**Background**

Increasing age is a known risk factor for knee osteoarthritis (OA), which results in increased muscle weakness and decreased mobility. Inter-muscular and intra-muscular adipose tissues are defined as the adipose tissue visible between muscle groups and muscle fibers, respectively. The quantities of inter-muscular adipose tissue (inter-MAT), intra-muscular adipose tissue (intra-MAT) and muscle in the thigh reflect adverse metabolic effects and muscle function.

**Objectives**

1. To investigate gender differences age related changes of muscle and adipose tissue volume in the thigh.
2. Propose a robust and automatic algorithm for the quantitative assessment of volume of thigh muscle, inter- and intra-muscular fat; Overcome the time-consuming and operator-dependent problems in traditional manual analysis, especially towards 3D datasets.

**Methods**

An automatic quantification framework consisting of 5 major steps was developed (Fig 1): 1) intensity inhomogeneity correction; 2) subcutaneous adipose tissue (SAT) removal; 3) tissue labeling for bone, marrow, fat and muscle; 4) inter- and intra-MAT classification; 5) measurement of volume. Fig 2 shows T1 weighted MRI of middle aged and elderly men and women together with the segmentation results.

![Fig 1: Analysis Framework](image)

**Fig 2: T1 weighted MRI images (left) with the segmentation results (right).**

- Dark & light Purple: Bone & Marrow,
- Pink: Subcutaneous Adipose Tissue (SAT),
- Light Blue: Inter-muscular fat,
- Green: Intra-muscular fat,
- Brown: Muscle

**Fig 3: Age related changes of muscle and adipose tissue volume in subjects without ROA.**

- Green lines: mean, red lines: +/- 2SD, blue lines: the regression function.

**Results**

Correlations with age for muscle volume normalized for BMI, for the sum of inter- and intra-MAT and separately for intra-MAT both normalized for muscle volume are shown in Fig 3.

**Conclusion**

In healthy subjects of the OAI cohort, BMI adjusted age-related muscle volume decreased more in female than male. The muscular fat to muscle volume ratio did not significantly change with age, although there was an increasing trend in both female and male groups. The proposed framework provides an automated approach for quantitative thigh tissue assessment in T1 weighted MRI images. Ongoing development efforts include reduction of operator interactions to correct segmentation defects.

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