Maximising the benefits of high fat and high fibre diets during the finisher period

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By

Cherie Collins, Kristy Tickle, Dave Henman, Rob Smits, Andrew Philpotts

Rivalea Australia Pty Ltd, Corowa NSW

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Executive Summary

Improving growth performance and feed efficiency of pigs during the finisher period can have a substantial impact on the cost of production given the high feed intakes during this time. Improvements in feed efficiency and growth performance during the finisher period have been observed when either high fat (up to 6 % tallow) or high NDF (up to 23 % NDF sourced primarily from mill mix) are added to finisher diets. It is however apparent that the benefits associated with feeding these high fat or high NDF diets to finisher pigs diminishes with time, with the maximum response observed during the initial two to three weeks of feeding. Further investigation is therefore warranted to investigate the optimal feeding strategy that will maximize the benefits from high fat and high NDF diets either alone or in combination during the final 6 week finisher period.

A total of 1296 pigs (Large white x Landrace, PrimeGro™ Genetics) were selected at 16 weeks of age and group housed in pens of 9 pigs. Pens were randomly allocated to 2 x 6 factorial experiment with the respective factors being sex (entire male and female) and feeding strategy (A: control finisher diet fed for 6 weeks; B: High fat diet fed for 6 weeks; C: High NDF diet fed for 6 weeks; D: High fat diet fed for 3 weeks followed by the high NDF diet fed for 3 weeks; E: High NDF diet fed for 3 weeks followed by the high fat diet fed for 3 weeks; F: Constant DE strategy in which the control diet was fed for 3 weeks followed by a high fat and high fibre diet (same DE as control diet) for the final 3 weeks). All diets were formulated to contain 0.53 g available lysine/ MJ DE. High fat diets contained 5% added fat (tallow), while high NDF diets contained 19% NDF. Pigs were offered their respective diets *ad libitum* from 16 weeks of age through to slaughter at 22 weeks of age.

Feed efficiency during the initial 21 day feeding period was markedly improved in the pigs offered either the high fat (treatments B and D, FCR 2.37) or the high fibre (treatments C and E, FCR 2.39) diets compared to those pigs offered the control diets (treatments A and F, FCR 2.53). Over the entire 42 day experimental period, feed efficiency was enhanced when pigs were offered feeding strategies B, C, D, or E. Carcass weight tended to be greater in the pigs offered the high fat diet for the entire experimental period (treatment B, P=0.057), while carcass P2 was reduced when pigs were offered treatments C, D or E (P<0.001). Economic analyses suggests that the feeding of high fat diets for the entire six week period will provide the greatest net return per pig above the control animals for both entire male (AU$4.88/pig) and female pigs (AU$5.58/pig).

The outcomes from this investigation confirm that incorporating 5 % added dietary fat as tallow into commercial finisher diets improves growth performance, feed efficiency and net returns. In this study the response was maximised when the dietary fat addition was maintained for the entire finisher period. The use of the high fat diet for a maximum three week period may however have merit in situations where the pigs have a greater propensity for fat deposition, thereby minimising the potential for carcass P2 being outside premium grade specifications.

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1. Introduction

The efficiency with which feed is utilised for weight gain during the finisher period has a considerable impact on the total cost of pig production given the high feed intakes during this time. Improving growth performance and feed efficiency can therefore have a substantial impact on reducing total feed costs and minimising the number of days to reach market weight. The addition of supplemental fat, sourced primarily as tallow in Australia, increases the energy content of the finisher diet and if feed intake is not reduced increases the pigs total energy intake. A number of studies have reported improvements in feed efficiency when up to 6% supplemental dietary fat is added to finisher pig diets. The addition of up to 6 % choice white grease to finisher diets for 28 days (start weight 82 kg) linearly improves daily gain and feed efficiency, while having no impact on feed intake (Linneen *et al.* 2008). In Australia, the addition of up to 6 % supplemental tallow to finisher diets improves daily gain and feed efficiency, with the response greater in the initial 14 day feeding period (Collins *et al.* 2009). In this same study, an economic analyses reported improved profit margins with the high fat diets, with the benefits greater in entire male pigs (profit margin AU$4.17 per pig) compared to the females (profit margin AU$1.47 per pig) (Collins *et al.* 2009).

