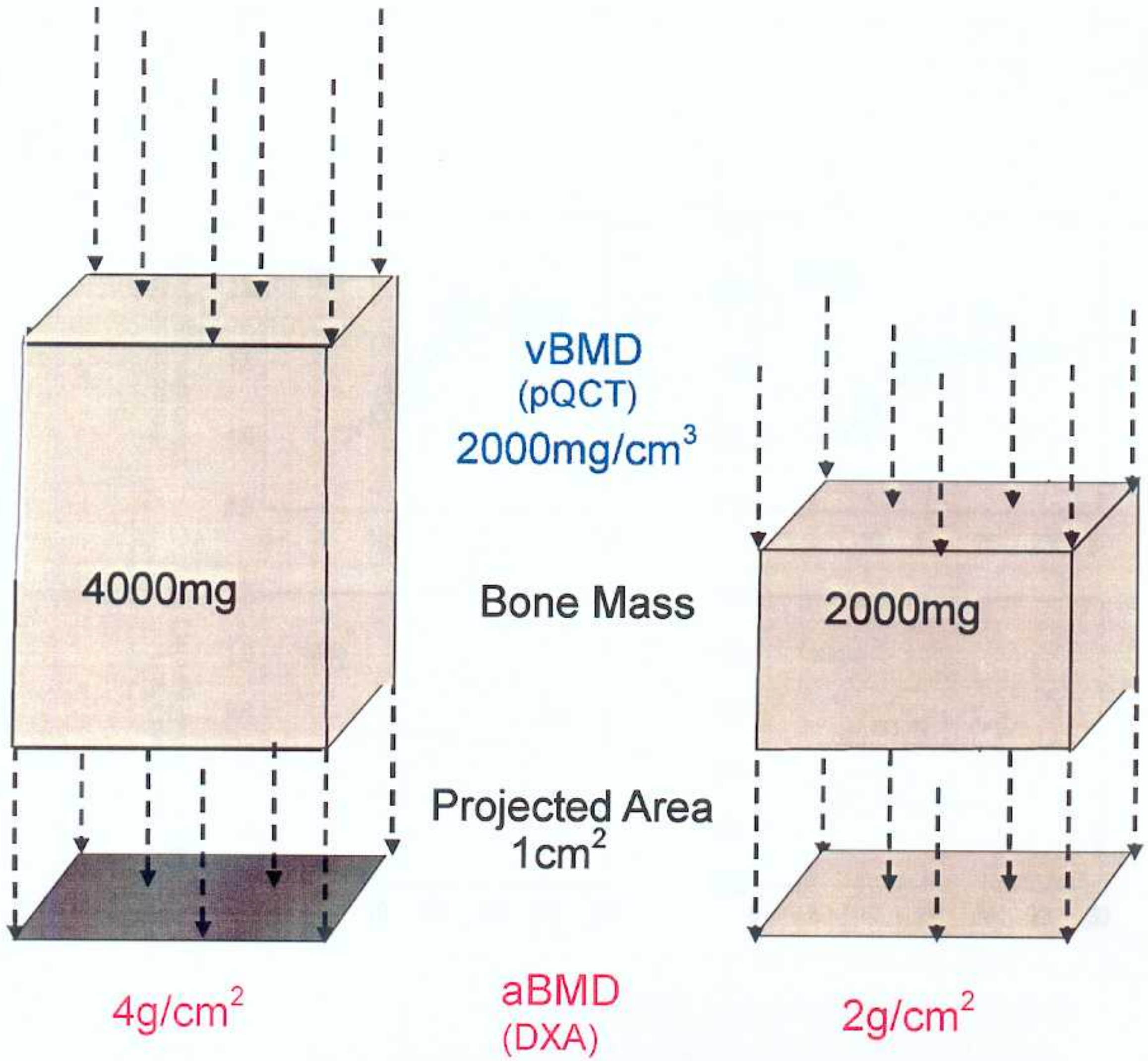

Fig. 1. The models of two bones, which have the same vBMD, but respond to completely different in aBMD.

