# *Evaluation of an in-feed appetite suppressant as a means to manipulate feed intake of pigs*

**Report prepared for the Co-operative Research Centre for an Internationally Competitive Pork Industry**

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# Executive Summary

Excess carcass fat (P2) lowers the price of the slaughtered pig. Restricted feeding of finisher pigs and/or the feeding of low digestible energy (DE) diets can help reduce fat deposition in finisher pigs. However, restricted feeding is not practical in today's finisher housing systems and the finisher pig can manipulate its intake of low DE diets unless extremely low DE diets are used. A practical way to suppress feed intake in finisher pigs would be to include an ingredient in the feed which suppressed appetite resulting in fewer meals or reduced feed consumption at meals or a combination of both. To this end, a specific proteinase inhibitor (P12) was used in a short duration, 'proof of concept' experiment. This proteinase inhibitor is used in tablet form by people before a meal to extend the feeling of satiety after the meal. The mechanism of action is by sustaining elevated cholecystokinin levels after a meal.

The experiment involved 40 individually penned 60kg liveweight female pigs offered a control diet or the same diet containing approximately 10mg of the proteinase inhibitor per kg of bodyweight. After a 7 day acclimatization period on the control diet, 20 pigs were fed the control diet for 10 days, followed by a 4 day transition period on the control diet and then 10 days on the treated diet (Group A). The other group of 20 pigs were fed the treated diet for 10 days, followed by a 4 day transition period on the control diet and then 10 days on the control diet (Group B). The feeding regime was designed to ensure feed was in front of the pigs at all times. Measurements included daily feed intake per pig, liveweight gain and feed conversion ratio for the 0-10 day, 11-14 day and 15-24 day periods. P2 measurements were also taken on each pig at days 0, 10, 14 and 24.

Comparing feed intake data within time periods produced a significant difference (P=0.03) in the 15-24 day period with pigs consuming less of the treated feed than control feed. However, the data do not support the hypothesis that P12 consistently suppressed appetite as there was no significant difference in feed intake during the 0-10 day period. Of note though, is that the increase in feed intake for the group of pigs that moved from the P12 treated feed to the control feed was 30%, yet was only 17% with the pigs that changed from the control feed to the P12 treated feed. It should also be noted that fat deposition profiles in group A pigs was unusual suggesting a confounding influence prior to day 15 which may have affected feed intake after day 15.

The appetite suppressant is taken by people approximately 1 hour before a meal but in this study was included in the feed and so was consumed by pigs during meals rather than prior to meals. The feed intake results were inconclusive from this experiment and so do not support the application of P12 in feed to consistently suppress appetite in finisher pigs.

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# 1. Introduction

The manipulation of feed intake in finisher pigs is a major goal in manipulation of the growth performance of the pig and the amount of fat deposition that occurs during this period. The rate of fat deposition is at a maximum during the finisher period and is related to the amount of energy that is consumed by the pig. Excess energy intake above that required for protein deposition during this time is deposited as fat. This deposited fat can lead to a significant reduction in the price received for the pig at slaughter. Restricted feeding is often practice in Europe to control this fat deposition along with low digestible energy diets. Restricted feeding is difficult, if not impossible, to practice successfully in today's finisher housing systems. The finisher pig has a significant capacity to manipulate its intake to overcome the restrictive effects of low digestible energy diets unless extreme levels are reached. Thus if we can control, or at least reduce the feed intake of the finisher pig through means of appetite suppression, we can thus control the energy intake of the animal and more effectively aim at maximum lean deposition without allowing excess energy being directed to undesirable fat deposition.

A specific patented proteinase inhibitor (P12) which sustains the presence of cholecystokinin is being used to extend satiety after meals in humans. This material was used in this short duration 'proof of concept' experiment to evaluate its capacity to suppress feed intake in finisher pigs to pursue the overall objectives of the CRC's output no. 2.13 as a part of sub-programme 2b.

# 2. Methodology

A control and treatment comparison was made over 2 periods in a cross-over designed experiment. Forty female pigs of 60kg (±2kg) and approximately 13 weeks of age were housed in individual pens in the QAF boar test facility. Diets were formulated with standard nutrient levels for this weight of pig. The control diet was fed to all pigs for 7 days to acclimatize pigs the diet and the environment. Twenty pigs were randomly assigned to each group at day 0.