Improvements in feed efficiency have also been observed with the inclusion of high concentrations of neutral detergent fibre (NDF) in finisher diets. Recent investigations have reported linear improvements in feed efficiency and carcass P2 when the NDF concentration of the diet was increased from 13 % to 23 % through the inclusion of mill mix in the diet (Collins *et al*., unpublished). Growth rates were also improved with increasing NDF concentration, but only during the initial 14 day feeding period. Together, these improvements in production efficiency and carcass characteristics resulted in greater profit margins for producers under Australian conditions.

It is clear that the inclusion of supplemental fat (up to 6 % fat as tallow) and NDF (as mill mix) can improve finisher growth performance, feed efficiency and increase the net returns per pig based on production costs and carcass returns. It is also apparent that the benefits associated with the feeding of high fat or high NDF diets to finisher pigs diminishes with time, with the maximum response to either feeding regime observed during the initial two to three weeks of feeding. Further investigation is therefore required to determine the optimal feeding strategy that will maximise the production and economic benefits from feeding high fat and/or high NDF diets to finisher pigs under

Australian conditions. This study tests the hypothesis that the strategic use of high fat and high fibre finisher diets will improve growth performance and feed efficiency above that observed with standard diets, with the response differing with feeding strategy.

2. Methodology

Animals and treatments

A total of 1296 pigs (Large White x Landrace, PrimeGro™ Genetics) were selected at 16 weeks of age (average 115 days of age) at an average weight of 61.8 kg ± 0.42 kg (mean ± s.e) and housed in pens of 9 pigs of the same sex (0.75 m^2/pig). Pigs were selected over a 12 week period commencing February 2009. Within week, pens were randomly allocated to a 2 x 6 factorial experiment with the respective factors being sex (entire male and female) and feeding strategy (A: control finisher diet fed for 6 weeks; B: High fat diet fed for 6 weeks; C: High NDF diet fed for 6 weeks; D: High fat diet fed for 3 weeks followed by the high NDF diet fed for 3 weeks; E: High NDF diet fed for 3 weeks followed by the high fat diet fed for 3 weeks; F: Constant DE strategy in which the control diet was fed for 3 weeks followed by a high fat and high fibre diet (same DE as control diet) for the final 3 weeks). The dietary compositions of the four experimental diets used in combination are displayed in Table 1. All diets were formulated to contain 0.53 g available lysine/ MJ DE. The high fat diet contained 5% added fat (tallow), while the high NDF diet contained 19% NDF. Pigs were offered their respective diets *ad libitum* from 16 weeks of age through to slaughter at 22 weeks of age. Experimental diets were pelleted and fed via self feeders. All animals had *ad libitum* access to water via nipple drinkers for the entire experimental period.

Management and measures

Pen weights were recorded at the beginning of the experimental period (day 0) and again at day 21 and day 42 (prior to slaughter). Pen feed intakes were also recorded over these time periods as measured by feed disappearance and feed conversion efficiency subsequently calculated. All deaths and removals were recorded and taken into account when calculating feed intake and feed efficiency by the adjustment of the number of days that pigs were on trial. Pigs were slaughtered in a commercial abattoir at the conclusion of the 42 day experimental period and hot standard carcass weight (HSCW) and fat depth at the P2 site (65mm from the midline, measured using a Hennessy grading probe) were measured, with dressing percentage calculated from live weight and carcass weight on a pen basis.

Statistical analyses

Data were subjected to an analysis of variance (ANOVA) with the main effects being sex and dietary fat concentration. Replicate was included in the analyses to account for the blocking factor. The experimental unit for all analyses was the pen of 9 pigs. All analyses were performed using Genstat 8th Edition (Payne *et al.* 2005).

Economic implications

The economic implications of the finisher feeding strategy were assessed for both entire male and female pigs. Diet costs used in these analyses were based on feed prices in Australia when the investigation was undertaken (early 2009). The cost per kg gain was determined for each of the treatments based on feed intake, feed costs and live weight gain over the six week experimental period. Return on carcass weight assumes a carcass price of $3.50/kg, while the price penalty for a P2 above 12 mm was assumed to be 25c/kg. The net return is the return on carcass weight minus the P2 price penalty and the total feed costs.

