MA Thesis – Human Skeletal Biology Track, Physical Anthropology - New York University (2010)

MAGNETIC RESONANCE IMAGING OF THE BRAINS OF NORMOCEPHALIC AND MICROCEPHALIC INFANTS, CHILDREN, AND ADOLESCENTS

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Abstract

The designation of *Homo floresiensis* as a new species derived from an ancient population is controversial, as the type specimen, LB1, might represent a pathological microcephalic modern *Homo sapiens*. Accordingly, developmental changes in brain volume and shape in infants, children, and adolescents were ascertained with MRI, using 20 craniometric (linear brain) measurements in 118 normocephalic and 21 microcephalic individuals ages 1 postnatal week to 18.7 years. Collected clinical data included age, sex, weight, height, body mass index, occpito-frontal circumference (OFC), and diagnosis prompting the MRI scan. Twenty craniometric measures were obtained to allow for the determination of specific ratios as well as sex and age-related changes in brain shape and size. Analysis of the normocephalic cohort showed that OFC is larger today than 40 years ago, likely related to a concomitant increase in body stature. Both body weight and body mass index also are greater today than previously, reflecting frequent childhood obesity in our society. The normative data indicated a wide variation in the maturational pattern of several specific craniometric ratios, which reflects changes in the volume and configuration of the brain with advancing age. The increases in brain volume and changes in brain shape were most dramatic during infancy, with continued minor escalations in volume and reshaping during childhood and adolescence. Sex differences existed both in brain volume and shape, as well as evidence of sexual dimorphism. Changes in cerebellar volume and shape lagged behind the corresponding changes in the cerebral hemispheres.

The investigation allowed for three major conclusions regarding microcephaly. Firstly, the brain volumes of both primary and secondary microcephalics are quite variable, ranging from very small to near normal. Secondly, living microcephalics can be distinguished from their normocephalic counterparts by two specific craniometric ratios (frontal cerebellar pole/sagittal cerebral length; axial temporal width/axial cerebellar width), which incorporate cerebral and cerebellar dimensions (length and width). Thirdly, the cerebral/cerebellar ratios of the LB1 endocast reported by Falk et al (2007) fall outside the range of living normocephalic individuals and within in the range of living microcephalics. The findings support the contention that LB1 represents a pathological microcephalic *Homo sapiens* rather than a new species, i.e. *Homo floresiensis.*