The treatment regime was as follows:

A. 20 pigs were fed the control diet for 10 days followed by the control diet for another 4 days and then 10 days receiving the same diet containing approximately 10mg of P12/kg bodyweight/day, ie. total trial period of 24 days
B. 20 pigs were fed the diet containing approximately 10mg of P12/kg bodyweight/day for 10 days, followed by a 4 day period on the control diet to eliminate any possible residual effects of P12 and then followed by another 10 days on the control diet, ie. total trial period of 24 days

The feed contained no medications and was offered at 3kg per pig per day at the same time each day. If there was <2.5kg remaining in a pig's feeder from the previous day, anadditional 3kg was weighed into the feeder. If >2.5kg of feed remained in a pig's feeder from the previous day, no additional feed was added to the feeder.
Measurements included:
Total feed intake, liveweight gain and FCR for the periods: 0-10 days, 11-14 days and 15 – 28 days. P2 measurements were also taken per pig at days 0, 10, 14 and 24.

## 3. Outcomes

Table 1 shows the results obtained and the P values for each measured variable.

**Table 1. Least square means for measured variables by treatment**

| Variable | P-value | Treatment A | Treatment B |
|---|---|---|---|
| Days -7 to 0 | | | |
| Pre-entry weight (kg) | 0.71 | 54.9 | 55.1 |
| Days 0 to 10 | | | |
| Starting weight (kg) | 0.75 | 59.9 | 60.2 |
| Starting P2 (mm) | 0.97 | 7.61 | 7.60 |
| Day10 weight (kg) | 0.60 | 68.6 | 68.1 |
| Day10 P2 (mm) | 0.05 | 7.44 | 8.24 |
| Rate of gain (kg/day) | 0.21 | 0.871 | 0.791 |
| Av. daily feed intake (kg/day) | 0.83 | 2.11 | 2.09 |
| Feed conversion ratio (kg/kg) | 0.04 | 2.48 | 2.71 |
| Transition Days 10 to 14 | | | |
| Day14 weight (kg) | 0.86 | 72.5 | 72.3 |
| Day14 P2 (kg) | 0.04 | 7.35 | 8.41 |
| Rate of gain (kg/day) | 0.51 | 0.976 | 1.067 |
| Av. daily feed intake (kg/day) | 0.23 | 2.36 | 2.49 |
| Feed conversion ratio (kg/kg) | 0.33 | 2.84 | 2.48 |
| Days 15 to 24 | | | |
| Day24 weight (kg) | 0.14 | 79.4 | 81.2 |
| Day24 P2 (kg) | 0.11 | 8.50 | 9.28 |
| Rate of gain (kg/day) | 0.0001 | 0.684 | 0.890 |
| Av. daily feed intake (kg/day) | 0.03 | 2.47 | 2.73 |
| Feed conversion ratio (kg/kg) | 0.02 | 3.72 | 3.16 |

The only time period with a significant difference in average daily feed intake was day 15-24 with a lower intake for pigs receiving the P12 diet than the control diet. Also of interest is the relative change in feed intake from the 0-10 day period to the 15-24 day period. The increase in average daily feed intake for pigs receiving the P12 diet in period 1 followed by the control diet in period 2 was 0.64kg which is an increase of 30%. However,

the increase in feed intake for pigs receiving the control diet in period 1 followed by the P12 diet in period 2 was 0.36kg which is only a 17% increase and is 44% less feed consumed, ie. 0.36kg compared with 0.64kg. Whilst this difference was not associated with a significant difference in day 24 liveweight, it was associated with a significantly lower rate of gain in the 15-24 day period for the pigs receiving the P12 diet in this period compared with pigs receiving the control diet.

The graph below shows the daily feed intake pattern for each treatment during the feeding of each diet.

