Successful supplementation

TEAGASC research examined the effects of dietary supplementation of gestating sows to improve offspring viability.

The hyper-prolific sow

The number of pigs produced per sow per year is one of the most important key performance indicators in pig farming. Sow output in Ireland has increased by 4.7 pigs/sow/year in the last decade, from an average of 22.3 in 2007, to 27.0 in 2017 (PigSys 2017). This has been achieved primarily through genetic selection for larger litters. Large litters of piglets, however, are associated with a higher proportion of piglets with low birthweight and poor viability, leading to an increase in stillbirths and pre-weaning piglet mortality. Thus, to counter the negative effects of large litters, nutritional strategies to promote piglet growth and development in utero are increasingly important.

Supplementation to improve sow output

L-arginine (ARG) is a progenitor for nitrous oxide, a vasodilator that promotes angiogenesis (formation of new blood vessels). Supplementing pregnant sows with ARG is hypothesised to increase the flow of oxygen, nutrients, ammonia and metabolic waste between the foetus and the placenta, and has previously been found to increase both the number of piglets born alive and birthweight. L-carnitine (CAR) is synthesised from lysine and methionine, and is involved in the transport of fatty acids across the mitochondrial membrane. Carnitine supplementation to pregnant sows has been shown to increase the number of muscle fibres that piglets are born with, piglet birthweight, piglet growth and overall litter size. There has been little work on ARG and CAR supplementation to highly prolific sows, and the effect of feeding both supplements in combination has not yet been investigated. We hypothesised that the supplementation of gestating sows with ARG and/or CAR would increase the number of piglets born, piglet weight and vitality at birth.

Experimental set-up

The experiment was conducted on a 1,000-sow commercial unit. At 28 days of gestation, 429 sows were assigned to one of four dietary treatments in a 2×2 factorial arrangement until parturition. The two factors investigated were ARG supplementation (0 or 25g/day) and CAR supplementation (0 or 0.125g/day). Piglets from a subset of 218 litters, which were classified as prolific (>14 piglets) or not, were weighed at birth and at weaning (28 days). Piglets were categorised into one of five quintiles based on birthweight (very light, light, medium, heavy, and very heavy). Measures of vitality (bucket test, rectal temperature, body length and abdominal circumference) were recorded at birth for a further 10 litters per treatment. The bucket test is a rapid method of assessing the vitality of piglets within three hours of birth, and high scores are correlated with the likelihood of survival to weaning. The piglet is placed in a circular enclosure, and the number of circles completed, movement capacity, vocalisations, and udder stimulation movements are counted and added together.

Sow performance

Neither ARG nor CAR had an effect on sow back fat depth at farrowing or weaning. Sows supplemented with ARG had fewer total piglets born (15.0±0.2) and born alive (14.1±0.2) than non-ARG sows (15.7±0.2, 14.7±0.2, respectively; $P<0.05$ for both), but CAR did not have an effect. When only considering the subset of sows that had birthweights of their piglets recorded, the results were similar.

Piglet performance

ARG had no effect on piglet birthweight. Across all litters, CAR supplementation increased piglet birthweight, and also tended to increase piglet birthweight in prolific litters (**Figure 1**). There was no

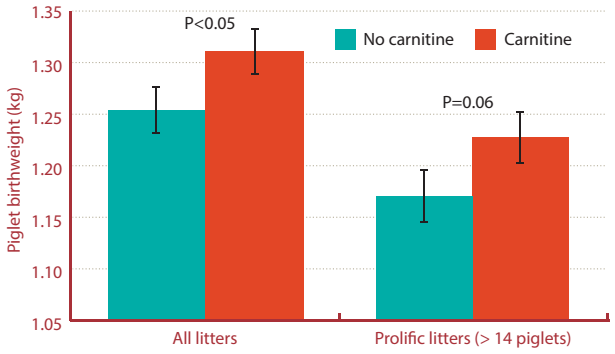

FIGURE 1: Mean birthweight of piglets from all litters and from litters of prolific sows (>14 piglets), when sows were or were not supplemented with 0.125g carnitine/day during gestation. Error bars represent the standard error of mean (SEM).

