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Type and amount of maternal dietary fat induce altered hepatic lipid metabolism in adult female offspring in rats

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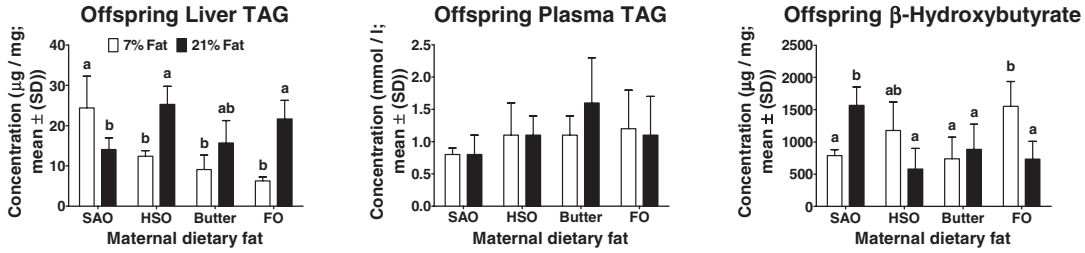
Non-alcoholic liver disease is a common feature of the metabolic syndrome[(1)]. Recent findings have shown that feeding mice a high-fat diet before and during pregnancy, and during lactation induced increased hepatic fat deposition in the adult offspring that was exacerbated by feeding a high-fat diet after weaning[(2)]. This suggests high fat exposure in early life induces phenotypic changes that increase the risk of fatty liver. The purpose of this study was to investigate whether the type of dietary fat consumed during pregnancy and lactation influences liver TAG concentration and on blood markers of hepatic TAG secretion and fatty acid β-oxidation in the offspring.

The study was carried out in accordance with the Home Office Animals (Scientific Procedures) Act (1986). Female Wistar rats (n 5 per group) were fed diets containing either 7% (w/w) or 21% (w/w) safflower oil (SAO), hydrogenated soybean oil (HSO), butter or fish oil (FO) from 14 d before conception until the offspring were weaned on postnatal d 28. Offspring (n 5 females per maternal diet) were weaned onto AIN93M containing 4% (w/w) soybean oil and killed on postnatal d 77 following a 12 h fast. Livers were collected into liquid N and stored at −80°C. Plasma was separated from cells and stored at −80°C. Total liver lipids were extracted, using tripentadecanoin added as internal standard, TAG purified and the fatty acid composition measured by GC[(3)]. Plasma TAG and β-hydroxybutyrate (βHB) concentrations were measured by an automated colorimetric method. Statistical comparisons were by a general linear model with amount and type of maternal dietary fat as fixed factors, and with Bonferroni's *post-hoc* test.



Different letters indicate values which were signficantly different ($P<0.05$) between maternal dietary groups.

There were signficant effects of the amount ($P<0.0001$) and type ($P = 0.002$) (interaction $P<0.0001$) of maternal dietary fat on offspring liver TAG concentration. The maternal 7% HSO, butter and FO diets decreased offspring liver TAG compared with 7% SAO. The maternal 21% SAO diet decreased, but the 21% HSO, butter and FO diets increased offspring liver TAG. In contrast, maternal dietary fat induced in the offspring almost reciprocal changes in plasma βHB (fat amount $P<0.0001$, fat type $P = 0.15$, interaction $P = 0.001$). There was no signficant effect of maternal dietary fat on offspring plasma TAG.

These findings show that even in the absence of a post-weaning high fat challenge and dyslipidaemia, both the type and amount of maternal dietary fat influenced liver TAG and βHB concentrations suggesting changes in hepatic fatty acid β-oxidation. Thus both the type and amount of maternal dietary fat may modify the future risk of the offspring developing fatty liver.

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