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The pH of spray-dried blood meal does not influence nursery pig performance

Abstract

Two studies were conducted to evaluate the effects of spray-dried blood meal and its pH on nursery pig performance. Spray-dried blood meal pH decreases as storage time increases prior to spray drying. In Exp. 1, addition of 2.5% spray-dried blood meal to the diet improved ADG and ADFI in nursery pigs (15.4 lb to 35.9 lb), but did not influence feed efficiency. In Exp. 2, the inclusion of 5% spray-dried blood meal improved feed efficiency without affecting ADG or ADFI. The pH (7.4 to 5.9 in Exp. 1 and 7.6 to 5.9 in Exp. 2) of the blood meal did not influence growth performance.; Swine Day, Manhattan, KS, November 16, 2000

Keywords

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THE pH OF SPRAY-DRIED BLOOD MEAL DOES NOT INFLUENCE NURSERY PIG PERFORMANCE [1,2]

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Summary

Two studies were conducted to evaluate the effects of spray-dried blood meal and its pH on nursery pig performance. Spray-dried blood meal pH decreases as storage time increases prior to spray drying. In Exp. 1, addition of 2.5% spray-dried blood meal to the diet improved ADG and ADFI in nursery pigs (15.4 lb to 35.9 lb), but did not influence feed efficiency. In Exp. 2, the inclusion of 5% spray-dried blood meal improved feed efficiency without affecting ADG or ADFI. The pH (7.4 to 5.9 in Exp. 1 and 7.6 to 5.9 in Exp. 2) of the blood meal did not influence growth performance.

(Key Words: Nursery Pig, Blood Meal, Growth.)

Introduction

Spray-dried blood meal is an animal protein product that is used to enhance nursery pig performance. However, the degradation of, or alterations in, the composition of blood meal from processing or prolonged storage may affect quality. Decomposition of blood meal prior to spray drying has been associated with an increase in volatile biological nitrogen (VBN), which decreases the pH of the blood meal. This decrease in pH is believed to increase the offensiveness of the blood meal's odor, which may have a negative effect on palatability. Thus, the objective of this experiment was to determine the effects of pH level of blood meal on growth performance in nursery pigs.

Procedures

Experiment 1. A total of 240 pigs (BW of 11.2 lb and 17 ± 2 d of age) was used in a 31-d growth assay. Pigs were blocked by weight and allotted to one of five dietary treatments with eight pigs/pen and six pens/treatment. Pigs were housed in an environmentally controlled nursery in 5 × 5 ft pens on a commercial farm in northeast Kansas. All pens contained one self-feeder and two nipple waterers to provide ad libitum access to feed and water.

All pigs were fed the same pelleted, segregated early weaning (SEW) and transition diets (Table 1) to d 10 after weaning. Then they were fed dietary treatments, which included a control diet with no added blood meal and four diets containing 2.5% blood meal. The four blood meals were from the same spray-drying processing facility, but had pHs of 7.4, 6.7, 6.4, and 5.9 at the time of spray drying. The first three originated from beef blood, whereas the blood meal of pH 5.9 was of poultry origin. The length of time between collection of the blood from the slaughter facility and drying was not available. Treatment diets were fed in meal form and formulated to contain 1.35% lysine, .82 Ca, and .48 available P (Table 2).

[1]Appreciation is expressed to Jerry Ball of California Spray Dry Company, Stockton, CA, for partial financial support.

[2]The authors thank Eichman Brothers and Ken Anderson, St. George, KS, for the use of facilities and pigs for Exp. 1.

[3]Food Animal Health and Management Center.

Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance on d 10 after weaning, then each 7 d for the remainder of the trial.

Experiment 2. A total of 150 pigs (BW of 13.8 and 17 ± 2 d of age) was used in a 19-d growth assay. Pigs were blocked by weight and allotted to one of five dietary treatments, with five pigs/pen and six pens/ treatment. Pigs were housed in the Kansas State University Segregated Early Weaning Facility. Each pen was 4 × 4 ft and contained one self-feeder and one nipple waterer to provide ad libitum access to feed and water. The initial temperature was 90°F for the first 5 d and was lowered approximately 3°F each week thereafter.