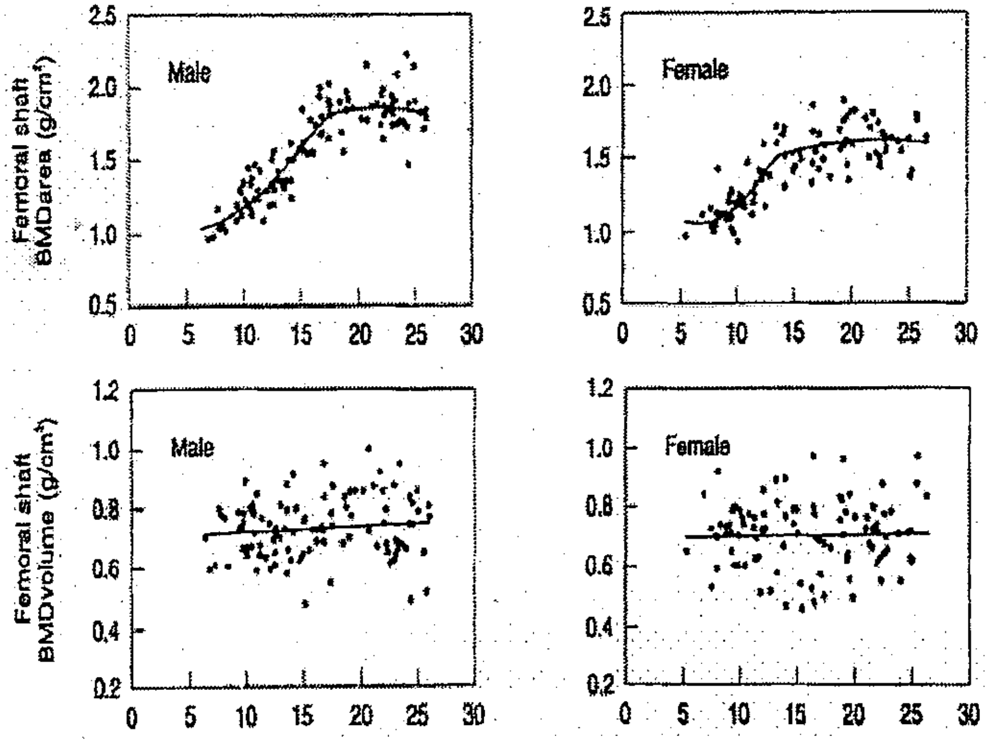

Fig. 2. The correlations of femoral aBMD and vBMD with age in both sexes (Adapted from Lu et al., J Clin Endocrinol Metab 81:1586-1590, 1996).

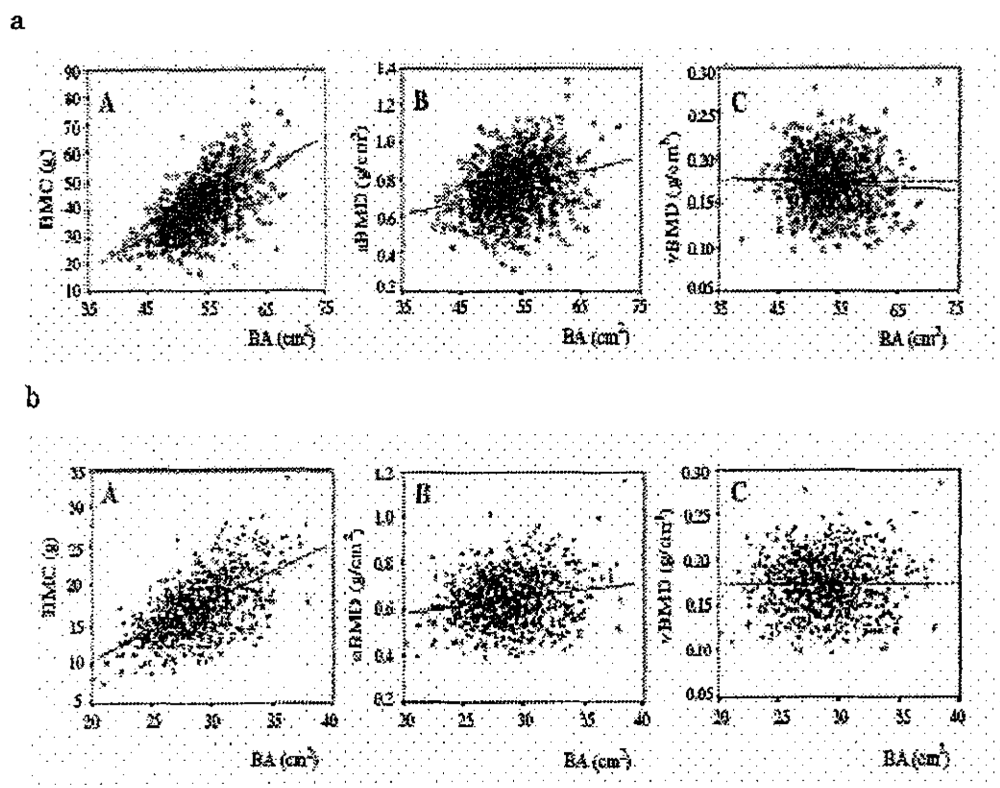

Fig. 3. The correlation of bone area (BA) with bone mineral content (BMC), areal bone mineral density (aBMD), and volumetric bone mineral density (vBMD) at the anteroposterior spine (L1-L4, a) and lateral spine (L2-L4, b) (Adapted from Liao et al., J Bone Miner Metab 22: 270-277, 2004).

