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Quantitative Cross-Sectional Imaging for Body Fat Analysis: A Feasibility Demonstration Using Low Dose Human Sized CT in a Pre-clinical Therapeutic Trial

Michelle I. Knopp
Washington University in St Louis

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With the ever-growing obesity rates worldwide, better quantitative methods of body composition analysis are needed to analyze the effectiveness of interventions. Due to fat’s characteristic low x-ray absorption, Computer Tomography (CT) allows quantitative assessment of fatty tissue and cross-sectional anatomic differentiation. In this study we examined the feasibility, reliability, and reproducibility of a new state of the art methodology to analyze body fat composition with low dose CT in pre-clinical non-human primates enrolled in a therapeutic intervention program on human sized clinical systems. A regional assessment was conducted on four single CT images at the pubic bone, sacral pelvic junction, pelvic crest, and lower pole of the lowest kidney. A total of 516 data sets were analyzed using threshold-segmented region of interests (ROI). Several experimental scanning parameters were used to test feasibility of different conditions. The use of segmented ROIs showed lower reproducibility error compared to the traditional method of longest diameter measurements of fat deposits. Comparison between different energy levels revealed an overall slight overestimation of the volume of fatty tissue on the lower energy approach but showed promise for comparison between different time points. A comparison between pre-contrast images and post-contrast images revealed that the volume of the fatty tissue was always calculated to be larger in the pre-contrast scan. Both of these test conditions show promise for anatomical differentiation. Biological examination and imaging with other modalities such as MRI could provide additional insight into the accuracy of these measurements. We demonstrated the benefits and limitations of different methodological approaches as well as feasibility for regional cross-sectional body fat assessment.