How to compare starter diets and their ingredients

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Protein ingredient prices have increased dramatically in recent years, resulting in average starter feed prices rising by nearly 20% since 2005. Clearly producers and feed manufacturers must focus to minimise future feed cost increases, especially as they contribute over 60% of total production costs.

With the background of a 'high price' market it is tempting to use cheaper alternative ingredients. However, any concession on the ingredient quality can have a detrimental impact on pig performance and as nursery performance is linked closely with lifetime performance, any compromise on starter feed quality should be thoroughly understood and evaluated.

When ingredient prices increase, there are two key questions:

- Is there an alternative source of the same ingredient that is better value for money.
- Is there an alternative ingredient or variety that is better value for money?

Alternative sources

Many different milk products can be used in a piglet starter diet; skim milk, whey protein concentrate, whey permeate and more commonly whey powder. As whey is readily available with a long pedigree it may be expected that any differences between whey sources would be minimal. However a recent study by Bergstrom et al., (2007) showed otherwise. The trial looked at the impact of whey source on pig performance for 14 days post-weaning.

The 'same' specification whey was purchased from seven suppliers (A to G) and each was fed in a fixed formula diet where the only difference was the source of whey, included at 10% (Table 1). These were compared to a control diet containing no whey.

Whilst the same whey specification was purchased, performance in average daily gain was highly variable (326 ± 20 g/d).

This highlights the importance of evaluating milk product quality through piglet performance trials and using accurate performance data to select the most appropriate whey. The difference between pigs fed the best and worst performing whey was 0.57kg/pig over the 14 day post-weaning period on a low inclusion level of whey (10%).

Table 1. The impact of whey source (quality) on piglet performance 14 days post-weaning (adapted from Bergstrom et al., 2007).

	Control	A	B	C	D	E	F	G	Av.
ADFI (g/d)	389^{a}	419^{ab}	386^{a}	405^{a}	393^{a}	442^{b}	415^{a}	397^{a}	408
ADG (g/d)	295^{a}	349^{b}	308^{a}	327^{ab}	308^{a}	349^{b}	327^{ab}	318^{a}	326
FCR	1.32^{a}	1.20^{b}	1.25^{ab}	1.24^{ab}	1.28^{a}	1.26^{ab}	1.27^{ab}	1.25^{ab}	1.25
Day 0 wt (kg)	7.8	7.8	7.7	7.7	7.7	7.8	7.7	7.7	7.7
Day 14 wt (kg)	11.9^{a}	12.7^{b}	12.1^{a}	12.4^{ab}	12.1^{a}	12.7^{b}	12.4^{ab}	12.2^{ab}	12.4

^{a} Means with differing superscript are significantly different

Alternative variety

Fishmeal quality is affected by many factors including variety, freshness at manufacturing and the manufacturing process itself. These factors sequentially affect pig performance as was demonstrated by Kim and Easter (2001). Four treatments were compared; Menhaden, Mackerel at 70°C, Mackerel at 85°C and Herring at 70°C.

All four fishmeals were trialled at the same inclusion level (9.5%) in an iso-nutrient diet from weaning to day 28 post-weaning. The results showed that fishmeal variety and process does impact post-weaning pig performance (Table 2).

Pigs fed the lower temperature processed mackerel gave the best overall average daily gain and lowest feed conversion ratio.

Primary Diets' own work with the University of Leeds has shown similar results testing typical fishmeals available in the UK and fed to piglets in representative UK conditions and health challenges (Table 3).

In this trial the higher quality, low temperature North Atlantic fishmeal gave superior performance to the improved South American fishmeal.

The above examples demonstrate that apparently insignificant changes in source or variety of an ingredient can have a large impact on performance.

Understanding changes in performance and conducting a cost:benefit analysis is key to determining whether dietary changes should be made.

Consistently high levels of performance needs high quality ingredients and this may not just mean an ingredient or nutrient specification but also an understanding of the process control to ensure high ingredient digestibility.

	Menhaden[1]	Mackerel 85°C	Mackerel 70°C	Herring 70°C
ADG (g/d)	247	275	272	251
ADFI (g/d)	419	427	410	402
FCR	1.69^{a}	1.55^{b}	1.50^{b}	1.60^{ab}

^{a} Means with differing superscript are significantly different, P<0.05
[1] Drying temperature of Menhaden fish unknown

Table 2. Fishmeal variety and processing can impact post-weaning performance 28 days post-weaning (adapted from Kim and Easter, 2001).