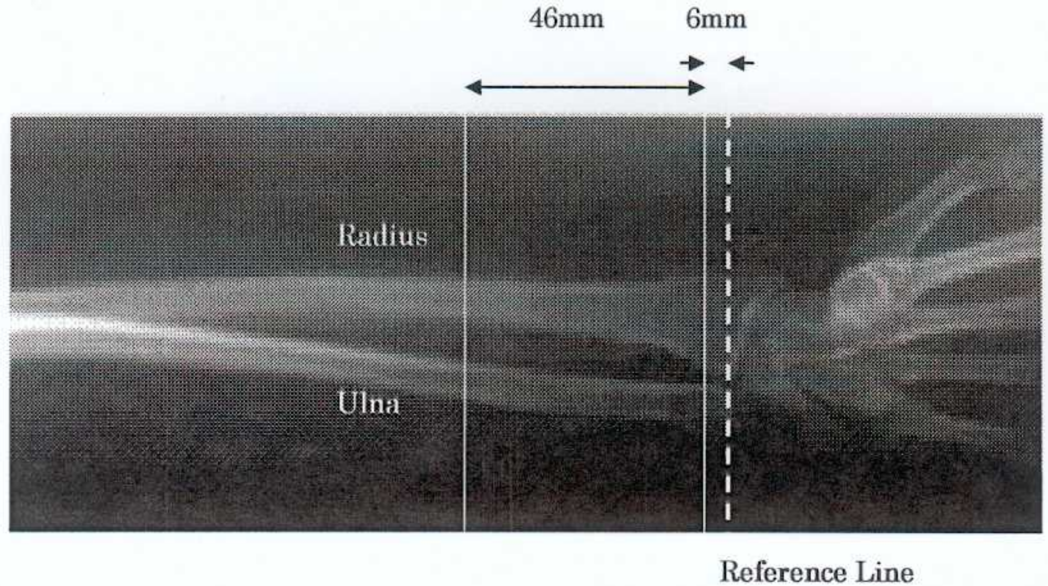

Fig. 4. The two measurement sites of the radius by pQCT. After an anterior-posterior projectional scout view was displayed, a reference line was set at the right angle to long axis of the lower arm and placed on the middle point of the end-plate of the distal radius. Two slices 6 mm and 52 mm proximal from the reference line were analyzed as trabecular and cortical bone assessment separately.

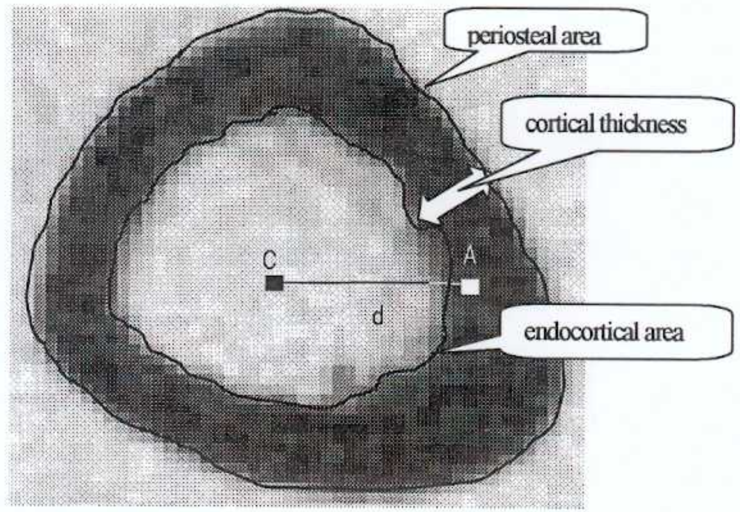

Fig. 5. A Densiscan image was imported into NIH Image to analyze the vBMD, BMC, bone geometric properties and strength indexes. The example is an inverse image of tibia on NIH Image software. Cortical bone was defined as that with a volumetric density of more than 0.7 mg/mm^3, and the strength indexes were calculated as follows:

$$\text{polar moment of inertia (mm}^4) = \Sigma(d^2 \times A)$$

$$\text{section modulus (mm}^3) = \Sigma(d^2 \times A)/d_{max}$$

$$\text{strength strain index (mm}^3) = \Sigma(d^2 \times A \times vBMD_{vox}/\ vBMD_{max})/d_{max}$$

where A is the cross-sectional area of a pixel (in this study it is 0.076 mm^2) and d is the distance (mm) of the pixel from the center of gravity (C), $vBMD_{vox}$ and $vBMD_{max}$ denote volumetric BMD and maximum vBMD (1200 mg/mm^3), and d_{max} is a maximum distance of a voxel from the center of gravity (C).

