

Sexual dimorphism of the first metatarsal bone: volumetric assessment for diagnosis of sex

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Sex assessment is one of the principal activities in the establishment of a biological profile in both forensic anthropology and osteoarchaeology; in addition, most of methods for diagnosis of sex are based upon anatomical findings, including morphological traits of cranium and pelvis [1]. As standard procedures based on cranial and pelvic morphology are not applicable in every context, literature is focusing on novel methods for assessing sex also from measurements of single bones. In the last years volumetric (CT, MRI) and surface (stereophotogrammetry, laser scanners) 3D acquisition systems enabled researchers to perform statistical evaluations not only of linear measurements, but also of surfaces and volumes. This article aims at assessing volume parameters of the first metatarsal bone through 3D acquisitions by laser scanning: 129 first metatarsal bones from 68 skeletons (35 men, 33 women) were acquired from the Milanese Skeletal Collection hosted by University of Milan (66 right and 63 left elements). A male-female cut-off value of 13,330 mm³ was found, with an overall accuracy of 82.4% ($p < 0.05$). Area under the receiving operating characteristic curve (AUC) was computed to assess the ability of the cut-off value to distinguish between men and women with a global performance of 87%. A novel method for sex assessment from the volume of the first metatarsal bone was developed, which however seems less reliable than similar procedures based on linear measurements [2]. Further studies are needed to verify the real advantage for sex assessment provided by volume measurements and possible bias due to ethnic variables.

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References

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Keywords

Anatomy; sex assessment; first metatarsal bone; laser scanner; bone volume.