Complete diet digestibility

It is well documented that the initial post-weaning phase is critical to lifetime performance with the Leeds University Group publishing papers showing the initial 20 days post-weaning growth is an excellent predictor of subsequent performance.

An independent trial studying the effects of feed digestibility on pig performance was conducted by Mahan et al., (2004) who looked at how a low, medium and high digestibility feeding program influenced pig performance 28 days post-weaning.

The results (Table 4) show the high digestibility program had the

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	Improved South American	North Atlantic
Wean weight (kg)	8.0	8.0
Day 20 weight (kg)	15.0^{a}	15.4^{b}
ADG (g/day)	351^{a}	371^{b}
ADFI (g/day)	398^{a}	414^{b}
FCR	1.13	1.11

^{a}Means with differing superscript are significantly different, P<0.05

Table 3. Effect of fishmeal source on post-weaning performance (Unpublished Primary Diets trial data conducted at the University of Leeds).

	Digestibility		
	High	Medium	Low
Weaning weight (kg)	6.34	6.32	6.35
28 day weight (kg)	18.21	16.91	15.56
Weight gain (kg)	11.87[a]	10.59[b]	9.21[a]
ADG (g/day)	422[a]	378[b]	328[b]
ADFI (g/day)	579[a]	544[a]	473[b]
FCR	1.37[a]	1.43[b]	1.44[b]

[*] *Means with differing superscript are significantly different*

Table 4. The effect of starter feed digestibility on nursery performance 28 days post-weaning (adapted from Mahan et al., 2004).

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best response with an extra 1.3kg and 2.65kg gain when compared to the medium and low digestibility programs respectively.

Translated, that is 46g/day benefit over the medium digestible regime and 94g/day benefit over the low digestible regime. A significant improvement in FCR was also observed as diet digestibility increased (low: 1.44; medium 1.43; high 1.37).

Pig production is a commercial business. Performance has a value and a cost so it is important to judge how they interact to achieve the best return per pig.

As producers, your pigs will assist you in determining the most appropriate feed program for your unit, run a trial and the pigs will tell you which diets work best for you.

Measure margin over feed

Of course, there are different measures to judge a diet or feeding program. Margin Over Feed (MOF) is our preferred measure, calculated from the value of weight gain per pig in the nursery phase less the feed cost associated with this gain.

We believe that in loss making times as well as profitable ones MOF is given greatest importance or chosen as the sole determining factor in assessing which starter diet regime to use.

A commercial trial conducted by Primary Diets is shown in Table 5. The producer wanted to compare their current starter feed regime (Regime 1) against an alternative also supplied by Primary Diets (Regime 2).

The trial was well conducted with six pens of pigs per dietary regime, in the same air space and balanced for number, sex and weaning weight.

The same amount of starter feed (Diets 1 and 2) per pig was fed before moving onto a common link diet (Diet 3) until exit from the nursery on day 26 post-weaning.

Initially the producer was attracted to regime 2 due to its lower cost per tonne (approximately -£10/t and -£90/t for Diets 1 and 2 respectively). However, whilst difference in performance was minimal, changing to regime 2 would be a false economy.

An increased MOF of +£0.23 per pig or +£73.60 per tonne of starter feed (320 pigs fed per tonne of starter feed; Diets 1 and 2) was achieved on regime 1, mainly due to the improved FCR.

There is no doubt the right starter feed regime is critical. After all, the pig will only eat starter feed once in its life and if it is wrong, there is no opportunity to correct this with the next diet.

A cost:benefit approach to diet choice has never been more important! ■

Table 5. The effect of starter feed regime on performance 26 days post-weaning.

	Regime 1	Regime 2
[*]Diet 1 (kg/pig)	1.04	1.04
[*]Diet 2 (kg/pig)	2.08	2.08
[*]Diet 3 (kg/pig)	8.58	8.96
Wean weight (kg)	7.52	7.55
Day 26 weight (kg)	17.23	17.12
Weight gain in nursery period (kg)	9.71	9.57
ADG (g/day)	374	368
ADFI (g/day)	450	465
FCR	1.20	1.26
Average cost per tonne feed (£)	383	361
Feed cost (£/pig)	4.49	4.37
[1] Return (£/pig)	14.58	14.35
[2] MOF (£/pig)	10.09	9.98

[*]*Diets 1 and 2 differed between regime and 2, whilst diet 3 was common between both treatments and fed until day 26 post-weaning.*

[1]*Return per pig calculated using a price of £1.50 per kg live weight gained*

[2]*MOF; Margin Over Feed = Return per pig – feed cost*