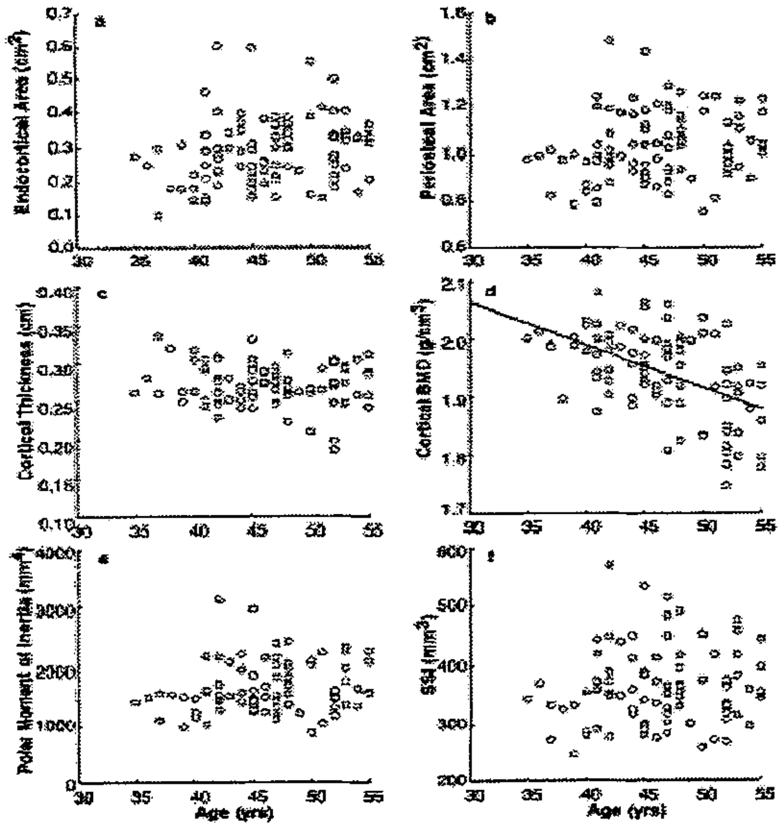

Fig. 6. Endocortical area (a), periosteal area (b), cortical thickness (c), cortical BMD (d), polar moment of inertia (e), and strength strain index (f).Means of the dominant and nondominant arm of each subject were plotted against age. Cortical BMD was significantly related to age ($p < 0.01$).

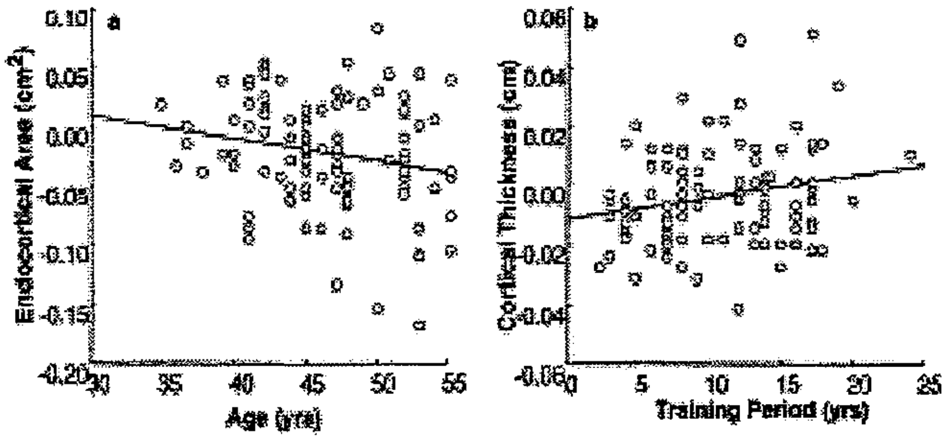

Fig. 7. Dependency of side-to-side difference in endocortical area on age (a) and cortical thickness on training period (b). Side-to-side differences for each individual are plotted against age or training period.

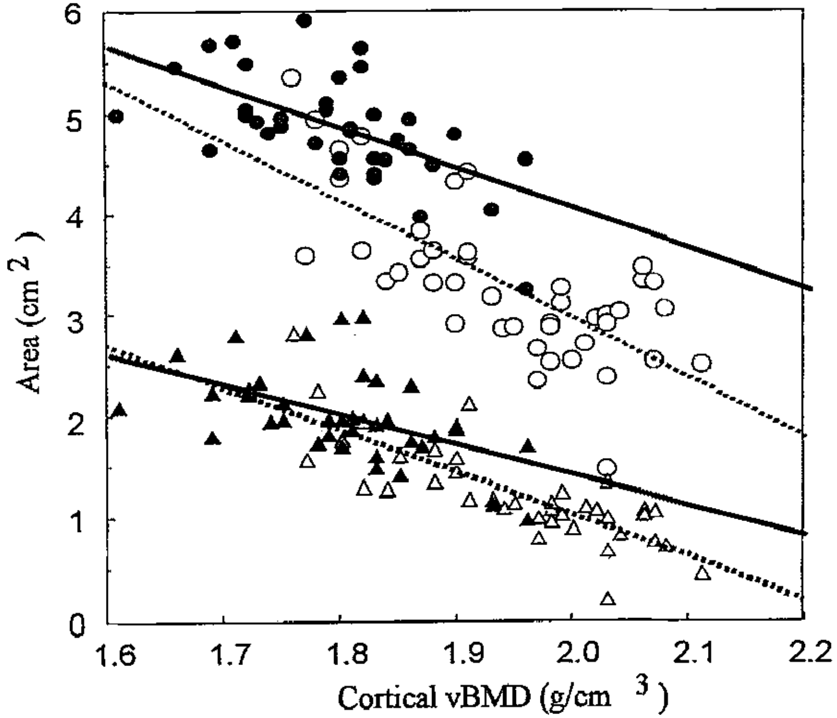

Fig. 8. Correlation of periosteal and endocortical areas with cortical vBMD in male and female subjects. Periosteal (●: male, ○: female) and endocortical (▲: male, △: female) areas were negatively correlated with cortical vBMD.

