Associations of dietary n-3 polyunsaturated fatty acids with liver fat content and composition quantified by ^{1}H magnetic resonance spectroscopy

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Introduction: Increase in hepatic triglycerides content as well as alterations in fatty acid composition of the deposited fat, namely, relative depletion of polyunsaturated fatty acids (PUFAs) and increase in the degree of saturation, are reported to present in nonalcoholic fatty liver disease. H[1] magnetic resonance spectroscopy (MRS) is a reliable and non-invasive method to quantify liver fat content. The degree of lipid saturation can also be calculated based on chemical shifts (peaks) corresponding to different fatty acid functional structures. Although there are studies that showed inverse association of dietary long chain polyunsaturated fatty acids (n-3 PUFAs) with fatty liver disease, whether dietary n-3 PUFAs intake is related to liver fat content and its composition is not well understood. We examined relationships of dietary n-3 PUFAs with liver fat content and its composition in middle-aged Japanese men and women.

Method: Subjects were retirees of a local government recruited by a letter (n=55) and were fasting eight hours or more at the time of examination. Each participant gave written informed consent, and the study protocol was approved by the Ethical Review Board of Nagoya University School of Medicine. We restricted present analysis to not-current smokers who drank less than two *go* (46g alcohol) per day without missing in necessary variables (n=40). The 3T Siemens Magnetic Resonance Scanner (TE=30ms) was used, and the volume of interest was determined in the right liver lobe with a size of 4×4×4 cm. The spectrogram was analyzed by LCModel. Sum of major lipid peaks at 0.9ppm (representing methyl protons: -CH$_3$) and 1.3ppm (methylene protons: -CH2-) was used as an indicator of liver fat content. Lipid saturation index (SI) was calculated from allylic and diallylic lipid peaks. n-3 PUFA intake was estimated by a validated self-administered diet history questionnaire that assesses intakes of 148 food items over a 1-month period. Partial correlation coefficients controlling for sex, age, body mass index and alcohol intake, were obtained to evaluate relationships of total energy-adjusted n-3 PUFA intake with liver fat content and its SI.

Results: Mean age and body mass index were 63.0 years and 23.9 kg/m^2, respectively. SI was positively associated with liver fat content (r=0.41, p=0.012). Intake of n-3 PUFA was not associated with liver fat content (r=0.09, p=0.6); however it was positively associated with SI (r=0.37, p=0.025). The positive association between n-3 PUFA intake and SI was particularly evident in subjects with lower than median liver fat content (r=0.44, p= 0.049).

Discussion: Although dietary n-3 PUFA intake did not appear to have association with liver fat content, it may be positively related to the degree of lipid saturation of the deposited fat particularly in subjects without high liver fat content. Physiological significance of the present findings warrants further investigation.