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Purpose :

In humans CT imaging is a validated method for the study of adipose tissue distribution and for quantification of visceral and subcutaneous fat. Equivalent methods adapted to murine models of obesity are still lacking. Indeed most attempts to quantify fat tissues *in vivo*, using dedicated small animal micro-CT, involve long-term X-ray exposure which limits longitudinal studies. We have overcome this limitation by using a human clinical CT which allows very fast 3D imaging and minimal radiation exposure for the study of adipose tissue distribution in mice *in vivo*. Moreover, we have developed an automatic image analysis method for the segmentation of Hounsfield units of adipose tissues and for the localization of abdominal regions of interest.

Materials and Methods :

For each mice, 1000 slices were acquired in 2 sec using a Toshiba medical CT (135 kV and 400mAs). The slice thickness was 100µm with a resolution of 160 µm.

A Gaussian mixture model of the Hounsfield curve of 2D slices was computed with the Expectation Maximization algorithm. The identification of each Gaussian part allowed the automatic classification of adipose tissue voxels. The abdominal region of interest (umbilical) was defined as the slice showing the highest ratio of the Gaussian proportion between adipose and lean tissues.

Results :

Three Gaussians allowed to discriminated adipose from lean tissues in the subpart [-500 HU; 500 HU] of the Hounsfield curve. Gaussian models of adipose tissue showed a larger window of Hounsfield densities in control mice [-221;-37] as compared to obese mice [-206;-32]. The resulting computed volumes of fat tissue were respectively 4756 and 5978 mm^3.

Conclusion :

Our results show that the medical CT imaging combined with automatic image analysis provide precise and reproducible quantification of adipose tissue in mice in vivo allowing repetitive examinations for longitudinal studies.

Clinical relevance/application:

The application of human clinical CT to mice is a promising approach for the study of obesity, allowing valuable comparison between species using the same imaging materials and software analysis.