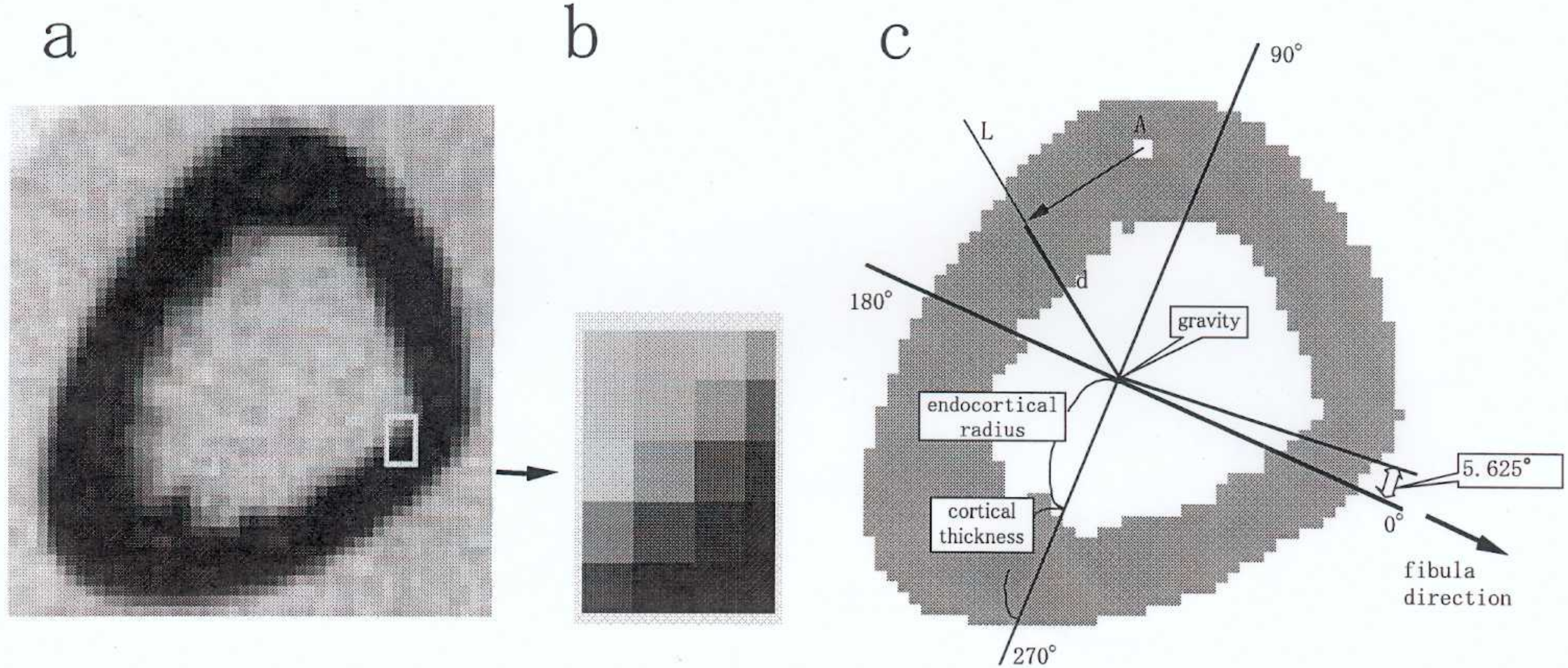

Fig. 9. Calculation of bone geometry properties and strength indexes from pQCT image of tibia.

(a) Image of a right tibia on NIH Image software. A Densiscan image of the tibia was imported into NIH Image to analyze the volumetric bone mineral density, geometric properties and strength indexes of the bone. Cortical bone was defined as that with a volumetric density of > 0.7mg/mm^3. (b) Magnified image of (a). Voxel size is 0.36mm × 0.36mm. (c) Calculation of bone geometry properties and strength indexes. Moment of inertia of area and SSI were calculated as follows.

$$\text{Moment of inertia of area} = \Sigma\,(d^2 \times A)$$

$$SSI = \{\Sigma\,(d^2 \times A \times vBMDvox\,/\,vBMDmax)\}/dmax$$

where A denotes area of voxel (0.126mm^2), d is distance (mm) of the voxel from the center of gravity of the bone, vBMDvox and vBMDmax denote volumetric bone mineral density (mg/mm^3) and maximum vBMD (1200mg/mm^3), and dmax is a maximum distance of a voxel from the center of gravity.

