Gait changes have been associated with compensatory reinforcement of femoral cross-sections. In particular, the body proportions of children, with wide torsos and short lower limbs, has been suggested to lead to mediolateral reinforcement of femoral cross-sections (Cowgill et al., 2010). Similar body proportions are found among the obese, who also have altered gait (Hills and Parker, 1992).

The femoral midshaft is suggested to respond to total body mass and/or lean body mass, and is dynamic through life (Cowgill et al., in prep; Ruff, 2003).

In contrast, proximal femoral shape is influenced by variation in body width associated with ecogeographic patterning (Holliday & Ruff, 2001; Ruff, 1995, 2000).

Most analyses of cross-sectional geometry control for mass, and have not examined the affect of extreme mass changes on diaphyseal shape.

**RESEARCH HYPOTHESES**

- **BMI** and mediolateral reinforcement of femoral cross-sections will be positively correlated.
- Proximal cross-sections will not match mid-femoral cross sections because of the effect of hip biomechanics.

**METHODS**

- Cross-sectional geometric properties were reconstructed following established protocol using external contour molds and biplanar radiographs using “the Latex Cast Method” (O’Neill & Ruff, 2004; Cowgill, 2010).
- Femora cross-sections were reconstructed at 50% and 80% of biomechanical length.
- Bi-iliac breadth was taken to control for variation in body mass ascribable to skeletal body breadth.
- Cross-sectional shape was calculated using a modified version of Sylvester et al. (2013)’s automated cross-sectional geometry program for R (R Core Team, 2016).
- Shape (I/L) and cortical area (CA) were regressed on bi-iliac breadth, and standardized residuals for obese and normal weight individuals were compared using t-tests.

**RESULTS**

- **Cortical Area**
  - Cortical area residuals were not significantly different between obese and normal weight individuals at midshaft.
  - Cortical area differed significantly between obese and normal weight individuals at the proximal femur (p = 0.016)

**CONCLUSIONS**

- Significant differences between obese and normal subjects were only found in cortical area at the 80% level.
- Despite observed gait differences, obese individuals do not have a corresponding mediolateral expansion of their femoral shape.
- This suggests that either the gait differences are not large enough, the sample was not active enough to capture the difference, or the difference observed in children is a function of their increased mechanosensitivity during growth.
- While most models of the effects of body breadth of hip morphology have focused on skeletal pelvic breadth, it remains possible that increased soft tissue body breadth may also have an influence on diaphyseal shape.

**REFERENCES**


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