Table 1. Ingredient composition and analysed nutrient profile of each of the experimental finisher diets, % of diet (as fed basis).

	Control	High fat	High NDF	Constant DE
Wheat	70.9	37.2	48.7	38.49
Barley	9.0	32.0	6.9	21.1
Millmix	2.5	8.5	24.1	19.8
Canola meal	8.5	8.5	4.0	8.5
Soyabean meal	3.5	4.5	10.6	2.9
Water	1.0	1.0	1.0	1.0
Ronozyme P	0.015	0.015	0.015	0.015
Porzyme 9310	0.03	0.03	0.03	0.03
Tallow	1.3	5.0	3.0	5.0
Salt	0.2	0.2	0.2	0.2
Limestone	2.1	2.0	2.0	2.2
Dicalcium phosphate	0.2	0.4	0.1	0.1
Lysine HCL	0.4	0.4	0.2	0.4
Threonine	0.1	0.1	0.1	0.1
Copper premix	0.1	0.1	0.1	0.1
Rivalea finisher premix	0.1	0.1	0.1	0.1
Betaine	0.1	0.1	0.1	0.1
*Estimated nutrient composition, %**				
DE, MJ/kg	13.8	14.0	13.8	13.8
Crude protein	16.02	15.42	17.69	15.40
Crude fat	2.78	6.41	4.65	6.58
Crude fibre	3.75	4.64	4.66	5.09
Neutral detergent fibre	13.50	16.2	19.0	19.0
Total Lysine	0.84	0.87	0.89	0.87
Available lysine: DE ratio g/MJ DE	0.53	0.53	0.53	0.53
Measured nutrient composition, %				
Moisture	10	9.6	9.8	10.1
Crude protein	18.7	18.0	19.7	18.3
Crude fat	3.0	6.3	5.1	6.7

* Estimated from composition of ingredients (SCA 1987)

3. Outcomes

Growth performance

The effect of feeding strategy on finisher growth performance is displayed in Table 2. The males and females responded similarly to the six different finisher feeding strategies, with no sex by feeding strategy interactions. Feed efficiency during the initial 21 day feeding period was markedly improved in the pigs offered either the high fat (treatments B and D) or the high fibre (treatments C and E) diets during this time compared to those pigs offered the control diet (treatments A and F). The improvement in feed efficiency with the use of the high fat finisher diet was primarily due to faster growth rates (P<0.001), whilst the improvement in feed efficiency with the use of the high fibre diet was due to both a modest improvement in growth rate coupled with a slight reduction in feed intake during this time. Entire males were more feed efficient than the females (2.37 and 2.47 respectively for the male and female finishers, P<0.001, sed 0.030), although there were no significant differences in growth rates during this time. Live weight at day 21 was greater in the animals offered the high fat diets due to their superior growth performance during the initial 21 day feeding period (live weight at day 21: 81.5, 82.9, 82.3, 83.0, 82.0, 81.0 kg respectively for treatments A through to F, P=0.003, sed 0.57). During the subsequent period, 21 to 42 days, feeding strategy did not have a significant impact on feed efficiency. Pigs offered the constant DE diet (feeding strategy F) did however grow at a faster rate than the pigs offered the control or high fibre diets during this time (feeding strategies A, C and D). There was no influence of feeding strategy on feed intake from 21 to 42 days. Males gained weight faster than the females during this time (977.4 and 878.8 g/d respectively, P<0.001), and were more feed efficient (2.69 and 3.00 respectively, P<0.001). Feeding strategy did not have a significant influence on final live weight at the end of the experimental period (99.6, 101.6, 100.3, 100.9, 100.7, 100.2 kg respectively for treatments A through to F, P=0.22, sed 0.80).