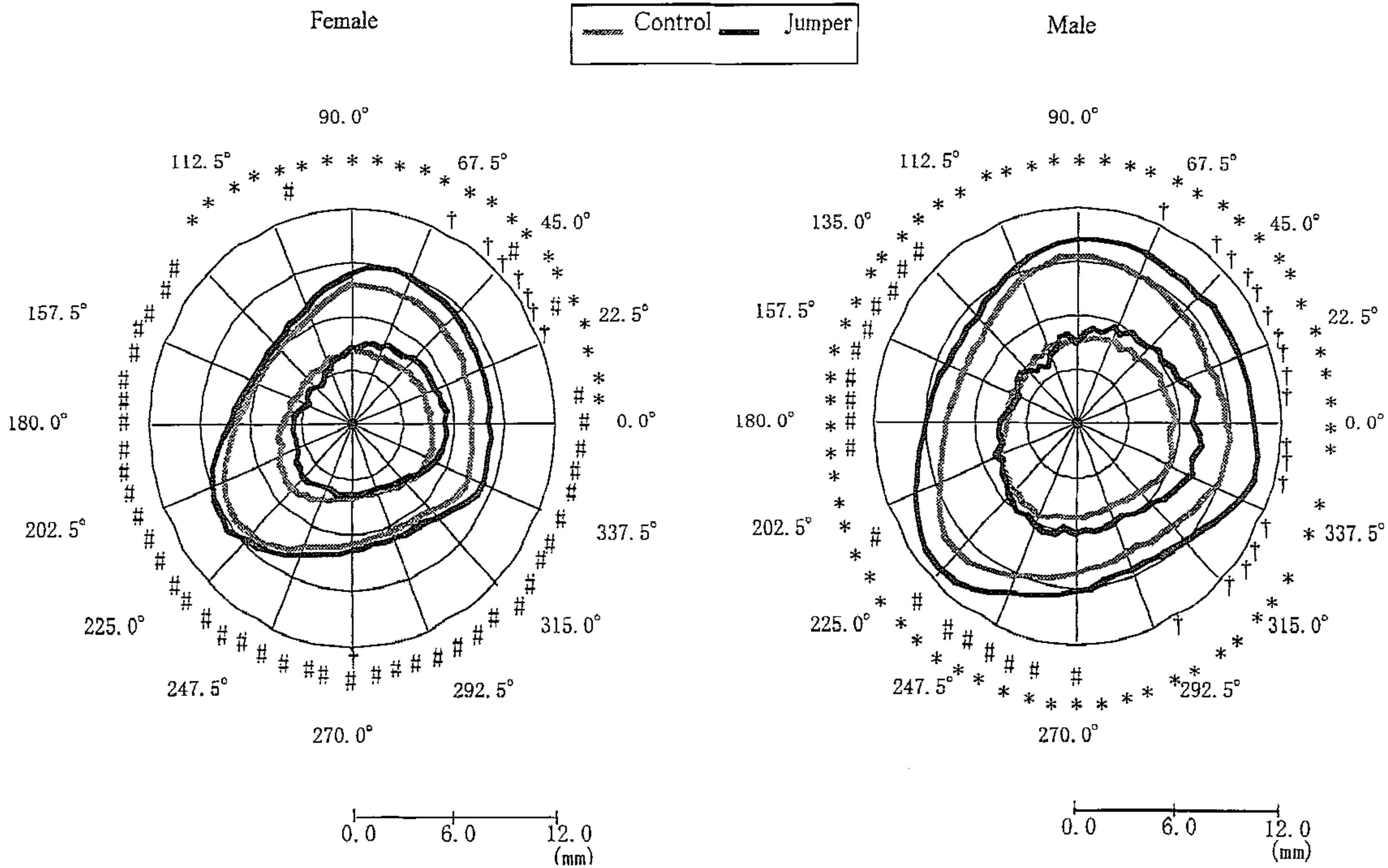

Fig. 10. Bone geometry.

Statistically significant differences ($p<0.05$) in periosteal radius (*), endoroctical radius (†), and cortical thickness (#) between jumper and control were shown.

