Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 186

1978

Effects of feeding a heat processed, predigested liquid diet to three-week old weanling pigs

S F. Binder

E R. Skoch

C W. Deyoe

See next page for additional authors

Recommended Citation

Binder, S F.; Skoch, E R.; Deyoe, C W.; Allee, G L.; and Behnke, Keith C. (1978) "Effects of feeding a heat processed, predigested liquid diet to three-week old weanling pigs," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6026

Effects of feeding a heat processed, predigested liquid diet to three-week old weanling pigs

Authors

S F. Binder, E R. Skoch, C W. Deyoe, G L. Allee, and Keith C. Behnke

Effects of Feeding a Heat Processed, Predigested Liquid Diet to Three-Week Old Weanling Pigs

S. F. Binder,[1] E. R. Skoch,[1] C. W. Deyoe,[1]
G. L. Allee, and K. C. Behnke[1]

Summary

One hundred forty, three-week old weanling pigs were used to evaluate the effects of feeding a heat-processed, predigested liquid diet. In Trial I, pigs were randomly allotted to a dry crumbled diet or a processed liquid diet. The basal corn-soybean meal diet contained 20% protein. A preference trial and a digestion trial were also conducted using the same treatments. A second feeding trial was conducted using a basal diet which contained 30% whey. Treatments consisted of a dry meal diet, a dry meal + water diet, and a processed liquid diet.

Trial I indicated that three-week-old pigs gained similarly during the first two weeks on trial. However, after four weeks on trial, the pigs on the dry crumbled diet gained significantly ($P<.05$) more. The processed liquid diet improved dry matter, energy, and protein digestibilities, and was also preferred over the dry crumbled diet during the initial week after weaning.

In Trial II, the groups on the liquid diets gained significantly more ($P<.05$) in the first four weeks after weaning than the group on the dry meal diet. Pigs fed the processed liquid diet gained an additional 2.1 kg (4.1 lb) per pig during the initial four weeks after weaning compared to the pigs on the dry meal diet.

Introduction

Pigs weaned at three weeks of age consume a very limited amount of feed for the first few days after weaning. This lack of feed consumption results in a growth lag and a loss of weight during the initial week after weaning. With the increasing trend of commercial producers to early weaning, it was our objective to evaluate the effects of feeding a heat-processed, predigested liquid diet to three-week-old weanling pigs.

Procedures

General

In the production of the processed liquid feed, the starch containing portion of the diet was hydrothermally processed through a Jet Cooker. The Jet Cooker works by applying live steam directly to a starch slurry; this results in high-shear cook, causing starch damage. Processing temperature was 148 C (300 F). The cooked product was then predigested using alpha-amylase, which caused additional breakdown of the starch molecules. All other ingredients (vitamins, minerals, and antibiotics) were added after the product had cooled to room temperature. Final moisture content was

[1]Department of Grain Science and Industry, Kansas State University, Manhattan, Kansas 66506.

approximately 60%. Phosphoric acid and propionic acid were added to control microbial growth.

The dry control diet was fed in either a crumble or a meal form. When fed in a crumble form, the diet was initially pelleted through a 3/16" die with a conditioning temperature of 70 C (158 F).

Trial I

Forty-eight three-week old Yorkshire piglets were weaned and assigned according to litter, sex, and weight. Treatments consisted of a dry crumbled diet and a processed liquid diet. The diet in a dry form was a corn-soybean meal based feed calculated to contain 20% protein (Table 12). Trial I lasted four weeks, with gains recorded at the end of the second and fourth weeks.

Digestion Trial

Twelve two-week old piglets were weaned and placed in individual digestion crates for separate feces collection. Criteria measured were dry matter, energy, and protein digestibilities of the dry crumbled and processed liquid diets used in Trial I. Piglets were given seven-days to adjust to the environment and diets before the first five-day collection period began. A second five-day collection period was preceded by five-day pre-test trial.

Preference Trial

Twenty three-week-old piglets were assigned to two replications to evaluate feed preference. Diets tested were the same as used in Trial I. The trial consisted of two seven-day periods. Feed consumption was recorded after each period.

Trial II

Sixty Yorkshire piglets were weaned at three weeks of age and randomly assigned to treatments by litter, sex, and weight. Treatments consisted of a dry meal diet, a dry meal + water diet, and a processed liquid diet. The dry meal + water diet was simply dry meal mixed with an equivalent amount of water as in the processed liquid diet. Composition of the basal diet is shown in Table 12. Piglets remained on their assigned treatment for the first four weeks after weaning. At the end of the fourth week, pigs on the liquid diets were switched to the dry meal diet for one week. Weight gains were recorded weekly.

All trials were conducted in environmental control housing equipped with slatted floors. In Trial I, the processed liquid diet was fed in open trough feeders. In Trial II, the liquid diets were presented to the pigs using nipple feeders.

Results and Discussion

Lab analysis of the diets used in Trial I showed that processing the diet brought about a sevenfold increase in maltose equivalence (ME, Table 12). ME is a measurement of starch damage. It can be used as an indicator for gelatinized starch susceptibility to enzyme degradation. The enzyme concentration in the three-week old pigs digestive tract is probably somewhat marginal for optimum starch utilization. Therefore, increasing the starch damage may help in improving the performance of the young pig.

Wastage of the processed liquid diet was the biggest problem encountered, making accurate feed efficiency data impossible to obtain. Weight gains

during the first two weeks after weaning were not significantly different (P<.05, table 13). However, after the first four weeks on trial, the pigs on the dry crumbled diet gained significantly (P<.05) more weight.

Digestibilities of dry matter, energy and protein (Table 14) were increased for pigs fed the liquid processed diet. These results suggest that either the inclusion of water in the diet or the increased starch damage resulting in increased rate and/or increased susceptibility to enzyme digestion may have brought about the increased digestibility of the liquid diet.