**Figure 1. Daily feed intake results by treatment during each feeding period**

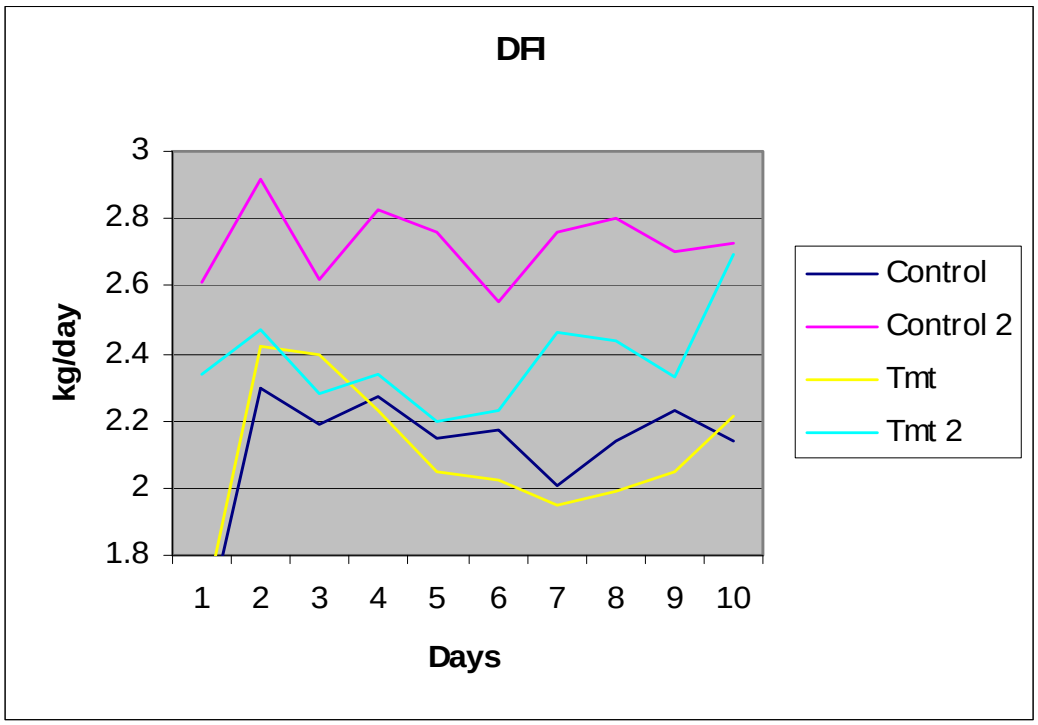


Figure 2 shows the feed intake data for individual pigs throughout the experiment. The treatment regime for the numbered pigs was as follows:

**Treatment A**: control diet followed by the treatment diet
Pigs 3, 4, 5, 6, 7, 10, 11, 12, 14, 16, 17, 22, 24, 29, 32, 33, 34, 38, 39, 40.

**Treatment B**: treatment diet followed by the control diet
Pigs 1, 2, 8, 9, 13, 15, 18, 19, 20, 21, 23, 25, 26, 27, 28, 30, 31, 35, 36, 37.

