EVALUATION OF SPRAY-DRIED CHEESE FOOD AS A SUPPLEMENTAL PROTEIN SOURCE FOR WEANLING PIGS[1]

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Summary

A growth study was conducted to determine the effects of substituting spray-dried cheese food for spray-dried plasma protein on weanling pig performance. Five dietary treatments included the control diet or diets with cheese food replacing 25, 50, 75, and 100% of the plasma on an equal lysine basis. Day 0 to 14 ADG and ADFI were decreased linearly as spray-dried cheese food increased. However, this decrease was most apparent when cheese food was included at more than 4% of the diet. No effects of cheese food inclusion were seen for F/G from d 0 to 14 postweaning or for growth performance from d 14 to 28 or from d 0 to 28 postweaning. These results indicate that spray-dried cheese food resulted in a linear reduction in ADG and ADFI. However, the growth reduction was not apparent until cheese food was included at more than 4% of the diet.

(Key Words: Cheese Food, Protein, Nursery Pigs.)

Introduction

The early-weaned pig presents several unique challenges in diet formulation and feeding. The pig needs a highly palatable diet containing ingredients with highly available nutrient profiles. This has led to the development of a complex nursery diet with highly digestible ingredients. Spray-dried plasma protein is one of these ingredients proven effective in nursery diets. It is a highly palatable feedstuff that stimulates feed intake in nursery pigs. Its high cost, however, has led to evaluation of lower cost proteins as substitutes.

Spray-dried cheese food is a pure cheese product made from leftovers in cutting and wrapping rooms at cheese plants. The leftovers are reliquified and spray-dried to form a powdered cheese product similar to powdered cheese found in high quality macaroni and cheese products. It has high protein and energy contents coupled with a low ash content. The amino acid profile has high levels of many essential amino acids (Table 1). These factors all contribute to the potential of spray-dried cheese food as a potential protein source for early-weaned pigs.

A cheese food product containing added soy flour was evaluated as a substitute for dried skim milk by researchers at the University of Minnesota in 1991. They noted decreased performance in nursery pigs as increased levels of cheese food were included in the nursery diet. They hypothesized several reasons for this, noting possible antinutritional factors from the soy flour or increased salt and decreased lactose levels in the cheese food. Therefore, the objectives of our experiment were to evaluate the effects of pure spray-dried cheese food (with no soy flour) on the growth performance of early-weaned pigs.

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[2]Land O'Lakes, Inc., Arden Hills, MN.

Table 1. **Compositions of Spray-Dried Cheese Food and Spray-Dried Plasma Protein**[a]

Item, %	Cheese Food	Plasma Protein
Protein	36.00	70.00
Fat	41.69	2.00
Ash	6.46	13.00
Lysine	2.50	6.10
Methionine	.61	.53
Tryptophan	NA	1.33
Isoleucine	1.69	1.96
Leucine	3.42	5.56
Valine	2.36	4.12
Threonine	1.34	4.13

[a]Values expressed on an as-fed basis.

Procedures

A total of 249 pigs (initially 10.9 lb and 18 d of age) was used in a 28-day growth trial. Pigs were blocked by weight and allotted to one of five dietary treatments with a total of eight or nine pigs per pen and six pens per treatment. Phase I dietary treatments (d 0 to 14 postweaning) were based on levels of spray-dried cheese food (4, 8, 12, and 16%) replacing spray-dried plasma protein on an equal lysine basis plus the control diet.

The trial had two phases with the experimental diets being fed from d 0 to 14 postweaning. The phase I experimental diets were pelleted and formulated to contain 1.5% lysine, .9% Ca, .8% P and at least .42% methionine (Table 2). The experimental diets all contained 20% dried whey, 1.75% spray-dried blood meal, 19.71% soybean meal, and .1% added L-lysine HCl. Corn, DL-methionine, soybean oil, and spray-dried plasma all were varied as increasing levels of spray-dried cheese food were included to maintain similar amino acid and fat levels. In phase II (d 14 to 28), a common corn-soybean meal diet was fed in meal form and contained 2.5% spray-dried blood meal and 10% dried whey. This phase II diet was formulated to contain 1.35% lysine, .9% Ca, and .8% P.

Pigs were housed in an environmentally controlled nursery in 5 ft × 5 ft pens with ad libitum access to feed and water. Weekly gain and feed disappearance values were measured to calculate ADG, ADFI, and F/G.

Data were analyzed as a randomized complete block design using general linear model procedures. Initial weight was used to establish the blocks. Linear and quadratic polynomials were used to detect the effects of replacing spray-dried plasma protein with spray-dried cheese food.

Results and Discussion

From d 0 to 7 postweaning, ADG and ADFI decreased as cheese food increased (linear, $P<.03$, and .0002, respectively; Table 3). These linear decreases became most apparent in pigs fed diets containing either 12 or 16% cheese food. No differences ($P > .10$) were noted for F/G from d 0 to 7 postweaning.