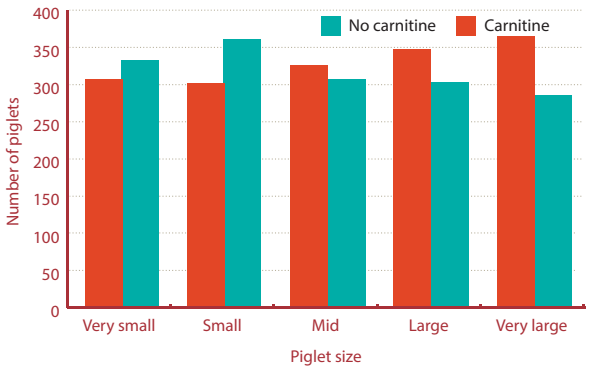

FIGURE 2: Numbers of piglets within each quintile at birth when sows were or were not supplemented with 0.125g carnitine/day during gestation.

effect of either supplement on average daily gain to weaning or on piglet weaning weight. A greater proportion of piglets from CAR-supplemented sows were in the top two heaviest quintiles at birth than in the bottom two (P<0.001; **Figure 2**). By weaning, this was no longer the case, as there were more carnitine piglets in all ranks other than the second lowest, and the overall percentage of carnitine piglets had increased from 50.9% to 53.2% (P=0.12). Thus more piglets from CAR-supplemented sows seemed to survive to weaning, particularly those from the lightest rank at birth.

Piglet vitality at birth

Piglets from sows supplemented with CAR scored better in the bucket test than those from unsupplemented sows, but piglets from ARG-supplemented sows scored poorer than from unsupplemented sows (**Figure 3**). In the CAR treatment, piglets did numerically better in each of the four aspects of the bucket test, which led to an overall higher score. However, in the ARG treatment, piglets did numerically worse in all aspects, and significantly worse in both the number of circles completed, and the number of vocalisations (P<0.05 for both). There was no effect of any treatment on piglet rectal temperature, body length or abdominal circumference at birth.

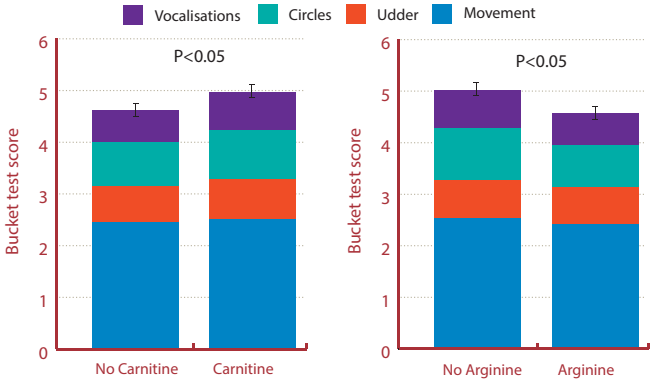

FIGURE 3: Piglet bucket test scores when sows were or were not supplemented with 0.125g carnitine/day, or 25g arginine/day during gestation.

Conclusions

- ARG supplementation reduced litter size and piglet vitality. Thus, the benefits to sow performance previously reported in less prolific sows were not evident in this study.
- CAR supplementation resulted in a 56g increase in birthweight, and improved piglet vitality scores at birth.
- There were indications that more CAR piglets survived to weaning, and that CAR is especially beneficial in larger litters.
- Further work is ongoing to investigate the effect of CAR supplementation on muscle fibre development.

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Authors

Keelin O'Driscoll
Research Officer, Teagasc, Pig Development Department, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork
Correspondence: keelin.odriscoll@teagasc.ie

Peadar Lawlor
Principal Research Officer, Teagasc, Pig Development Department, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Kathryn Reid
Walsh Fellow, Teagasc, Pig Development Department, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork