The challenges of rearing large litters

TEAGASC researchers have been looking at the use of maternal feeding strategies during gestation and lactation to ameliorate some of the challenges associated with large litter sizes.

Background

Genetic selection for increased sow prolificacy has resulted in a significant increase in litter size at birth, with the number of pigs born alive per litter increasing from 10.6 in 2000 to 13.7 in 2018 in Ireland (Teagasc National Pig Herd Performance Report). Larger litters are associated with a higher proportion of light piglets at birth (Beaulieu *et al.*, 2010). Compared to their heavier litter-mates, low-birthweight piglets are less likely to survive and experience impaired lifetime growth. Therefore, nutritional strategies to increase piglet birthweight and postnatal growth are increasingly important.

L-carnitine (CAR) is a quaternary compound composed of the amino acids lysine and methionine. CAR plays a vital role in transporting fatty acids across the mitochondrial membrane, where energy is generated through fatty acid oxidation. When supplemented to gestating and lactating sows, it has been shown to increase litter size, piglet birthweight and the concentration of nutrients in milk, as well as improving foetal muscle fibre development. However, there is little information available regarding the efficacy of CAR when supplemented to gilts. Gilts give birth to lighter piglets with lower growth rates than those from sows (Calderón Díaz *et al.*, 2017). Therefore, CAR supplementation could be particularly beneficial for gilt litters. Additionally, most research on CAR supplementation to sows was published over a decade ago and significant increases in litter size since then may invalidate previous findings. It is therefore important to determine if CAR can provide a beneficial effect when supplemented to high genetic merit sows.

WALSH SCHOLARS

Hazel Rooney was the 2019 winner of the Teagasc Gold Medal at the annual Teagasc Walsh Scholarships seminar for her presentation on 'Nutritional management strategies to optimise annual sow output and to promote the growth and development of progeny from large litters'.

Experimental set-up

We investigated the effect of dietary CAR supplementation, to gilts during gestation (Experiment 1), and to high genetic merit multiparous sows during gestation and/or lactation (Experiment 2), on sow productivity and milk composition. Semitendinosus muscle (STM) development and lifetime growth in progeny was also examined. In Experiment 1, gestating gilts (n=84) were assigned to a CAR treatment (0 mg or 125 mg/day) from day 38 of gestation until farrowing. In Experiment 2, multiparous sows (n=64) were assigned to a CAR treatment during gestation (0 mg or 125 mg/day) and/or lactation (0 mg or 250 mg/day). Sow and gilt measures were recorded during gestation and lactation, and progeny were monitored from birth until slaughter (~ 142 days old).

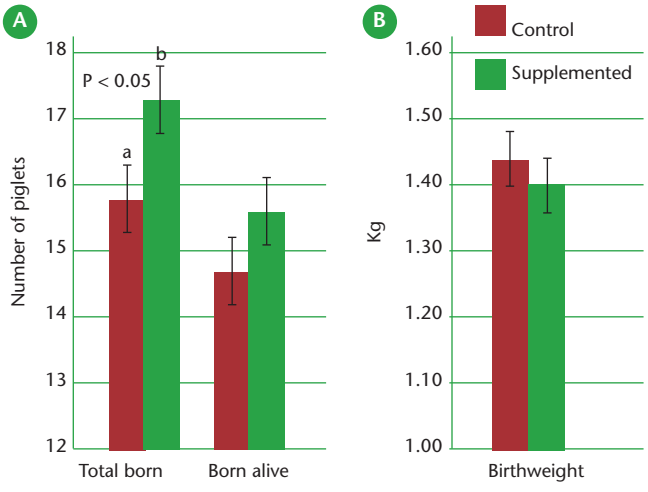

FIGURE 1: (A) Experiment 2 – Effect of sow dietary treatment on the total number of piglets born and on the number of piglets born alive. Superscript letters (a, b) indicate a difference of P < 0.05 between dietary treatments. (B) Experiment 2 – Effect of sow dietary treatment on piglet birthweight.

Results

In Experiment 1, the number of piglets born and piglet birthweight were similar between treatments. Contrary to expectations, piglets from CAR-supplemented gilts had a lower pre-weaning average daily gain than piglets from control gilts (185 v 196 ± 3.8 g/day). However, CAR-supplemented gilts tended to rear more piglets to weaning than control gilts (12.9 v 12.2 ± 0.31 piglets). At slaughter, pigs from gilts fed CAR had heavier liveweights (113.1 v 111.3 ± 0.64 kg) and carcass weights (86.6 v 85.1 ± 0.46 kg), and increased carcass muscle depth (51.3 v 50.5 ± 0.20 mm) than pigs from control gilts. CAR supplementation has been shown to increase muscle fibre number and size, and thus the results seen at slaughter could be due to hyperplasia of muscle fibres in the progeny of CAR-supplemented gilts.

In Experiment 2, CAR supplementation to sows during gestation increased litter size at birth (**Figure 1a**), without compromising piglet birthweight (**Figure 1b**). These findings suggest that CAR has the potential to be utilised as an effective feeding strategy to mitigate against low birthweight progeny in large litters. We also observed a tendency towards a greater total number of muscle fibres in the STM of piglets born to sows supplemented with CAR during gestation (144 v 120 ± 8.9 x 10^4 fibres). This finding confirms our hypothesis that CAR supplementation can improve muscle development in neonatal progeny. We observed no benefit in supplementing CAR during lactation.

Benefits to industry

The CAR supplementation strategies applied in these two studies could be utilised by commercial pig producers to increase litter size in sows, improve offspring muscle development at birth and, as a consequence, increase carcass weight at slaughter. We carried out a cost–benefit analysis of CAR supplementation to sows and gilts during gestation using the calculator from the Teagasc Pig Production Model. At the CAR inclusion rates used in our studies (125 mg/day) and using the current cost of CAR (€15,000/tonne), the financial benefit at farm level from the additional carcass weight of pigs sold at slaughter is €0.59/pig, where gilts in the herd were supplemented with CAR during gestation (Experiment 1). The financial benefit of the increase in sow litter size at birth due to supplementing multiparous sows with CAR during gestation is €1.85/pig (Experiment 2). Thus, supplementation of CAR to gestating gilts and sows will provide a financial benefit to the industry.

Conclusions

- CAR supplementation to gilts increased the liveweight, carcass weight and carcass muscle depth of progeny at slaughter.
- CAR supplementation to sows increased litter size at birth, without compromising piglet birthweight.
- CAR supplementation to sows increased muscle fibre number in progeny at birth.

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