Over the entire 42 day experimental period, feed efficiency was enhanced when pigs were offered feeding strategies B, C, D, or E, but not the constant DE strategy (feeding strategy F). These improvements in feed efficiency were the result of non significant changes in growth rates and feed intake over the entire experimental period. Once again, the entire males were more feed efficient (FCR 2.52 and 2.71 respectively, P<0.001) and gained weight faster than the females (955.6 and 901.9 g/d, P<0.001). Carcass weight tended to be greater in the pigs offered the high fat diet for the entire experimental period (treatment B, P=0.057, Table 2), while carcass P2 was reduced when pigs were offered treatments C, D or E (P<0.001). The percentage of animals with a P2 measurement greater than 12 mm also tended to be reduced when pigs were offered treatments C, D, E or F (P=0.095, Table 2). The influence of feeding strategy on the total number of deaths and removals during the finisher period is displayed in Table 3. Feeding strategy did not have a significant impact on the total number of deaths and removals during the treatment period (x^2=1.01, P=0.96).

Table 2. Influence of finisher feeding strategy on growth performance from 16 to 22 weeks of age and carcass characteristics

							SED	Significance		
Feeding strategy (FS)	A	B	C	D	E	F	FS	FS	Sex	FS x Sex
0-21 days										
ADG (g/d)	898.7	965.4	933.5	967.8	922.0	874.6	21.56	<0.001	0.25	0.77
ADFI (kg/d)	2.24	2.29	2.19	2.26	2.21	2.22	0.031	0.021	0.001	0.80
FCR (kg/kg)	2.50	2.39	2.36	2.35	2.42	2.56	0.049	<0.001	<0.001	0.72
21-42 days										
ADG (g/d)	905.3	933.0	899.5	895.2	942.7	968.3	25.04	0.026	<0.001	0.91
ADFI (kg/d)	2.61	2.63	2.58	2.54	2.64	2.66	0.059	0.41	0.95	0.52
FCR (kg/kg)	2.91	2.84	2.89	2.87	2.84	2.78	0.059	0.34	<0.001	0.37
0-42 days										
ADG (g/d)	901.9	950.0	917.3	933.2	933.9	922.8	17.26	0.11	<0.001	0.88
ADFI (kg/d)	2.42	2.46	2.38	2.39	2.42	2.44	0.036	0.29	0.11	0.44
FCR (kg/kg)	2.69	2.59	2.60	2.58	2.61	2.67	0.034	0.006	<0.001	0.74
Carcass characteristics										
Carcass weight (kg)	76.7	78.3	76.3	77.3	77.3	76.9	0.65	0.057	0.039	0.89
Carcass P2 (mm)	9.1	9.3	8.5	8.6	8.6	8.9	0.22	0.003	<0.001	0.57
Percentage of pigs with a P2 >12 mm (%)	9.6	6.7	4.6	3.4	4.7	4.9	2.23	0.095	0.043	0.32
Dressing %	77.0	77.1	76.1	76.6	76.7	76.7	0.34	0.098	<0.001	0.44

Table 3. Influence of finisher feeding strategy on the total number of deaths and removals.

Feeding strategy	Sudden death	Removed unthrifty	Removed lame	Total deaths/ removals
A	2			2
B	1			1
C		2		2
D	1			1
E	1			1
F			1	1

Economic analyses

Increasing the tallow content of the diet increased the diet cost by approximately $3.34/tonne based on ingredient prices in early 2009. In comparison, increasing the NDF concentration in the diet increased the diet cost by approximately $5.00/tonne. Utilising the high fat and high NDF diets generally improved the net return for both entire male and female finisher pigs (Tables 4 and 5), with the exception of feeding strategy C (high NDF diet fed for the entire six week period) when fed to the male pigs only. The finisher feeding strategy with the greatest net return in margin for both the entire male and female finishers was treatment B (high fat for the entire six week period). Treatments D and E produced similar net returns for the female pigs, while in contrast there was a difference in net return between treatments D and E in the male finishers (net return in margin $4.61 and $2.53 per pig for treatments D and E respectively). This difference in net return was due to minor differences in total feed costs, carcass weight and the % of pigs with a P2 back fat depth greater than 12 mm.

Table 4. Influence of finisher feeding strategy on total finisher feed costs, income per pig and net return for male finishers.