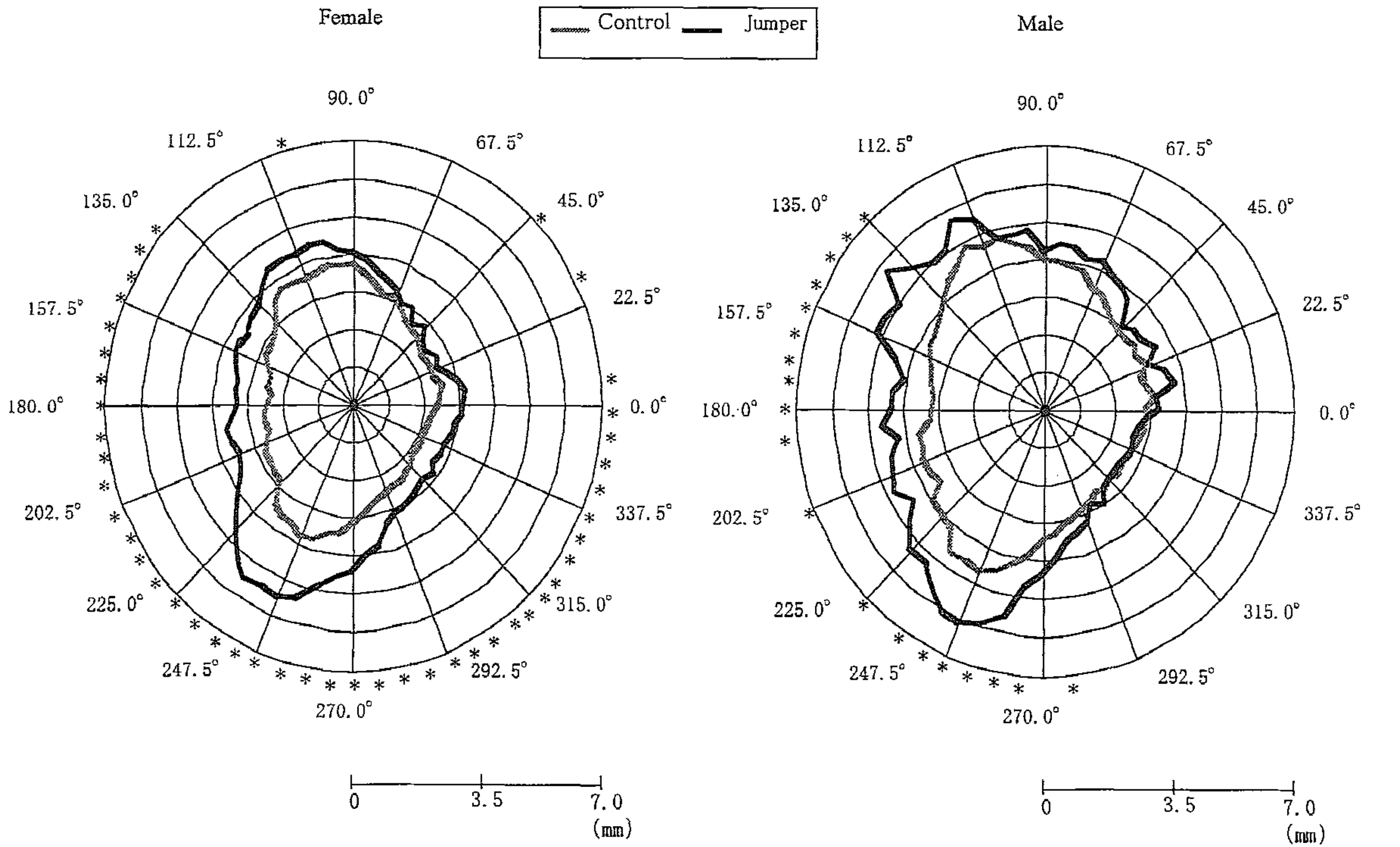

Fig. 11. Cortical thickness.

* Significant difference between jumper and control group ($p<0.05$).

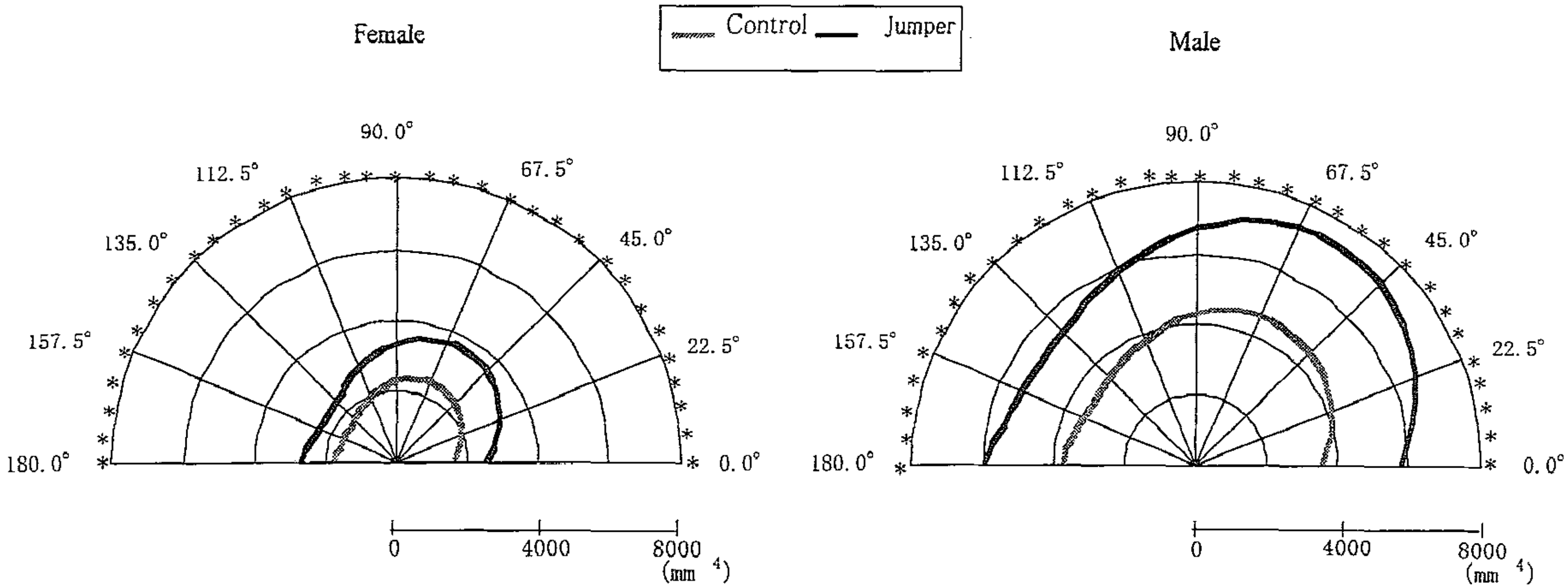

Fig. 12. Moment of inertia of area.

Moment of inertia of area (mm^4) along 180°–360° were not shown since it is identical to the value calculated along 0°-180°. * Significant difference between jumper and control group ($p<0.05$).