In phase I (d 0 to 14 postweaning), ADG and ADFI decreased with increasing dietary cheese food (linear, $P<.003$, and .007, respectively). This decrease became most apparent when the cheese food product was included at levels above 4% of the diet. No differences were noted for F/G because of corresponding decreases in ADG and ADFI from d 0 to 14 postweaning.

When all pigs were switched to a common phase II diet (d 14 to 28 postweaning), no differences were noted for ADG, ADFI, and F/G. During phase II, ADFI and ADG tended to be higher for pigs previously fed cheese food levels above 4% during phase I, resulting in similar pig weights at the end of the trial. No differences in growth performance were noted during the overall trial (d 0 to 28 postweaning).

Although growth performance showed a linear decrease in phase I, this decrease was not apparent until cheese food replaced more than 25% of the plasma. This effect is consistent with previous research evaluating alternative protein sources. Plasma appears to be a necessary ingredient to stimulate

optimal growth and feed intake in phase I. However, the exact level required by early-weaned pigs may vary for different production situations. A portion of the spray-dried plasma protein apparently can be replaced by less expensive protein sources. This research indicates that up to 25% of the spray-dried plasma protein can be replaced by spray-dried cheese food without affecting pig performance in phase I. Also, for the overall trial, no performance differences were noted as increasing levels of spray-dried cheese food were fed.

Table 2. Composition of Experimental Diets[a]

	Plasma Protein:Cheese Food, %					
Ingredients, %	5.88:0	4.41:4	2.94:8	1.47:12	0:16	Phase II[b]
Corn	40.10	39.38	38.65	37.92	37.22	56.86
Soybean meal (46.5%)	19.71	19.71	19.71	19.71	19.71	25.86
Plasma protein	5.88	4.41	2.94	1.47	--	--
Cheese food	--	4.00	8.00	12.00	16.00	--
Soybean oil	8.00	6.33	4.66	3.00	1.33	--
Dried whey	20.00	20.00	20.00	20.00	20.00	10.00
Spray dried blood meal	1.75	1.75	1.75	1.75	1.75	2.50
Monocalcium phosphate	1.51	1.41	1.32	1.22	1.12	1.85
Limestone	.99	.94	.89	.84	.78	.85
Antibiotic	1.00	1.00	1.00	1.00	1.00	1.00
L-lysine HCl	.10	.10	.10	.10	.10	.15
DL-methionine	.13	.14	.15	.16	.16	.075
Vit, TM premix	.35	.35	.35	.35	.35	.35
Zinc oxide	.38	.38	.38	.38	.38	.25
Salt	.10	.10	.10	.10	.10	.25
Total	100	100	100	100	100	100

[a]Phase I diets were formulated to contain 1.5% lysine, .42% methionine, .9% Ca, and .8% P.
[b]Phase II diet was formulated to contain 1.35% lysine, .37% methionine, .9% Ca, and .8% P.

Table 3. Influence of Spray-Dried Cheese Food on Starter Pig Performance[a]

	Plasma Protein:Cheese Food, %						P-values ($P<$)	
Item	5.88:0	4.41:4.0	2.94:8.0	1.47:12.0	0:16.0	CV	Linear	Quadratic
d 0 to 7								
ADG, lb	.39	.41	.38	.35	.29	21.8	.03	.20
ADFI, lb	.61	.61	.61	.55	.51	7.8	.0002	.05
F/G	1.67	1.50	1.58	1.61	1.81	21.2	.40	.22
d 0 to 14								
ADG, lb	.63	.62	.56	.57	.50	12.8	.003	.67
ADFI, lb	.72	.70	.65	.62	.59	10.0	.007	.98
F/G	1.12	1.16	1.21	1.17	1.16	9.4	.58	.40
d 14 to 28								
ADG, lb	1.0	1.02	1.05	1.06	1.06	8.7	.19	.68
ADFI, lb	1.80	1.78	1.85	1.85	1.82	5.4	.38	.47
F/G	1.82	1.75	1.80	1.77	1.72	7.9	.32	.80
d 0 to 28								
ADG, lb	.81	.82	.80	.81	.78	8.9	.38	.64
ADFI, lb	1.24	1.23	1.22	1.21	1.20	5.7	.29	.94
F/G	1.47	1.52	1.56	1.55	1.52	7.5	.48	.33
Average pig weight, lb								
d 0	11.09	10.79	10.83	10.79	10.79	2.8	.13	.30
d 14	19.93	19.42	18.65	18.79	18.20	4.7	.003	.60
d 28	33.97	33.72	33.29	33.66	33.43	5.0	.62	.76

[a]A total of 249 pigs (18 ± 3 d; eight or nine pigs/pen) with six replicate pens per treatment.