Feeding strategy	*A*	*B*	*C*	*D*	*E*	*F*
ADI (kg/d) 0-21 days	2.20	2.29	2.16	2.20	2.18	2.18
Feed costs ($/t) 0-21	342.53	345.87	347.54	345.87	347.54	342.53
Total feed intake (kg)0-21	46.20	48.09	45.36	46.20	45.78	45.78
Feed costs ($/pig)0-21	15.82	16.63	15.76	15.98	15.91	15.68
ADI (kg/d) 21-42	2.64	2.70	2.58	2.50	2.60	2.64
Feed costs ($/t)21-42	342.53	345.87	347.54	347.54	345.87	335.27
Total feed intake (kg)21-42	55.44	56.70	54.18	52.50	54.60	55.44
Feed costs ($/pig)21-42	18.99	19.61	18.83	18.25	18.88	18.59
Total Feed cost 0-42 days ($/pig)	34.81	36.24	34.59	34.23	34.79	34.27
Live weight gain (kg)	39.04	41.77	39.61	40.48	40.35	39.75
Cost/kg ($/kg)	0.892	0.868	0.873	0.845	0.862	0.862
Cost saving (cents/kg)		2.41	1.84	4.63	2.94	2.97
Carcass weight	77.17	79.03	76.38	78.09	77.78	77.08
Return on carcass weight ($3.50/kg)	270.10	276.61	267.33	273.32	272.23	269.78
% pigs above 12mm back fat	5.19	6.08	5.95	1.03	3.21	3.35
Discount for P2	1.00	1.20	1.14	0.20	0.62	0.65
Income per pig	269.09	275.40	266.19	273.11	271.61	269.13
Net return	234.28	239.16	231.60	238.89	236.81	234.87
Net return in margin ($/pig)		4.88	(-2.68)	4.61	2.53	0.59

Table 5. Influence of finisher feeding strategy on total finisher feed costs, income per pig and net return for female finishers.

Feeding strategy	*A*	*B*	*C*	*D*	*E*	*F*
ADI (kg/d) 0-21 days	2.27	2.30	2.22	2.31	2.34	2.25
Feed costs ($/t)0-21	342.53	345.87	347.54	345.87	347.54	342.53
Total feed intake (kg)0-21	47.67	48.30	46.62	48.51	49.14	47.25
Feed costs ($/pig)0-21	16.33	16.71	16.20	16.78	17.08	16.18
ADI (kg/d) 21-42	2.59	2.58	2.58	2.58	2.67	2.67
Feed costs ($/t)21-42	342.53	345.87	347.54	347.54	345.87	335.27
Total feed intake (kg)21-42	54.39	54.18	54.18	54.18	56.07	56.07
Feed costs ($/pig)21-42	18.63	18.74	18.83	18.83	19.39	18.80
Total Feed cost 0-42 days ($/pig)	34.96	35.44	35.03	35.61	36.47	34.98
Live weight gain (kg)	36.89	38.27	37.60	38.10	37.84	37.34
Cost/kg ($/kg)	0.948	0.926	0.932	0.935	0.964	0.937
Cost saving (cents/kg)		2.15	1.59	1.31	-1.62	1.08
Carcass weight	76.26	77.67	76.27	76.68	76.95	76.80
Return on carcass weight ($3.50/kg)	266.91	271.85	266.95	268.38	269.33	268.80
% pigs above 12mm back fat	13.23	7.16	3.51	5.33	5.91	6.21
Discount for P2	2.52	1.39	0.67	1.02	1.14	1.19
Income per pig	264.39	270.45	266.28	267.36	268.19	267.61
Net return	229.43	235.01	231.24	231.75	231.72	232.62
Net return in margin ($/pig)		5.58	1.81	2.32	2.29	3.20

4. Application of Research

The strategic use of high fat and/or high NDF diets during the finisher period resulted in marked improvements in feed efficiency. During the initial three week feeing period, feed conversion ratio reduced from 2.53 in the animals offered the control diet (feeding strategies A and F) to an average of 2.37 for the animals offered the high fat diets (strategies B and D) and an average of 2.39 for those offered the high NDF diets (strategies C and E). The response to the feeding of high fat and/or high NDF diets in this current study was most pronounced during the initial three week feeding period, and declined with time. During the subsequent period from 21 to 42 days FCR was not significantly influenced by feeding strategy. This observation supports previous research with finisher pigs in which the maximum response to high fat (Collins *et al.* 2009; Weber *et al.* 2006) or high NDF (Collins *et al.* unpublished) diets were obtained within the first three weeks of the feeding period.

