Proceedings of the Nutrition Society (2011), **70 (OCE4)**, E165 doi:10.1017/S0029665111002163

Summer Meeting, 4–6 July 2011, 70th Anniversary: From plough through practice to policy

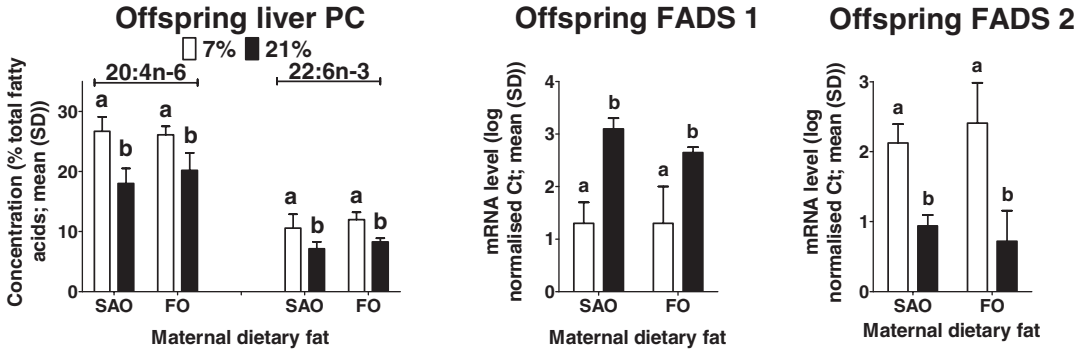
Maternal high fat diet induces impaired polyunsaturated fatty acid synthesis in adult female offspring in rats

S. P. Hoile[1], N. A. Irvine[1], C. Kelsall[1], C. Torrens[1], K. A. Lillycrop[2], M. A. Hanson[1], P. C. Calder[1] and G. C. Burdge[1]

[1]*Faculty of Medicine, University of Southampton, Southampton, SO16 6YD, UK and* [2]*Faculty of Natural and Environmental Sciences, University of Southampton, Southampton, SO16 6YD, UK*

The long chain PUFA arachidonic acid (20:4*n* − 6) and dosocahexanoic acid (22:6*n* − 3) can be synthesised from their respective essential fatty acid precursors linoleic acid (18:2*n* − 6) and α-linoleic acid (18:3*n* − 3) by a series of desaturation and chain elongation reactions[(1)]. Dietary fat alters capacity for 20:4*n* − 6 and 22:6*n* − 3 synthesis in adults[(1)]. The purpose of this study was to determine whether the type and amount of fat consumed by rats before and during pregnancy, and during lactation alters liver PUFA status and mRNA expression of the genes encoding Δ6 (FADS2) and Δ5 (FADS1) desaturases in the adult 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) or fish oil (FO) from 14 d before conception until the offspring were weaned on postnatal day 28. Offspring (*n* 5 females per maternal diet) were weaned onto AIN93M containing 4% (w/w) soybean oil (without 20:4*n* − 6 and 22:6*n* − 3) and killed on postnatal day 77 following a 12 h fast. Livers were collected into liquid nitrogen and stored at −80°C. Liver phosphatidylcholine (PC) fatty acid compositions were measured by gas chromatography[(2)]. FADS 1 and 2 mRNA expression were measured by real-time RTPCR[(3)].



Different letters indicate values which were significantly different ($P<0.05$) between maternal dietary groups. Statistical comparisons were by a general linear model with Bonferroni's *post hoc* test.

There were signficant effects of the amount, but not type, of maternal dietary fat on the proportion of 20:4*n* − 6 and 22:6*n* − 3 in liver PC, and on FADS1 and 2 mRNA expression (all $P<0.0001$). 20:4*n* − 6 and 22:6*n* − 3 were lower in offspring of dams fed the 21% SAO or FO diets compared with those of dams fed the 7% diets. This was accompanied by increased FADS1 and decreased FADS2 mRNA expression in offspring of dams fed the 21% fat diets.

These findings suggest that the 21% fat maternal diets induced a long-term reduction in PUFA synthesis in offspring through altered regulation of FADS2 transcription. Because Δ6 desaturase is rate limiting, decreased FADS2 expression may override the potentially compensatory increase in FADS1. Together these findings suggest that maternal dietary fat intake influences capacity of female offspring to synthesise PUFA which, in turn, may affect their ability to meet fetal demands for 20:4*n* − 6 and 22:6*n* − 3.

This work was funded in part by the British Heart Foundation.

1. Burdge GC & Calder PC (2006) *Nutr Res Rev* **19**, 26–52.
2. Burdge GC, Wright P, Jones AE *et al.* (2000) *Br J Nutr* **84**, 781–787.
3. Burdge GC, Lillycrop KA, Phillips ES *et al.* (2009) *J Nutr* **139**, 1054–1060.

https://doi.org/10.1017/S0029665111002163 Published online by Cambridge University Press