PhD – Thesis

Osteometric Variation of the Human Spine in Central Europe by Historic Time Period and Its Microevolutionary Implications

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Abstract

For most parts of the human body, the morphometry and its variation with regard to microevolutionary and secular trends, sexual dimorphism and individual aging are well known. Surprisingly, studies focusing on the vertebral column have so far primarily used either a macroevolutionary or a clinical focus. The aim of this study is to address the osteometry and variation of the human spine from a special perspective, possible microevolutionary alterations.

A total of 348 human skeletons, dating from 28,000 B.C. to the mid 20th century A.D., from 24 sites mostly in Switzerland and Southern Germany, and without macroscopic pathology, were measured with a caliper by a single observer. These measurements at vertebral levels cervical 3 and 7, thoracic 1, 6 and 10, and lumbar 1 and 5 were taken: ventral and dorsal vertebral body height, sagittal and transverse vertebral body and spinal canal diameters, spinous and transverse process length, pedicle height and intervertebral foramen widths; as well as the diameters of the foramen magnum, humerus and femur length and circumference, femur head breadth and bi-iliac widths.

With the exception of most of the bony outlines of the neural pathways, males show larger osteometric dimensions than females. No side difference of bilaterally measured variables was found. Variables of neighbouring vertebrae correlate to a higher extent than more distantly located variables; similar measurements at different vertebral levels correlate generally better than non-related measurements. With greater individual age, especially in males, the diameters of the vertebral body and pedicle height increase. A positive microevolutionary trend, with both increasing mean values and standard deviations, could be found; this trend was independent of stature for selected measures.

The samples show a microevolutionary increase in most of the spinal variables. Since both, mean values and standard deviations, increased, one may explain this higher intra-group variability to be a result of relaxed natural selection. Various environmental or genetic factors could explain the short-term alteration of the spinal osteometry. Furthermore, the relative smaller size and decrease with age of the bony outline of the neural pathways in males, could explain their higher vulnerability to modern lower back pathologies.