VISCERAL FAT SATURATION IS POSITIVELY CORRELATED WITH LIVER FAT CONTENT

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Introduction

Non-alcoholic liver disease (NAFLD) and visceral fat content are associated with the metabolic syndrome [1]. Insulin resistance is the likely culprit, thought to lead to a high influx of fatty acids from the enlarged visceral adipose tissue depot to the liver. We have developed and validated long TE ^{1}H-MRS as a method of characterizing lipid composition *in vivo* [2]. We observed that the CH_2/CH_3 ratio was a marker of saturated fat content in adipose tissue [2]. Recently, it was shown that the saturated fat content of subcutaneous adipocytes correlated positively with insulin sensitivity [3]. This association was attributed to de-novo-lipogenesis of saturated fatty acids in adipose tissue [3]. In accordance with this we reported a negative correlation between subcutaenous adipose tissue CH_2/CH_3 and liver fat content in men [4]. This implies that a high saturated fat content in subcutaneous adipose tissue associated with good insulin sensitivity. Whether the saturation of visceral adipose tissue is associated with liver fat content is unknown. The aim of this study was to determine the association between visceral adipose tissue fat saturation and liver fat content.

Experimental

Fourteen male subjects with characteristics of the metabolic syndrome were recruited for the study. All MRI/MRS measurements were performed on a clinical 1.5 T MRI scanner (Avanto, Siemens). Liver spectra were obtained with PRESS, TE/TR = 30/3000ms in free breathing. A T1-weighted gradient echo imaging sequence with selective fat excitation was used to measure waist adipose tissue distribution. Adipose tissue spectra were obtained with PRESS using TE = 135 and TR = 3000ms from the retroperitoneal area, see localization in Figure 1. All spectra were analyzed with jMRUI v3.0 using the AMARES algorithm, according to [2]. Liver fat content was determined according to [5]. The methylene-to-methyl ratio (CH_2/CH_3) was calculated for the visceral adipose tissue spectra.

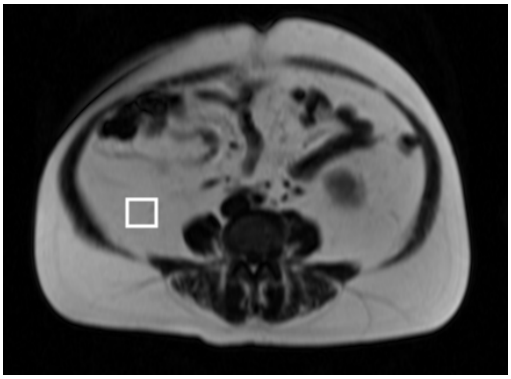
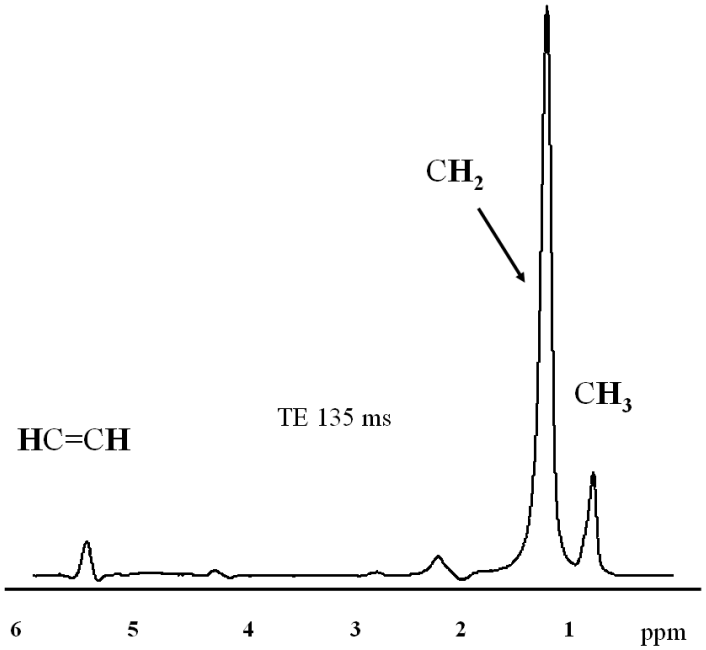


Figure 1. PRESS VOI in Visceral adipose tissue.



Results

Long TE spectra from visceral adipose tissue were of good quality comparable to spectra from subcutaneous adipose tissue, see figure 2. Spectra with indication of motion artifacts due to respiration were discarded. The CH_2/CH_3 of visceral fat correlated positively with liver fat content ($R = 0.46$, $P < 0.05$).

Discussion

The results link high saturated fat content in visceral adipose tissue to a high liver fat content in males with metabolic syndrome. This is in contrast to the negative correlation observed between subcutaneous adipose tissue saturation and liver fat content. These results may provide further insights into the mechansims of fat accumulation in visceral adipose tissue and ectopic fat depots.

Figure 2. Visceral adipose tissue TE = 135 ms spectrum with fatty acid resonances labeled: olefinic at 5.3ppm (C**H**=C**H**), methylene at 1.3ppm (C$\mathbf{H_2}$) and methyl at 0.9ppm (C$\mathbf{H_3}$).

References:
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