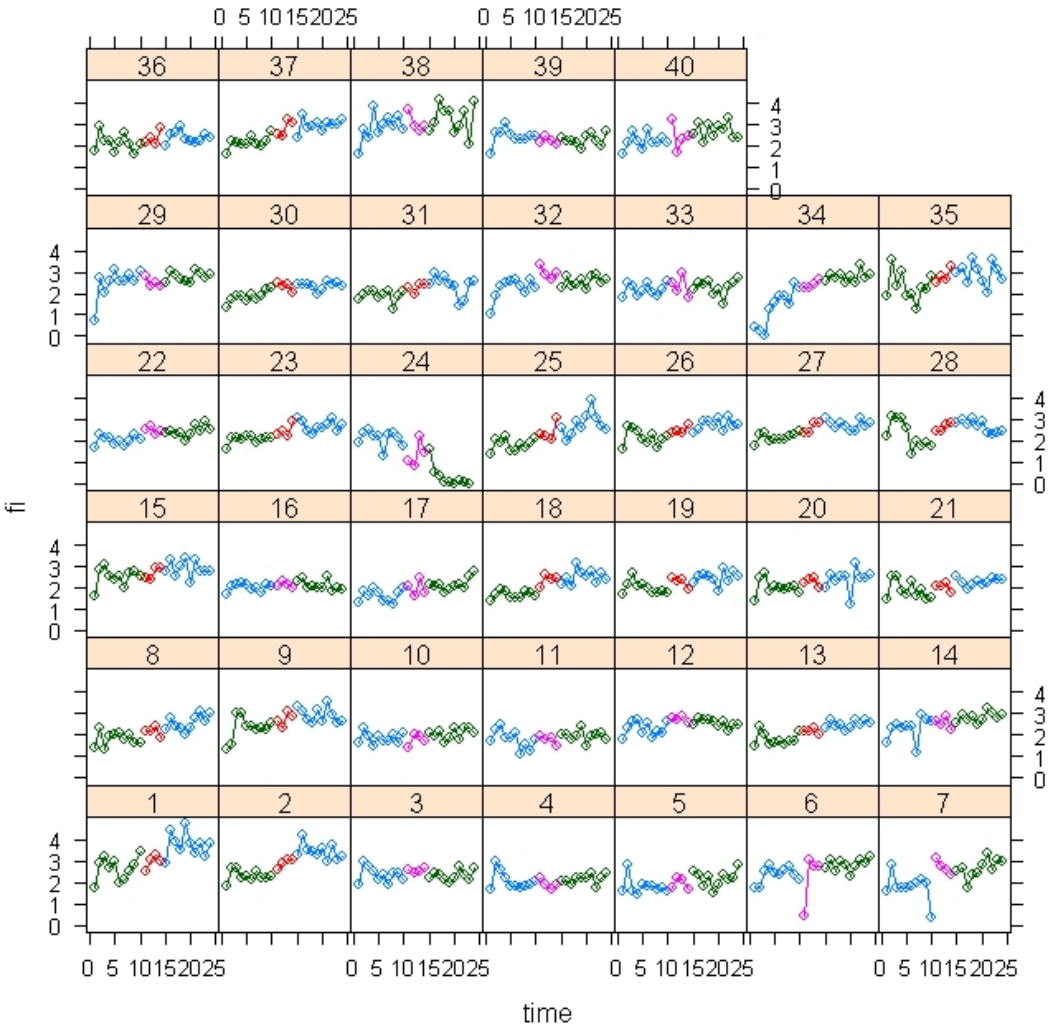


**Figure 2. Daily feed intake results for each individual pig; treatment diet in green and control diet in blue**

Comments from the statistician's report regarding feed delivery are:

'The pattern of feed delivery was examined first. Generally, the number of zero feeding events decreased over time as the gilts became larger and consumed more feed per day. There was no significant difference (P=0.18) between treatments in the number of zero feed delivery events over the full 24 days, or for the number of zero feeding events in the first 10 days of the trial (P=0.94). However, the delivery of feeds in the transition period of 11-14 days did significantly differ (P<0.0001) and approached significance for the number of zero feed delivery days (P=0.08) after day 14 (Table 2).

**Table 2. Least squares means for zero feed deliveries by treatments**

| Variable | P-value | Treatment A | Treatment B |
|---|---|---|---|
| Number of zero feed delivery days between D11-14 | <0.0001 | 0.79 | 0.25 |
| Number of zero feed delivery days between D15-24 | 0.08 | 1.21 | 0.75 |

The lower number of zero feeding events in treatment B from days 11-14 could indicate a response to fresh feed replacement (P12 with control) and/or an increased appetite for the control diet. Alternatively, providing all treatment B animals with fresh feed on day 10 could simply create a numerical difference that arises simply from a reduced need to skip a feed when only 3kg was available; in contrast treatment A animals averaged 3.65kg available on day 11. This could only be disentangled if all animals had their feed replaced on day 11 regardless of diet.

The difference between treatments was larger but more variable from 14 days onwards, hence lack of significance at the 5% level. There was a suggestion that treatment A animals, now on the P12 diet, had a higher level of feed refusal on this diet, as indicated by more zero feeding days.'

The conclusions from this study are:

- These data do not consistently support the hypothesis that P12 universally suppresses appetite in finisher pigs since there was no evidence for a reduction in average daily intake for treatment B animals in days 1 to 10
- However, the lower intake of treatment A animals from days 15-24 might indicate dietary appetite suppression since the increase from period 1 (0-10 days on the control diet) to period 2 (15-24 days on the P12 diet) was 17% but was 30% for treatment B which was the P12 diet followed by the control diet; a similar magnitude of difference was recorded from the 4 day transition period to period 2 being 5% for treatment A and 10% for treatment B). Unfortunately, the fat deposition profiles within treatment A are unusual and suggest something else might be happening prior to day 15 which might affect results in the later time period and be unrelated to the P12 dietary treatment
- Rates of gain are strongly depressed in days 15 to 24 for treatment A, but this was also the case for treatment B. It seems likely that some other factor (eg high temperatures, scouring?) might have affected the outcomes for both treatments in this time period
- A longitudinal analysis may better illustrate the pattern of changes over time with this trial design. However, it was not performed due

to the unusual results for deposition of back fat in treatment A prior to the P12 diet

## 4. Application of Research

Based on the results of this small, short-duration experiment, there is currently no application to commercial pig production.

## 5. Conclusion

If energy intake of the finisher pig could be controlled through feed intake management then the producers could more effectively aim at maximum lean deposition without allowing excess energy being directed to undesirable fat deposition. This could be achieved by suppressing appetite. A specific patented proteinase inhibitor (P12) which sustains the presence of cholecystokinin (CCK) is being used to extend satiety in humans by taking a tablet approximately 60 minutes prior to a meal. This same compound was used in this project to evaluate its potential to inhibit feed intake in the finisher pig. Of course in this work, the test substance is consumed by the pig during meals rather than prior to meals as used in humans. The feed intake results were inconclusive from this study and couldn't support the hypothesis that P12 universally suppresses appetite in finisher pigs.

## 6. Limitations/Risks

Not applicable

## 7. Recommendations

As a result of the outcomes in this study the recommendation is not to proceed with further work with P12 for this application.

## 8. References

None supplied.