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The effect of increased maternal dietary intake during pregnancy on offspring birth weight and neonatal survival

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Altering maternal nutrition affects fetal development and may have long-lasting effects on the offspring, potentially predisposing them to later disease such as diabetes and obesity. Studies have shown that these effects may take place without alterations in birth weight[(1)], although smaller-birth-weight offspring appear to be at increased risk[(2)]. There is limited literature on the effects of increasing the fat and protein content of the gestational diet on birth weight and postnatal survival.

Pregnant sows were fed one of six isoenergetic diets (Table) that differed only in composition and quantity fed during the first and final trimester of gestation. Sows fed on a low–high feeding scheme were fed 2.7 kg/d between day 0 and day 70 of gestation and 3.5 kg/d between day 70 and day 110 of gestation. Sows fed on a high–low feeding scheme were fed 3.5 kg/d between day 0 and day 40 of gestation and 2.7 kg/d between day 40 and day 110 of gestation. All sows received a standard diet from day 110 and throughout lactation. All sows delivered naturally and all piglets were weighed. At 7 ± 3 d one small and one median piglet per sow were selected and weighed. All preliminary data was analysed using SPSS version 15 (SPSS Inc., Chicago, IL, USA).

Treatment	Diet description	Feeding scheme	No. of sows
1 (Control)	High starch	Low–high	8
2	High fat	Low–high	8
3	High protein	Low–high	8
4	High starch	High–low	8
5	High fat	High–low	8
6	High protein	High–low	8

There was no effect of diet on piglet birth weight or litter size. Maternal diet had no effect on the growth rate of the small piglets. Median-birth-weight piglets born to sows fed diet 5 (151 (SE 10.4) g) had a significantly reduced ($P<0.05$) growth rate up to 7 d when compared with sows fed diet 1 (control diet, 189 (SE 12.7) g) and diet 2 (226 (SE 15.2) g). Median-birth-weight piglets had a significantly increased ($P<0.05$) growth rate up to 7 d when compared with the smaller piglets born to sows fed diet 1 (control diet; small, 91.0 (SE 19.8 g); median, 189 (SE 12.9) g), diet 2 (small, 127 (SE 18.3) g; median, 226 (SE 15.2) g), diet 4 (small, 109 (SE 17.1) g; median, 189 (SE 14.8) g) and diet 5 (small, 98.3 (SE 15.6) g; median, 151 (SE 10.4) g). Maternal diet had no effect on the percentage of stillborn piglets per litter. There was a significant increase ($P<0.05$) in the percentage of postnatal deaths per litter in sows fed diet 2 (16.8 (SE 5.87)), diet 3 (1.88 (SE 0.52)) and diet 6 (8.83 (SE 1.72)) when compared with diet 1 (control; 3.95 (SE 1.66)).

Maternal nutrition during gestation appears to have no major effect on offspring birth weight or growth rate up to 1 week of age. This outcome may be a result of the sow compensating for any dietary change by compromising her own metabolism in order to avoid any detrimental effects on offspring birth weight. It may be interesting to compare sow body condition and glucose tolerance during pregnancy to confirm this notion. Smaller-birth-weight piglets tend to grow more slowly than median piglets during the first week of life[(3)]. High-fat feeding of the sow during late gestation and high-protein feeding in either early or late gestation increases the percentage of piglet mortalities in the litter. The prospective findings from the ongoing study will inform further on the influence of increasing dietary components during pregnancy.

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