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Do Patterns of Covariation between human pelvis shape, stature, and head size alleviate the obstetric dilemma?

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Fischer and Mitteroecker claim to have resolved the obstetric dilemma by establishing a previously-unrecognised, ameliorating-pattern of selective-covariation between pelvis shape, stature and head size (1). We feel that, while their results are intriguing, they do not fully consider the interconnecting web of factors that play important roles in complexity and the evolutionary trade off between bipedalism and the pattern of increasing brain size in the genus Homo.

The suite of adaptations that defines the Hominin sub-family started around 7 million years ago. By comparison obstetrically-compromising rapid-encephalisation started in tall *Homo* populations around 2 million years ago with *Homo erectus (sensu lato)*. From this point onwards, the obstetric dilemma is best thought of as how to integrate brain expansion with a pre-existing bipedal architecture. The relationship between brain size and pelvis morphology is a question of bioplasticity versus genetic evolution. In order to properly address this question one must explicitly consider whether the suggested relationship is an evolutionary-selective phenomenon or an analytic artefact of combining multiple anatomically-related variables and/or the plasticity of the individual (with or without epigenetic shifts between the mother and offspring).

Fischer and Mitteroecker do highlight an increase in cranial volume between 600-100,000 years ago within the genus Homo but this was followed by an opposite evolutionary trajectory. Using the same cited Ruff data, brain expansion, peaked in both Neanderthals and *Homo sapiens* around 100,000 years ago, plateaued, then decreased markedly within *Homo sapiens* after 35-21,000 years ago, along with stature and mass (Oppenheimer 2013 (2)). If, however, we use Encephalisation Quotient (EQ) as a diachronic measure then we see a flat lining over the last 100,000 years while body size actually decreases. It should be noted that this was a period of massive cultural expansion by *Homo sapiens*. So, although EQ was maintained, some other benefit presumably ameliorated and balanced the economy of brain size. This must suggest a very strong stabilising selective pressure on an appropriately safe brain size, maintaining EQ, while body size was reducing, possibly with obstetric risk, balanced against continuing sexual selective pressure for relatively larger brains (Miller & Penke 2007; Oppenheimer 2013). This pattern of reduction of adult height while EQ is maintained, only makes obstetric sense if smaller *populations* allow easier delivery. While such a relationship is obstetrically counter-intuitive, Kurki (2011) has found evidence consistent with it, by comparing between modern era regional populations, including the San.

A distinct but complementary test of these scenarios would be to examine and compare changes in brain and body sizes and coefficients of phenotypic variation and obstetric outcome among regional populations over the past 100 years when high rates of obstetric intervention could have reduced natural selection and 'allowed' the dramatic secular trends in size of elite populations, usually put down solely to nutrition and health. This would provide a broad based framework to try and understand the on-going interaction between selective pressures operating on female pelvic morphology and foetal development patterns.

References

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