Many of the problems resulting from the early weaning of pigs may be caused by pigs' rejecting or not identifying the diet presented to them, whether because of taste or of form. Results of the preference trial indicated that three-week old pigs consumed almost 66% of their dry matter intake in the liquid form during the initial week after weaning (Table 15). During the second week after weaning, pigs consumed the same amount of liquid on a weight basis; however 70% of their dry matter consumption was in dry form. Why weanling pigs preferred the liquid diet may be that they are identifying the liquid diet with sow's milk.

In Trial II, the diet was altered to contain 30 percent whey (Table 12). Figure 1 shows average daily gains by individual weeks. In each individual week up to week 3-4, pigs on the processed liquid diet gained significantly (P<.05) more weight than those on the dry meal + water diet or the dry meal diet. Pigs on the processed liquid diet gained on the average 74 grams more per day than the pigs on the dry meal diet. This is equivalent to 2.1 kg (4.6 lb) additional gain per pig in the first four weeks after weaning. Consumptions during this period were 4.1 kg (9.0 lb), 4.0 kg (8.8 lb), and 4.1 kg (9.0 lb) per pig on the dry meal diet, the dry meal + water, and the processed liquid diet, respectively.

Table 12. Composition of diets on a 90% dry matter basis.

Ingredient	Trial I, %	Trial II, %
Ground yellow dent corn	62.4	45.7
Soybean meal (44% protein)	32.7	
Soy flour (50% protein)		20.2
Whey (spray dried)		30.0
Dicalcium phosphate	2.2	
Phosphoric acid		1.1
Limestone	1.2	
Calcium chloride		2.0
Salt	0.5	
Vitamin mineral premix	1.0	1.0
	100.0	100.0
Analysis of diets		
Dry matter[a], %	89.9	38.2
Crude protein[a], %	21.1	22.0
Maltose equivalent, mg/g[a]	48.1	329.9

[a]Values reported on a dry matter basis.

Table 13. Performance of three-week old weanling pigs allowed ad libitum intake of diets based on a corn-soybean meal mix in dry and liquid forms.[a]

Criterion	Average daily gain, g (lb)	
	Crumbled dry diet	Processed liquid diet
Weeks 0-2	208 (.46)[b]	189 (.42)[b]
Weeks 0-4	310 (.68)[b]	277 (.61)[c]

[a]Values are observations of 24 piglets, 4 replications with 6 animals per pen (initial weight 5.3 kg [11.6 lb]).

[bc]Rows with similar superscripts are not signficantly different (P<.05).

Table 14. Apparent protein, energy, and dry matter digestibilities of dry and processed liquid diets fed to three-week old weanling pigs.[a]

Criterion	Treatment	
	Dry crumbled diet	Processed liquid diet
Dry matter, %	85.0[b]	88.3[c]
Energy, %	85.8[b]	88.9[c]
Protein, %	80.3[b]	86.7[c]

[a]Values are averages of 12 observations using 12 boars during two periods (initial weight 3.9 kg [8.6 lb]).

[bc]Rows with the same superscripts are not significantly different (P<.05).

Table 15. Feed preference of pigs weaned at three weeks of age fed diets in dry and processed liquid forms.[a]

Treatment[b]	7 day dry matter intake, kg(lb)[a]			
	Pen 1	Pen 2	Avg.	%
Period 1				
Dry crumbled diet	5.7(12.5)	4.4(9.7)	5.0(11.1)	34.2
Processed liquid diet	9.9(21.9)	9.5(20.8)	9.7(21.3)	65.8
Period 2				
Dry crumbled diet	23.7(52.3)	19.4(42.7)	21.6(47.5)	69.8
Processed liquid diet	8.4(18.5)	10.2(22.5)	9.3(20.5)	30.2

[a]Each pen contained 10 pigs (initial weight 5.1 kg [11.2 lb], ADG 236 g [.52 lb], F/G 1.37).

[b]Each period consisted of 7 days.

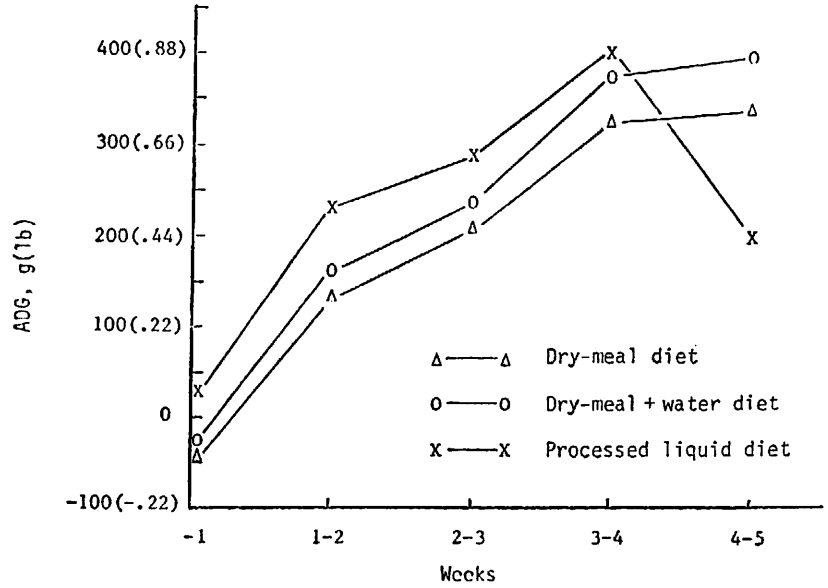

Figure 1. Performance of three-week old weanling pigs allowed ad libitum intake of a diet containing corn, soy flour and whey in dry and liquid forms.