Historically, supplemental fat has not been added to the diets of finisher pigs due to their propensity to deposit the excess energy as adipose tissue. The relationship between energy intake and protein deposition in these older (heavier) animals, as well as in castrates and pigs of poorer genotypes is linear plateau. In this case the maximum rate of protein deposition is achieved within the limit of feed intake. The selection for leaner, improved genotypes has however resulted in the plateau occurring at higher feed intakes for some animals, or in other cases not at all with protein deposition rates increasing linearly with energy intake up to commercial slaughter weights (Dunshea *et al.* 1998; King *et al.* 2004; Rao and McCracken 1992). Investigations by King *et al.* (2004) indicated that current genotypes may not have an intrinsic limit to protein deposition up to 120 kg live weight with protein deposition rates increasing with increasing energy intakes during this time.

Daily feed intake did not decline in this investigation when the high fat diets were fed for an extended period of time. Comparing feeding strategies B (high fat for six weeks) and E (high fibre for three weeks followed by high fat for three weeks), average daily feed intakes from 21 to 42 days was similar despite pigs offered feeding strategy B having already been offered the high fat diets for the previous three week period. This observation is in contrast to several other studies which suggest that feed intake is reduced when high fat diets are offered to growing pigs for an extended period of time. Collins *et al.* (2009) reported reduced feed intakes during the final 3 weeks of the finisher period when pigs were offered diets containing more than 4 % supplemental fat. This reduction in feed intake corresponded to a reduction in growth rates compared to those animals offered the 3 or 4 % supplemental fat diets. These authors suggested that this reduction in feed intake was due to inferior pellet quality of the higher fat diets, with the pellet durability index (measured using a Holmen Pellet Durability Tester, Holmen, UK) reduced from 95.2 % to 77.3 % when the supplemental tallow concentration in the diet was increased from one to six percent. Pellet quality of the high fat diet in this current investigation was not inferior when compared to the control diet or the high NDF diets (average pellet durability index: 98.1, 94.1, 96.8 and 87.4 % respectively for the control diet, high fat diet, high fibre diet and the constant DE diet). This implies that if feed milling procedures can be improved to maintain pellet quality when tallow is included in the diet above 4 %, then any adverse affects on feed intake can be minimised. It should also be noted that the majority of this investigation was undertaken during the autumn period of high daily feed intakes, and as such seasonal conditions may influence the long term feed intake response to high fat finisher diets.

The neutral detergent fibre (NDF) component of a diet is a measure of the plant cell wall material in the diet and encompasses the hemicelluloses, cellulose and lignin components of fibre. Wheat by-products such as mill mix are high in NDF and rich in insoluble non-starch polysaccharides (NSP) such as cellulose and arabinoxylan. In the past, products such as mill mix have been considered to be poorly utilised by the pig due to the inability of the animal's digestive enzymes to hydrolyse NSP's. The addition of commercially available xylanase enzymes have however improved the animals utilisation of such feed ingredients (Barrera *et al.* 2004). Previous Pork CRC research showed a 9.4 % improvement in feed efficiency during the first two weeks of the experimental period when the NDF concentration of the finisher diet was increased from 13 to 23 %. This improvement in feed efficiency resulted from an enhanced rate of gain during the initial feeding period without any significant impact on feed intake. In this present investigation, the improvement in feed efficiency associated with the high NDF diet during the initial three week feeding period was 4.4 %. The benefits associated with feeding high NDF diets during the finisher period did however diminish with time in this present investigation, consistent with previous studies (Collins *et al.,* unpublished). It is possible that the initial increase in weight gain associated with high NDF diets is due to an increase in the weight of the intestinal tract of the animal. Numerous studies have observed a decrease in dressing percentage with increasing concentrations of NDF in the diet (Kass *et al.* 1980; Pluske *et al.* 1998; Stanogias and Pearce 1985), and this current experiment was no exception.

