Abstract

Previous studies proposed that Neandertals had one third higher energetic cost of locomotion than anatomically modern humans. Greater cost of locomotion could disadvantage Neandertals in competition with anatomically modern humans and could be a factor in their extinction. Greater cost of Neandertal locomotion was ascribed to their shorter lower limb and greater body mass. However, Neandertals differed also in other morphological parameters that were not considered in estimation of their locomotor cost. In this dissertation we model locomotor cost of Neandertals and anatomically modern humans using previously described relation between muscle force production and energetic cost of movement. We estimate the key locomotor parameters using a model developed by us from osteometric data from literature (n =50) and from our measurement (n = 21), and from kinematic data of 26 individuals. Further, we analyze the effect of relative lower limb length (in relation to body mass) and crural index on energetic cost of locomotion. Our results suggest that walking of Neandertal males was 9–14% energetically more demanding than walking of anatomically modern males. Nevertheless, the walking cost of Neandertal females was similar to that of anatomically modern females. Inclusion of lower limb proportions into the model suggests that Neandertal lower limb was energetically more effective than limb of anatomically modern humans and that the greater walking cost of Neandertal males is a consequence of their greater body mass. The analysis of the effect of lower limb proportions reveals that relative length of lower limb (in relation to body mass) and crural index have minimal effect on energetic cost of locomotion. In other presented studies related to lower limb proportions and/or locomotion we 1) identified the effect of body mass on knee flexion during walking; 2) gave evidence about relationship between decrease of mobility in Holocene and onset and intensification of agriculture in Europe; 3) developed equations for stature and body mass estimation from long bones for European Holocene populations; and 4) developed equations for stature estimation from long bones for Central European Early Medieval populations.