Concurrent Session 7: Comparative Nutrition – Production animals relevant to human nutrition

Dietary fat does more than simply providing energy: experience with pigs

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Background – The addition of fats to pig diets has primarily concentrated on the contribution to the energy component of the diet, principally the digestible energy content. The results of experiments where pigs were kept under individual (ideal) housed conditions are consistent in that the pigs adjusted their voluntary feed intake with digestible energy (DE) density to maintain a constant energy intake (1). The results of experiments where pigs were kept in groups (commercial housing conditions) showed that pigs tended to increase their daily DE intake as the DE density of the feed increased. This increase in DE intake improved the growth rate of the pigs but also increased the fat deposition of those pigs (1). Economic analysis of the experiments indicates that formulating diets to a least cost per MJ of DE is not the most profitable point to set the DE density (1). In recent years we have seen the upsurge in evidence that individual fatty acids can have significant defined metabolic effects. This has been led by the interest from human nutrition circles. The latest work on dietary fats has shown a significant effect on metabolism and feed intake control separate from its role on energy metabolism.

Objectives – To show that the inclusion of fat into a balanced diet will increase the growth performance of growing pigs above that expected from increased DE density of the diet.

Design – The experiment involved 576 male pigs of 25 kg randomly allocated to 2 dietary treatments over a four week period. The pigs were assigned to either a low DE density feeding program or a high energy density feeding program. The low DE program consisted of feeding a diet containing 13.8 MJ of DE per kg for 48 days and a diet consisting of 13.6 MJ DE/kg for 35 days. The high DE program consisted of a 14.6 MJ DE/kg diet and a 14.5 MJ DE/kg diet fed over the same time periods. The extra DE content of the high DE diets was obtained from adding fat to the diets. The diets were balanced for amino acids. Average live weights were recorded on a pen basis at the start of the experiment and again at 21, 48, 69 and 83 days into the experiment. Average daily feed intakes were recorded at day 21, 48, 69 and 83 of the experiment. An ultrasound fat depth was recorded at the P2 site at the end of the experiment. The animals were then sent to the abattoir for slaughter where hot standard carcass weight and a carcass P2 fat depth measurement were recorded.

Outcomes – The 7% increase in DE density and 7.8% increase net energy density during the first 49 days of the experiment had no significant effect on growth rate or average daily intake. The pigs on the high DE diets did have a 3.3% reduction in feed conversion. This indicates that the pig did not efficiently utilise the 6% increase in DE intake per day, the reasons for this are unclear but it does show that the pig is not responding to DE. The response of the pigs through the final 35 days of the experiment is shown in table 1. There was a significant 7.63% increase in rate of gain with a reduction in feed intake. The 6.6% increase in DE density and 8.2% increase in net energy resulting in a 13% improvement in feed conversion, despite the fact that the DE intake of the pigs per day was equivalent. This clearly shows that there is an effect on metabolism, above that of DE, when the fat level of the diet is increased. The increase in fat deposition that was shown in this experiment and previous experiments discussed above indicates that the effects on growth rate and feed efficiency are magnified further than can be explained by the energetic relationships alone.

		Low DE	High DE	Difference	SEM	(p=)
Start weight	Kg	60.32	61.03	1.18%	0.337	0.293
Final weight	Kg	87.16	89.91	3.16%	0.533	0.009
P2 fat depth	mm	9.21	9.74	5.65%	0.102	0.010
Rate of gain	Kg/d	0.762	0.820	7.63%	0.009	0.001
Feed conversion ratio		2.852	2.479	13.09%	0.030	0.000
Average daily feed intake	Kg/d	2.167	2.025	6.58%	0.021	0.000
Energy intake	MJDE/d	29.42	29.31	0.37%	0.269	0.840

Conclusion – The series of experiments discussed above indicate that there is clearly an effect of fat addition above that of a direct energy intake effect by increasing the conversion of the energy to live weight. The mechanisms for this are as yet unclear but it appears that the greatest effects occur on changes in fat levels and the ability of the animal's metabolism to react to those changes in fat content of the diets. The implications for pig and human nutrition are that while we tend to take into account just the energy density of the diet the functional properties of fat addition must also be taken into account, as they can be as significant as the energy density of the diet. Ths will extend further as we look at the metabolic and functional properties of individual fatty acids.

1. Henman, DJ, Argent, CJ and Bryden, W. Response of male and female finisher pigs to dietary energy density. In: Manipulating Pig Production VII, ed. PD Cranwell, Werribee, Australia, 1999;263