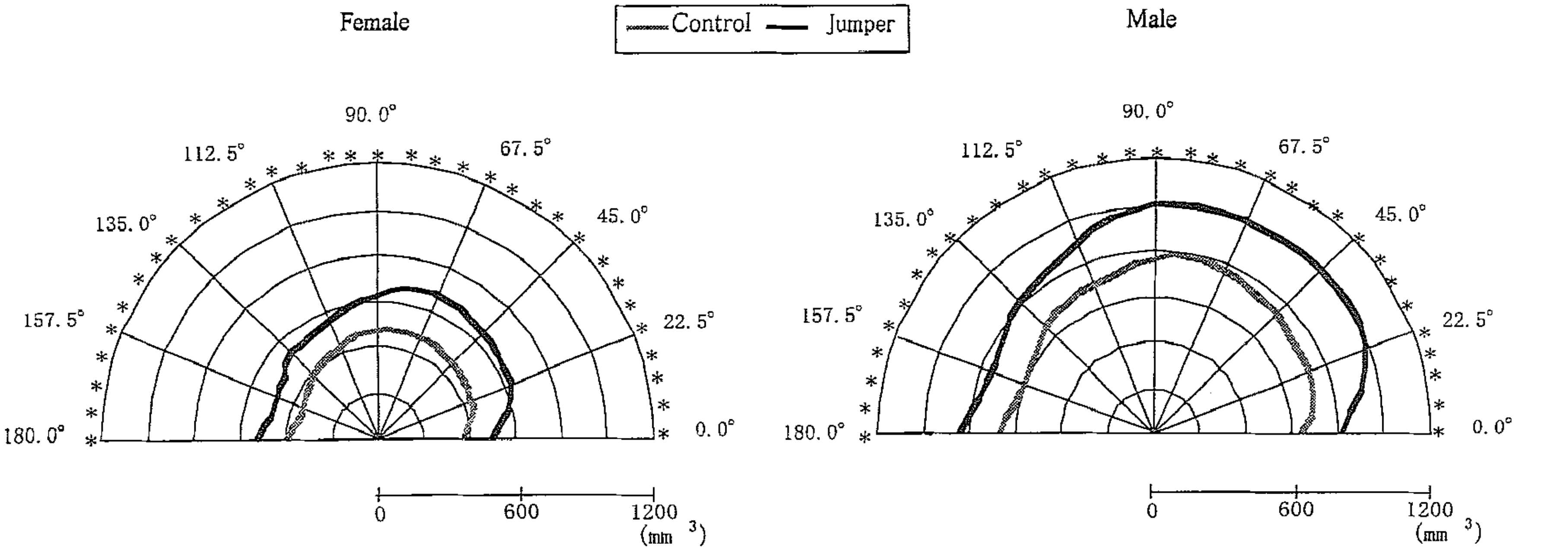

Fig. 13. SSI.

SSI (mm^3) along 180°–360° were not shown since it is identical to the value calculated along 0°-180°. * Significant difference between jumper and control group ($p<0.05$).

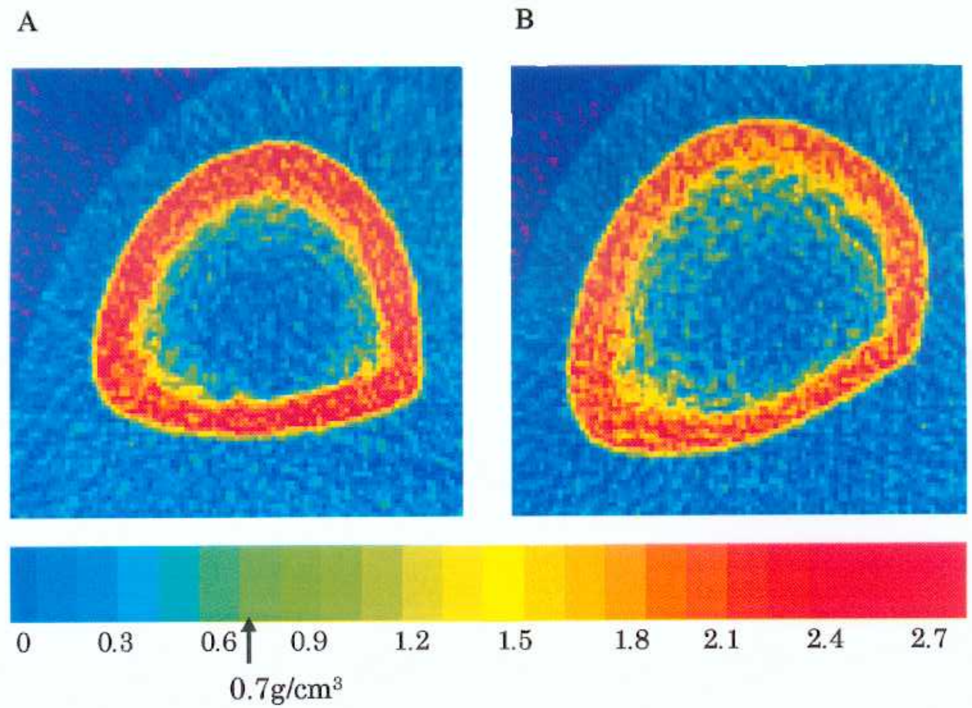

Fig. 14. An example of the mid-tibia in the male control (A) and jumper (B). The cortical bone was defined as that with a volumetric density of >0.7 g/cm^3.