

# Quantitative MRI Analysis of Aging of Human Fat Tissue: Intra-Orbital versus Extra-Orbital Fat

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**Background:** Although intra- and extra-orbital fat show similar signals, the properties of intra-orbital fat appear different from that of extra-orbital; intra-orbital fat is often involved in autoimmune disease, lymphoproliferative disorder, and lymphoma. Except for the T2 measurement of retrobulbar fat in Graves ophthalmopathy versus normal subjects (Ref. 1), quantitative assessment of intra-orbital fat has not been described in the literature. Moreover, to the best of our knowledge, the normal aging pattern of fat tissue in the head and neck region are not known in regards to quantitative MRI (qMRI) analysis.

**Purpose:** To study tissue-specific age-related changes of the retrobulbar fat, buccal fat and subcutaneous fat of the cheek by multispectral qMRI, including measurements of proton density (PD), T1, T2, and secular-T2, which represents the pure spin-spin (T2) component.

**Materials and Methods:** This prospective study was approved by the IRB of our institution and included 42 subjects (21 males, 21 females, age range = 0.5-87 years, average age = 31.5 years) without orbital disorders who underwent brain MRI for various clinical reasons. All subjects were imaged at 1.5T (Achieva or Intera, Philips Medical Systems, Cleveland, OH) including our experimental qMRI sequence, mixed turbo spin echo (mixed-TSE) pulse sequence (Ref. 2, 3). Scans were DICOM-transferred for processing of quantitative measurements using algorithms developed in MathCAD (PTC, Needham, MA). After PD values of cerebrospinal fluid (CSF) were normalized to 1.0 for each subject, PD, T1, T2, and secular-T2 measurements were obtained using rectangular voxel-based regions-of-interest (ROI). ROIs studied include medial and lateral retrobulbar fat, buccal fat, and subcutaneous fat tissue of the cheek. The multispectral qMRI values were then plotted as a function of age.

**Results:** Both medial and lateral retrobulbar fat tissue exhibited higher PD and T1 values than subcutaneous and buccal fat (Fig. 1, 2). PD and T1 values for all regions increased as a function of age except for the medial retrobulbar fat, which exhibited a slight, age-dependent T1 shortening. T2 (Fig. 3) and secular-T2 values of retrobulbar fat increased with age, while those of extra-orbital fat were shown to decrease.

**Conclusion:** Tissue-specific, age-related changes in PD, T1, T2, and secular-T2 measurements of normal intra- and extra-orbital fat tissues were demonstrated. PD and T1 measurements showed similar trends with age, with the exception of a slight T1 shortening tendency of medial retrobulbar fat above ~50 years of age. T2 and secular-T2 values of retrobulbar fat increased with age, in contrast to the decrease seen in extra-orbital fat. The difference in aging patterns between intra- and extra-orbital fat suggests different distributions and densities of microscopic non-fatty components, including vascular, lymphatic and nervous tissue as well as fibrous tissue, which may be associated with unique pathologies of the intra-orbital fat.

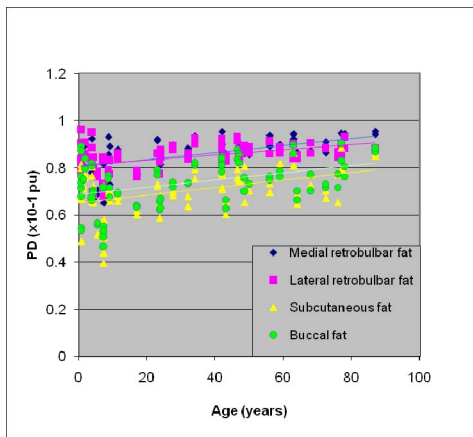


Fig.1 Proton densities of fat tissues.

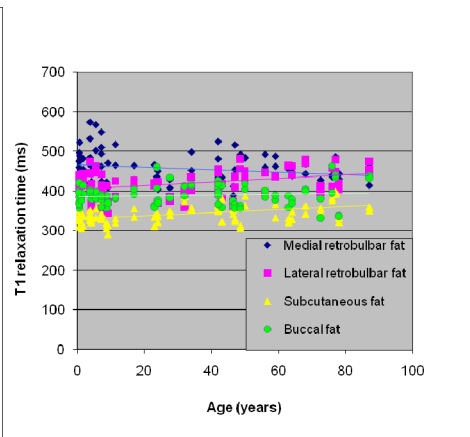


Fig.2 T1 relaxation time of fat tissues.

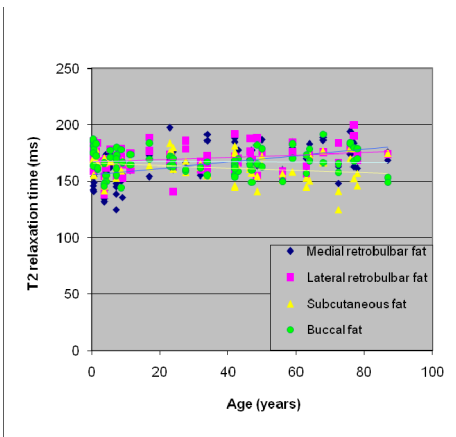


Fig.3 T2 relaxation time of fat tissues

## References:

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