Influence of nutrient asynchrony on whole body protein retention rate in growing pigs

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The concept of nutrient synchrony depends on supplying dietary glucose and amino acids (AA) in a synchronised manner to increase nitrogen (N) utilisation efficiency by minimising the energy-dependent conversion of certain AA to glucose or glucose to AA (van den Borne et al., 2007). The hypothesis tested was that the whole body N retention rate would be limited in pigs fed a nutrient asynchronised diet compared to pigs fed a synchronous diet.

A duplicate 6x6 Latin Square experiment with 12 individually-housed entire male Large white x Landrace pigs (39.5±0.36 kg; mean±SEM) was conducted with six combinations of nutrient synchronised and asynchronous diets to determine N balance and N utilisation efficiency, using the total collection method. Selection of starch and protein sources was based on the results of in vitro starch and protein digestion studies (Sopade and Gidley, unpublished). Based on these results, combinations of three starch sources [barley (fast digestible starch, FDS), wheat (moderately digestible starch, MDS), sorghum (slowly digestible starch, SDS)] and two AA sources [casein (rapidly digestible AA, RDAA), soybean meal and canola meal (slowly digestible AA, SDAA)] were used to create a range of synchrony in the availability of glucose and AA. The experimental diets were FDS+RDAA, FDS+SDAA, MDS+RDAA, MDS+SDAA, SDS+RDAA, SDS+SDAA. The six dietary treatments were randomly assigned to two pigs per 10-d metabolism study (5-d adaptation plus a 5-d total collection), which were repeated three times to collect six faecal and urine samples per diet. Pigs fed at 3 times maintenance energy level (0900 and 1600 h). All diets were formulated to contain 13.8 MJ digestible energy (DE)/kg and 0.53 g available lysine/MJ DE whilst maintaining the ideal pattern of AA, but the timing of nutrient availability differed due to the differing ingredient compositions. Data were analysed by one-way ANOVA (Genstat 15; VSN International Ltd), because the purpose of the experiment was to examine the effect of individual combinations rather than interaction effects. As body weight and N intake are known to influence N retention rate, N output and N retention data were calculated as g/kg body weight (BW)⁰·⁷⁵/day, and N intake was used as a covariate.

Feeding RDAA decreased faecal N output (P<0.01); however, when glucose is not readily available (MDS or SDS with RDAA), feeding RDAA increased urinary N excretion (P<0.05) compared with FDS+RDAA. In conclusion, a combination of FDS and RDAA improved N retention rate (P<0.05) compared with a combination of SDS and SDAA. Based on these data, it is recommended that diet formulations for growing/finishing pigs should avoid a combination of SDS and SDAA to minimise metabolic N loss associated with nutrient asynchrony.


Supported in part by Pork CRC Limited Australia.