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**Target Audience :** This paper could be of interest to the researchers doing methodological development in magnetic resonance spectroscopy (MRS) acquisition and quantitative analysis.

**Material and Methods:** Acquisitions were performed on the liver of three male C57BL/6J-ob/ob mice on a 7T Bruker System at two different weeks (W1 & W2, respectively five and seven weeks after birth). Experiments were conducted according to the procedures approved by the Institutional Animal Care and Ethical Committee of our University. Mice averaged mass were for W1,  $m = 33.5 \pm 1.7$  g and W2,  $m = 37.2 \pm 1.5$  g. LCOSY acquisitions were performed in N-type mode leading to phase dispersive 2D spectra with  $T_{\text{Emin}} = 16$  ms,  $n_2/n_1 = 2048 \times 256$  Pts,  $F_0 = 4000 \times 4000$  Hz. Acquisition time was about ~20min. The acquisitions were respiratory triggered as described in [4]. The quantification procedure consists in adjusting a model function describing the acquired signal with  $\widehat{S_{2D}}(t_1, t_2) = \sum_m a_m \widehat{x}_{Tri\ m}(t_1, t_2) R_m(t_1, t_2, T_{2inh}, T_{2m}) f_m(t_1, t_2, \Delta\omega_m, \phi_0)$  and which gives triglyceride coupled spin system ( $\widehat{x}_{Tri\ m}$ ) contribution in term of amplitude ( $a_m$ ), relaxation ( $R_m$ ) and frequency & phase ( $f_m$ ) modulation. Relaxation time was estimated as two main contributions: T2 and T2inh due to B0 inhomogeneities which are assumed to impact in the same way the different chemical groups and leading to a mean linewidth of  $69.4 \pm 9.7$  Hz (W1) and  $71.9 \pm 4.5$  Hz (W2) on the water peak. A metabolite simulation basis set was used as prior knowledge using SPINACH simulation package [5]. Basis simulation was designed to describe (sub) spin system of triglyceride group using coupling values found in [6] and is represented in figure 1.

**Discussion/ Conclusion:** Results show that respiratory triggered LCOSY can be used to acquire spectrum with sufficient resolution regarding the quantification, despite: important inhomogeneities, i.e poor shim conditions and a moving organ. 2D COSY Spectrum can be quantified via a dedicated time domain fitting procedure using prior knowledge. This quantification approach has the advantage of handling the phase twisted lineshape of LCOSY spectrum with dispersive tails. Results obtained by this method allow assessing fatty liver composition indexes equivalently to 1D MRS [7]. These later are in agreement with mice model evolution used (increased steatosis leading to increase of total lipid and saturated component indexes [8]). The quantification method allows to access T2 relaxation of each sub spin systems in disadvantageous experimental condition. More acquisition are planned to corroborate these preliminary results.

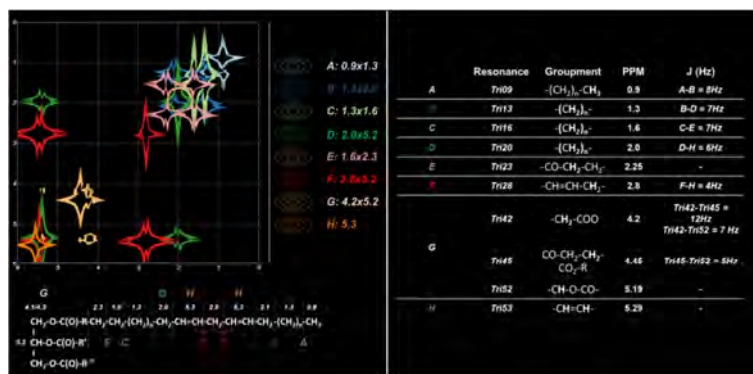


Figure 1: Parameters used in the simulation and basis set simulation corresponding to sub spin system of triglyceride group annotated with the molecule (TriXX refers to 1D MRS assessment). Liver fatty acid is composed of a triglyceride chain beginning with group A and ending with group E.

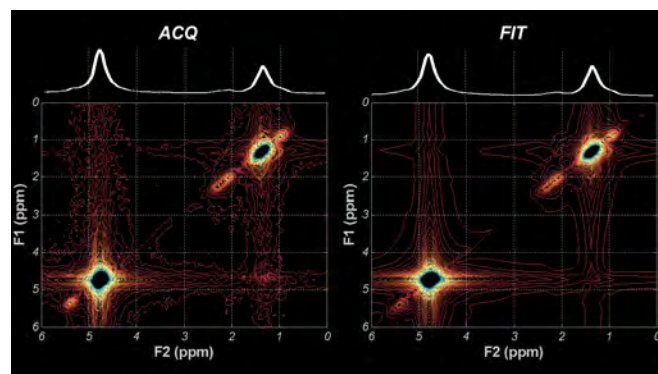


Figure 2: Acquired LCOSY spectrum (ACO) and its quantification (FIT)

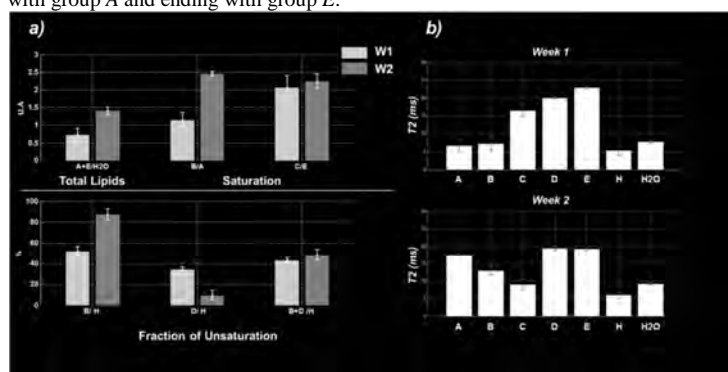


Figure 3: Results of Quantification between the two weeks. a) Evolution of calculated index: Total lipid was defined as the ratio of mean number of liver triglyceride chain and water ( $A+E/H_2O$ ). Saturated component as the ratio  $B/A$  and  $E/C$ . Fraction of Unsaturated Lipids (fUL). fUL is relevant to B and D groups. Index  $B/H$  is relative to number of unsaturation at beginning of the chain and  $D/H$  the number at the end, their combination gives the proportion of fatty unsaturated chain.

**References:** [1] Hamilton, G et al, J. Magn Reson Imagin 2009; 30(1):145-52 [2] Ramamonjisoa, N et al, J. Lipid Res. 2013; 54:2010-2022; [3] Thomas MA, et al, Magn Reson Med 2001; 46:58-67; [4] Garbow, J.R et al, Concepts Magn. Reson; 21B: 40-48; [5] Hogben, H.J et al, J Magn Reson. 2011; 208(2):179-94; [6] Stokes, M et al, Magn Reson Med. 2013; 69(4):1044-1055; [7] Lundbom, J, et al, J Magn Reson. 2009; 201(1):39-47 [8] Ye, Q., et al Magn Reson Mater Phy 2012; 25(5):381-9