

Abstract:

Locomotion is one of the most important qualities of man and has always been associated with survival, foraging and subsistence. During the course of evolution, men and women developed some form of gender specialization which resulted in different levels of mobility between the sexes. Throughout history, the types of subsistence have changed and the degree of sedentism has increased. However, despite all the changes in subsistence, gender specialization and bone robusticity sexual dimorphism in the robusticity of the lower limb bones remained surprisingly stable. Is it possible that women load lower limb bones differently than men (e.i. due to different body proportions)? The aim of this work is to determine whether there is sexual dimorphism between the sexes of the recent living population in the cross-sectional properties of the tibia and in the load on the tibia during running. In this work we used images of the tibia from magnetic resonance imaging and kinematic and kinetic data during the run of 20 probands. By using musculoskeletal modeling we estimated the bending moment acting at 50 % of the tibial length as well as the angle of action of this moment. After adjusting for size, no significant difference was found in the results of cross-sectional geometry of the bone in any of the monitored variables. No significant difference between the sexes was reflected in the shape of the bone in its cross-section. In comparison to the previously obtained results of Ruff et al. (2015) the lowest and second lowest rates of sexual dimorphism in the last 12,000 years were found in the values indicating antero-posterior and medio-lateral bending strength of the bone. After adjusting for size no significant difference was observed in the bending moment and the angle of action of the moment on the tibia. Based on our results we believe that there is no significant difference in the load of tibia when running between men and women. Our results suggest that the differences observed in the lower limb bones of men and women in historically older populations are not due to different bone loads but probably due to the amount of this load associated with the level of physical activity.

Key words: tibia, loading, sexual dimorphism, running, cross-sectional geometry, musculoskeletal modeling