Carcass quality, in particular carcass fatness as measured at the P2 site, is an important consideration for maximising the economic returns from any feeding strategy. Previous studies have shown that the feeding of high fat diets for five weeks during the finisher period can result in a significant increase in the percentage of animals with a P2 greater than 12 mm (current maximum carcass specification for a premium grade carcass) (Collins *et al.* 2009). The results from this present study do not support this observation, with the animals offered the control (treatment A) and high fat (treatment B) feeding strategies displaying a similar percentage of pigs with a carcass P2 greater than 12 mm. Interestingly, there was a tendency for the percentage of animals with a carcass P2 greater than 12 mm to be reduced (P=0.095) when the high fat diets were fed for a maximum three week period (treatments D and E) compared to the control animals. These results are in agreement with Campbell (2005) in which the author suggests that the addition of fat to finisher diets in the United States has little impact on carcass fat given the lean genotypes used in this country, but rather that the increase in dietary fat increases the percentage of lean tissue at slaughter.

The addition of dietary fat to finisher diets consistently improves finisher growth rates and feed efficiency above that expected by the increase in energy content alone. In this present investigation, daily energy intakes increased by 2.8 % over the entire experimental period when pigs were offered the high fat feeding strategy for six weeks compared to the control feeding strategy (Table 6). In comparison, feed efficiency improved by 3.7 % and growth rates improved by 5.1 % over the entire experimental period with the high fat feeding strategy.

Table 6. The effect of finisher feeding strategy on daily digestible energy (DE) intake

Feeding strategy	*A*	*B*	*C*	*D*	*E*	*F*
DE day 0-21 (MJ/kg diet)	13.8	14.0	13.8	14.0	13.8	13.8
DE day 21-42 (MJ/kg/d)	13.8	14.0	13.8	13.8	14.0	13.8
Daily feed intake day 0-21 (kg/d)	2.24	2.29	2.19	2.26	2.21	2.22
Daily feed intake day 21-42 (kg/d)	2.61	2.63	2.58	2.54	2.64	2.66
Daily energy intake day 0-21 (MJ DE/day)	30.91	32.06	30.22	31.64	30.50	30.64
Daily energy intake day 21-42 (MJ DE/day)	36.02	36.82	35.60	35.05	36.96	36.71
Average daily energy intake (MJ DE/day) day 0-42	33.47	34.44	32.91	33.35	33.73	33.67

The economic analyses suggest that the feeding of high fat diets for the entire six week period will provide the greatest net return per pig for both entire males and females. This result is very similar to that reported by Collins *et al.* 2009, in which the 5 % supplemental dietary fat diet provided the greatest improvement in net return for both the entire male and female pigs. Differences in the actual margin ($/pig) between studies reflects the greater return on carcass weight at the time that this more recent experiment was undertaken.

5. Conclusion

Incorporating 5 % added dietary fat as tallow into commercial finisher diets improves growth performance, feed efficiency and net returns. Economically, this response was maximised when the dietary fat addition was maintained for the entire finisher period. The use of a high fat followed by high fibre (or the reverse) feeding strategy during the finisher period will also increase net returns, but not to the same extent as the high fat diet for the entire finisher period. The use of the high fat diet for a maximum three week period may however have merit in situations where the pigs have a greater propensity for fat deposition, thereby minimising the potential for carcass P2 outside premium grade specifications.

6. Limitations/Risks

The length of inclusion of 5 % added fat (tallow) in finisher diets may need to be limited in situations where the pigs have a greater propensity for adipose tissue deposition compared to the lean, fast growing genotype used in this current investigation. In this situation, the use of the high fat diet during the finisher period may need to be limited to a three week period to maintain a premium carcass grade.

7. Recommendations

As a result of the outcomes in this study the following recommendations have been made:

- Additional fat (tallow) may be added to finisher diets at inclusion rates of up to 5 % to improve finisher feed efficiency and reduce the costs of production
- Genotypes with a greater propensity for fat deposition may limit the feeding of the high fat diet to a maximum three week period, and utilise a high NDF diet for remaining finisher period.

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