



Body Size Trends in Ice Age (Pleistocene) Horses from the Great Plains

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INTRODUCTION

This study explored the relationship between mammalian body size and climate. In this specific study, data were collected from fossil horses from the Great Plains from the Pleistocene epoch to determine their body size trends.

- Bergmann's Rule: mammals that live in cooler climates tend to be larger in size than mammals that live in warmer climates (Dayan, 2003).
- Environmental Stress
 - Quantity and Quality of food
 - Temperature Fluctuations
- Pleistocene Epoch (1.8Ma ~ 20,000)
 - Climate fluctuated between periods of cold to warmer temperatures.

METACARPAL DATA

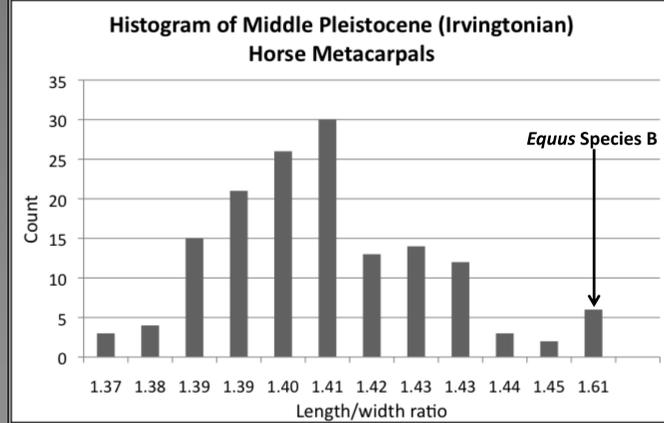


Figure 1

SKELETAL FEATURES

Figure 4: Metacarpals



Figure 5: First Upper Molar



RESULTS

Metacarpal Data

- Suggests two species of *Equus* are present in this data set. (Figure 1)
 - These species have not been determined yet.
- Shows a decrease in body size from the Early Irvingtonian to Late RanchoLabrean.
- Length range: 212.9mm - 266.1mm; Length avg: 236.5mm
- Width range: 29.9mm - 55.6mm; Width avg: 48.4mm

First Upper Molar Data

- Suggests two species of *Equus* are present in this data set. (Figure 6)
 - These species have not been determined yet.
- Did not show a clear decrease in body size from the Early Irvingtonian to Late RanchoLabrean.
- Length range: 20.9mm - 33.4mm; Length avg: 26.9mm
- Width range: 18.8mm - 28.7mm; Width avg: 25.2mm

HYPOTHESIS

The idea that mammals should get smaller with warming climate is a supported theory, and is tested in this research by looking at fossil horses from the Great Plains that went through an interval of warming at the end of the last Ice Age (Pleistocene epoch).

MATERIALS AND METHODS

To estimate body size, two different skeletal features were used. Fossil horses from the Early Irvingtonian to the Late RanchoLabrean were selected.

- Metacarpals
 - Chosen because they are located within each front forelimb and support a main portion of the horse's body weight. Therefore, this bone fluctuates with body size.
- First upper molars
 - Chosen because they are more accurate at representing body size.

Metacarpal Data Collection

- Measured length and width to the nearest mm.
- Both dimensions were measured twice, and then the average of the two measurements was taken to get a more accurate length or width.

First Upper Molar Data Collection

- M1s first had to be identified from isolated teeth using several characteristics, including angle of the imaginary vertical axis that passes through the tooth, width of the parastyle compared with the mesostyle, and ratio between the anteroposterior diameter (length) and transverse diameter (width).
- Measurements were then taken of the length and width. The length is the distance from the posterior contact surfaces to the anterior contact surfaces (Bode, 1931).

