

Optimization of the fat fraction and T2* measurements in mice at 4.7T with the IDEAL algorithm

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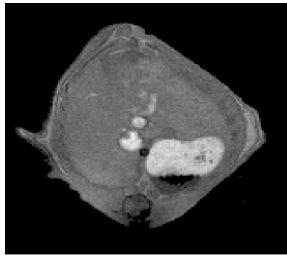


Fig. 1: MR image of a mouse, acquired in axial direction

The aim of the current work is to compare the fat fraction as well as T2* values calculated with the 6-echo and 15-echo reconstruction on mice at 4.7T.

Materials and methods: Four mice L-PK/c-myc were anesthetized with 2% isoflurane-oxygen (v/v). MRI measurements were performed at 4.7T (47/40 Bruker

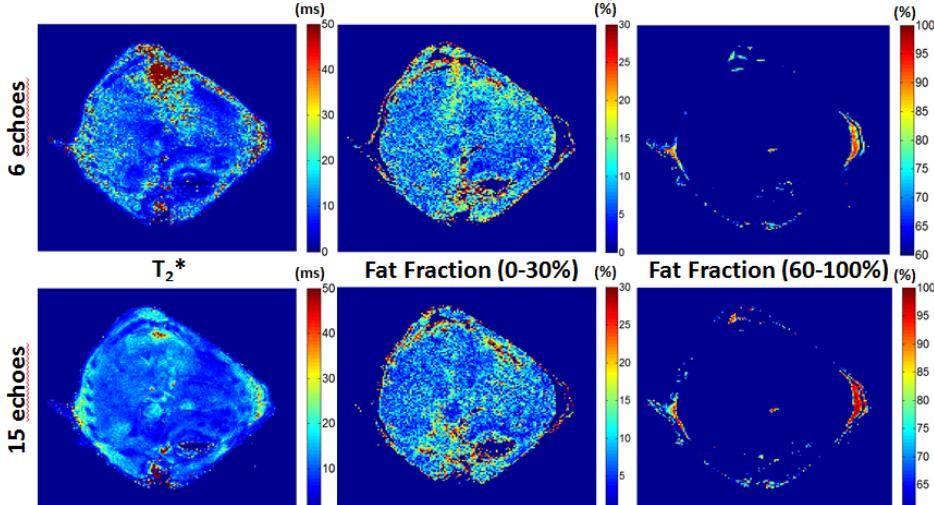


Fig. 2: T2* and fat fraction maps obtained in mice with IDEAL using the first 6 echoes (Top) and 15 echoes (Bottom) of the interleaved sequences. For a better visualization, fat fraction maps are presented in two images ranging from 0% to 30% (center) and from 60% to 100% (right).

reconstructions are shown in **Tab. 1**. With respect to the fat fraction, in accord with 6-echo and 15-echo reconstruction. It is pointed out that there is an agreement between the results of T2* at both reconstruction as well. Nevertheless, the standard deviations of the values relative to the 6-echo reconstruction are higher than the ones relative to the 15-echo reconstruction. **Fig. 2**, presents the outputs of IDEAL for the two reconstructions obtained in the slice shown **Fig. 1**. In the T2* maps, the values over 50ms were set as maximum. While the fat fraction maps are both well reconstructed, the quality of the T2* map is higher in the 15-echo reconstruction than in 6-echo reconstruction, which presents more aberrant values and more noise. This is in agreement with the results obtained in the ROIs: the red zone on top gives $1/T2^* = 0$.

Conclusion: In the current work, the results relative to the fat fraction and T2*, reconstructed with IDEAL, were compared using 6 and 15 echoes. Good agreement was achieved between the fat fraction values as well as T2* values, nevertheless the last parameter was better calculated with the 15-echo reconstruction.

Reference

1. Reeder S B et al. Multicoil Dixon chemical species separation with an iterative least-squares estimation method. *Magn Reson Med.* 2004; 51(1):35-45.
2. Hines C D G et al. "Quantification of hepatic steatosis with 3-T MR imaging: validation in ob/ob mice. *Radiology.* 2010;254(1):119-28.

	Fat Fraction values (%)		T2* values (ms)	
	6 Echoes	15 Echoes	6 Echoes	15 Echoes
L	7,3 ± 3,4	5,9 ± 3,9	14,2 ± 6,1	9,9 ± 1,8
L	8,2 ± 3,1	7,2 ± 3,2	13,9 ± 4,5	10,4 ± 1,5
L	6,9 ± 4,0	8,4 ± 3,2	12,9 ± 4,5	10,6 ± 1,3
L	7,7 ± 3,1	8,1 ± 4,2	16,8 ± 14,7	10,6 ± 2,5
M	8,7 ± 3,8	7,9 ± 4,1	13,9 ± 5,9	12,7 ± 1,8
M	15,1 ± 3,9	8,9 ± 3,4	35,1 ± 27,6	14,4 ± 2,0
M	14,5 ± 4,7	9,9 ± 4,5	12,8 ± 4,9	21,5 ± 6,9
M	7,2 ± 3,4	6,4 ± 2,4	21,0 ± 17,7	13,7 ± 2,1
S	89,6 ± 3,1	96,5 ± 1,8	33,4 ± 26,0	27,6 ± 7,5
S	90,3 ± 4,3	83,2 ± 9,3	17,4 ± 12,3	12,8 ± 7,3
S	91,9 ± 1,5	96,5 ± 2,2	35,1 ± 26,7	14,3 ± 2,7
S	88,9 ± 5,5	90,9 ± 5,5	7,9 ± 4,9	7,9 ± 2,4

Tab. 1: Fat fraction and T2* ROI measurements obtained on mice on different areas (L = Liver, M = Muscle, S = Subcutaneous fat): mean values and standard deviation are shown for both the reconstruction.

Biospec). Three shifted multi gradient echo (MGE) sequences were used with these parameters: echo spacing = 2.37ms, first echo time = 1.37, 2.16 and 2.79, 12 echoes, repetition time = 380ms, flip angle = 50°, field of view = 3x3cm², slice thickness 1.25mm, 8 slices, interslice distance = 1.5mm, matrix size = 160x160, bandwidth = 2x10⁵ Hz and 4 averages. The three sequences were put together to create a single sequence of 0.79ms echo spacing. All images (**Fig.1**) were processed with a homemade script in MATLAB® which reproduces the IDEAL algorithm. Mean values and standard deviation of fat fraction and T2* were obtained in ROI positioned in the liver, muscle and subcutaneous fat of the mice.

Results: Fat fraction and T2* values obtained on 6-echo and 15-echo

obtained Hines et al.², good agreement was achieved

between the results of T2* at both

reconstruction as well. Nevertheless, the standard deviations of the values relative to the 6-echo reconstruction are higher than the

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