Fat composition and location: assessment by magnetic resonance imaging in muscle and adipose tissue

**Background:** Fat-water imaging is the most common magnetic resonance imaging (MRI)-based method for separating fat and water. It provides the possibility to visualize the fat fraction in various body parts to study the infiltration and distribution of fat.

From pure quantification of fat, fat-water imaging has been developed to a method with the possibility to measure the fat composition as well. This opens up for the opportunity to further characterize accumulated body fat and how it affects the risk and development of various fat related diseases.

**Research questions:** One limitation of fat-water imaging is that the short inter-echo spacing needed for correct estimation of fat fraction contradicts a high spatial resolution. In project 1, alternative methods for quantifying fat using high-resolution MRI were investigated and compared to fat-water imaging in healthy volunteers.

In project 2, the accumulated fat in lymphedema patients was studied. Not much is known about how lymphedema affects the subfascial compartment. The aim was therefore to investigate the subfascial (intra- and intermuscular) fat infiltration of patients with arm or leg lymphedema using fat/water-imaging.

Validation of the MRI-based fatty acid quantification method in vivo has so far been comparison with MR spectroscopy. No validation against an independent method has yet been conducted. The purpose of project 3 is to validate the MRI-based fatty acid quantification against both MR spectroscopy and gas chromatography.

The fatty acid quantification method has mainly been evaluated by our group and others in phantoms. Few in vivo imaging results have been reported. In project 4, the method is used to study the difference in fat composition between patients with high risk of diabetes type 2 and matched controls.

**Preliminary results:** In project 2, excess fat was found using fat/water-imaging in the edematous limbs compared to the normal limbs in both the intra- and intermuscular compartment.

**Significance:** This doctoral project will hopefully provide an independent validation of a MRI-based fatty acid quantification method, which is important to make it clinically applicable, as well as further expand the possible applications of fat/wat-imaging.

**Publication:**