# Comparison of Liver Fat Fraction Measured by MR Spectroscopy at 1.5T and 3T

**G. Hamilton[1], M. S. Middleton[1], T. Yokoo[1], A. Kuo[2], and C. B. Sirlin[1]**

[1]Department of Radiology, University of California, San Diego, San Diego, California, United States, [2]Department of Medicine, University of California, San Diego, San Deigo, California, United States

**Introduction:** $^1$H-MR spectroscopy at both 1.5 T and 3 T has served as a gold standard for liver fat quantification in clinical studies. Using spectroscopy at 1.5T and 3T as the reference is valid only if the fat fraction measurements made at both field strengths are sufficiently similar. In this study, we compare the spectroscopy-determined fat fraction given at 1.5T and 3T in human subjects examined at both field strengths on the same day.

**Methods:** Liver $^1$H MR spectra were collected at 3 Tesla on a GE Signa scanner and at 1.5T on Siemens Symphony scanner from 13 subjects with known or clinically suspected fatty liver (IRB approved). At 1.5T STEAM spectra were acquired with TR 3000 ms and voxel size 20 x 20 x 20mm. Five single-average spectra (at TEs of 20, 30, 40, 50 and 60 ms) were obtained in a single 15 sec breath-hold. At 3T STEAM spectra were acquired with TR 3500 ms and voxel size 20 x 20 x 20mm. Five single-average spectra (at TEs of 10, 15, 20, 25 and 30 ms) plus a pre-acquisition excitation were obtained in a single 21 sec breath-hold. Subjects were scanned on the same day with less than a one-hour gap between the 1.5T and 3T scans. The spectroscopy voxel was placed in the same region of the liver at both field strengths, although identical placement was not possible in vivo. The spectra were quantified in the time domain, using the AMARES algorithm (1) included in MRUI (2) and the T2-corrected peak area of the water and fat (0.5-3 ppm) peaks were calculated. The hepatic lipid values were expressed as a fraction of the 0.5-3 ppm peak area to the total peak area (water and fat).

**Results:** The **Figure** compares the fat fraction given at 1.5T with the value at 3T. There is no statistically significant difference between the values given by the two field strengths (intercept 0.001 p = 0.44, slope 1.019 p = 0.027). The two methods gave similar results despite collecting data at different TR and over different TE ranges, and the 1.5T having no pre-acquisition excitation. However, in both cases the TR was long enough to be T1 independent, and the range of TE was short enough not to be significantly affected by j-coupling. Perfect agreement between the two fat fraction measurements is not to be expected, as identical voxel placement agreement could not be achieved in vivo. At 1.5 T, the mean T2 of water was 35.4 ms and that of fat T2 was 65.6ms. This compares to mean water T2 of 22.7 ms and fat T2 of 68.9 ms at 3T. The dependence of water and fat T2 values on field strength indicates that correction for T2 is required for meaningful comparison of fat fraction results obtained at different field strengths.

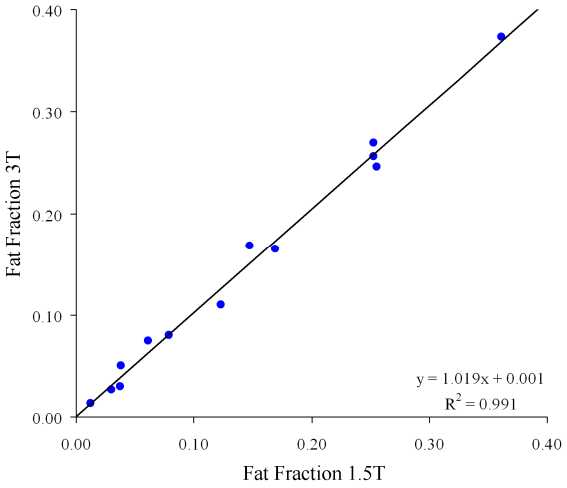


**Figure:** Comparison of the in vivo fat fraction measured at 1.5T to that measured at 3T

**Conclusions:** There is close agreement between the liver fat fraction measured by MR spectroscopic at 1.5T with that measured at 3T. For the measurements at the two field strengths to be in agreement, T2 correction is necessary**.**

**Refs:**

**1.** Vanhamme L, van den Boogaart A, Van Huffel S. *J Magn Res* **129**:35-43, 1997.

**2.** Naressi A, Couturier C, Devos JM, Janssen M, Mangeat C, de Beer R, Graveron-Demilly D. *MAGMA* **12**: 168-176, 2001.