Pleistocene Body Size Trend of Equus Species A

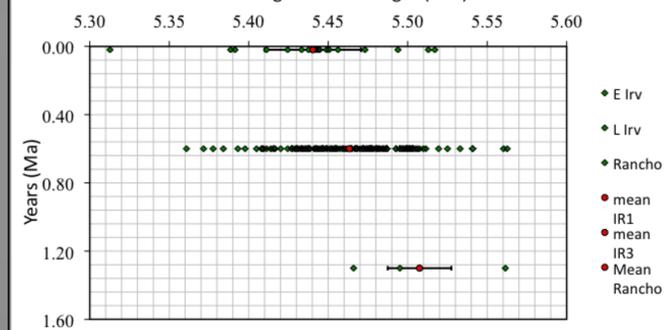


Figure 2

MOLAR DATA

Histogram of Pleistocene (Irvingtonian & RanchoLabrean) Horse First Upper Molars

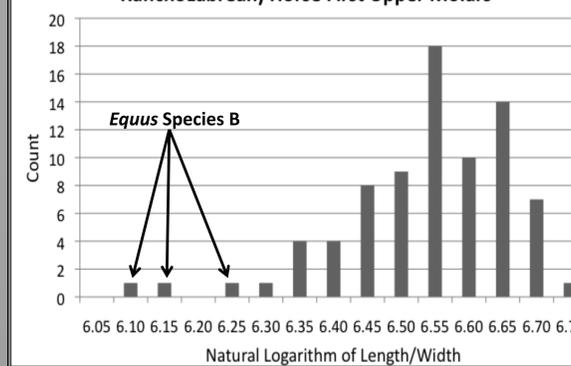


Figure 6

Pleistocene Body Size Trend of Equus Species B

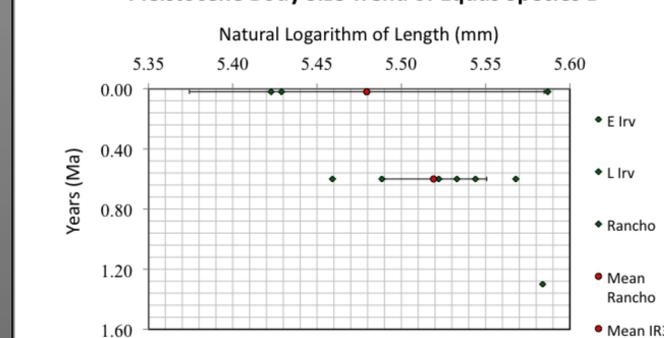


Figure 3

Pleistocene Body Size Trend of Equus Species A

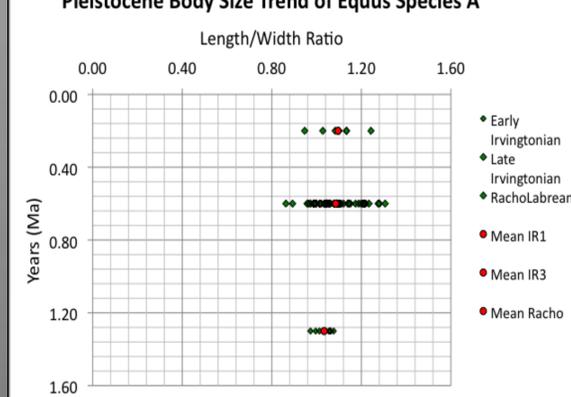


Figure 7

CONCLUSIONS

Using Bergmann's rule, one might assume that the horses would decrease in body size as temperatures changed from cold to warm at the end of the Pleistocene; the data demonstrated this trend. *Equus* Species A and *Equus* Species B from the Great Plains did decrease in body size during the Pleistocene. Metacarpal data showed a clear decrease in size, while the first upper molar data did not show a clear decrease in size. The reduction in metacarpal size, while tooth size remained static, suggests that the inferred decrease in body size was not the result of natural selection (i.e., genetic change), but rather was a phenotypic response to environmental pressure.

FUTURE RESEARCH

Future research will include carbon dating the first upper molars to acquire more accurate dates that will be compared to the Pleistocene epoch more closely. Statistical tests will be run to see how significant this decrease in body size is, and to determine the species of horses that are present in these localities. Finally, a closer examination will be conducted to determine possible underlying factors of body size change.

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