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MANUAL SEGMENTATION OF HEAD, NECK, TRUNK AND PELVIS SEGMENTS FROM DXA SCANS IS A RELIABLE APPROACH FOR DETERMINING TISSUE MASS ESTIMATES

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To facilitate the use of wobbling mass models in biomechanical research, accurate and reliable quantification of in-vivo soft and rigid tissue masses is required [1]. The reliability of upper and lower extremity tissue mass estimates has been reported to be good to excellent, following manual segmentation of Dual Energy X-ray Absorptiometry (DXA) scans [2]. The purpose of this study was to quantify the within- and between-measurer reliability of the head, neck, trunk, and pelvis tissue masses, using a comparable approach.

Full body DXA scans were performed on 102 younger (51F, 51M; 16-35 years) and 101 older (50F, 51M; 36-65 years) participants, and manually segmented twice by four trained measurers using regions of interest for the head, neck, trunk and pelvis segments. Between- and within-measurer reliability of segment lean mass (LM), fat mass (FM), wobbling mass (WM=LM+FM) and bone mineral content (BMC) were assessed using intra-class correlation coefficients (ICCs) (good to excellent: ICCs>0.75) [3] and coefficients of variation (CVs) (good: CVs<10%) [3].

Within- and between-measurer ICCs ranged from 0. 595 (neck BMC) to 1.00 (trunk WM, FM, BMC; head BMC; pelvis BMC), and 0.523 (neck LM) to 1.000 (head BMC; trunk WM, FM), respectively. Over 95% of all CV values had magnitudes below 5%, and maximum between- and within-measurer CVs were only 7.34% (neck BMC) and 6.28% (neck FM).

All tissue mass estimates (across segments and age groups) had good to excellent reliability except a few ICCs for the neck and head. Limitations with planar scanning of the neck and head contributed to this finding. Overall, these very positive results are consistent with previous work for the extremities [2] and suggest that manual segmentation of core body segments from DXA scans is an appropriate approach for determining tissue mass estimates of living people of a range of ages.

References:

[1] Gruber K. et al. (1998). A comparative study of impact dynamics: Wobbling mass model versus rigid body models. J. Biomechanics 31(5); p. 439-44.
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[3] Brydges E. et al. (2015). Leg soft tissue position and velocity data from skin markers can be obtained with good to acceptable reliability following heel impacts. J. Sports Sciences 33(15); p. 1606-13.