All pigs were fed the same pelleted SEW diet (Table 1) to 5 d after weaning. Then they were fed experimental diets, which included a control diet with no added blood meal and four diets containing 5.0% blood meal. The four blood meals were spray-dried from the same lot of blood from a beef slaughter facility. One fourth of the total lot was dried on d 0, 3, 8, and 12 after collection. This drying schedule resulted in blood meals with pH values of 7.6, 6.4, 6.0, and 5.9, respectively. Treatment diets were fed in meal form; formulated to contain 1.40% lysine, .90 Ca, and .54 available P; and balanced for Na and Cl concentrations (Table 2). In addition, we added crystalline amino acids to the diets containing spray dried blood meal to maintain similar ratios of amino acids to lysine compared to the control diet. Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance on d 5, 12, and 19 after weaning. Furthermore, spray-dried blood meal samples were obtained for analysis to determine bacterial concentrations within each lot.

Data from both experiments were analyzed as a randomized complete block design with pen as the experimental unit. Pigs were blocked based on weaning weight, and analysis of variance was performed using the GLM procedure of SAS. Linear, quadratic, and cubic polynomial contrasts for unequally spaced treatments were used to determine the effects of decreasing blood meal pH. Initial pig weight at the start of the experimental period was used as a covariate for statistical analysis.

Results and Discussion

Experiment 1. When pigs were fed the common diets from d 0 to 10 after weaning, ADG, ADFI, and F/G were .41 lb, .43 lb and 1.05, respectively. Adding 2.5% blood meal to the diet numerically increased ADG ($P>.10$) during all 3 weeks of the experiment. Pigs fed added dietary spray-dried blood meal had greater ($P<.02$) ADG for the overall trail. The addition of blood meal increased ($P<.03$) ADFI from d 7 to 14, d 14 to 21 , and for the overall trial. Feed efficiency was not influenced by the addition of blood meal to the diet.

The pH level of the blood meal did not influence pig performance during the experiment.

Experiment 2. When pigs were fed the common diets from d 0 to 5 after weaning, ADG, ADFI, and F/G were .24 lb, .23 lb, and .96, respectively. The inclusion of 5.0% spray-dried blood meal did not influence ADG or ADFI. However, the response to spray-dried blood meal was similar to that in Exp. 1 for the same time period, with a numerical trend ($P>.10$) for an increase in ADG. Efficiency of growth was improved from d 7 to 14 ($P<.02$) and overall ($P<.004$) in pigs fed spray-dried blood meal. In addition, no significant effects of blood meal pH were detected. However, an overall numerical decrease in ADFI was observed for the lowest blood meal pH level. This indicates that storing whole blood for 12 d before spray drying may begin to result in decreased food intake. However, this may be a function of some other change during predrying storage time rather then pH level, because the identical pH level in Exp. 1 did not elicit this same response.

The concentration of bacteria (Table 5) rose as storage time increased until d 8 (pH level of 6.0) and then declined slightly at d

12 of spray-drying (pH level of 5.9). No coliforms were detected in any of the blood meal lots. In addition, the greatest reduction in blood meal pH was seen when blood was stored for 8 d, and changes were minimal with further storage. The bacterial level in the blood meal did not appear to influence the growth performance in this trial.

In conclusion, data from this trial and others indicate that spray-dried blood meal addition in nursery diets improves growth performance. Furthermore, the pH of blood meal (7.6 to 5.9) did not affect nursery pig performance in these experiments. Thus, pH is not a reliable quality parameter that is predictive of growth performance.

Table 1. Compositions of Common Diets (Exps. 1 and 2)[a]

Ingredient, %	Segregated Early Weaning	Transition
Corn	33.37	39.81
Spray-dried whey	25.00	20.00
Soybean meal (46.5%)	12.80	23.30
Spray-dried animal plasma	6.70	2.50
Select menhaden fish meal	6.00	2.50
Choice white grease	6.00	5.00
Lactose	5.00	—
Spray-dried blood cells	1.65	2.50
Medication[b]	1.00	1.00
Monocalcium phosphate (21% P)	.75	1.30
Limestone	.45	.73
Zinc oxide	.38	.38
Vitamin premix	.25	.25
Salt	.20	.30
Trace mineral premix	.15	.15
L-Lysine HCl	.15	.15
DL-Methionine	.15	.13
Total	100.00	100.00
Calculated Analysis		
Lysine, %	1.70	1.60
Met:lysine ratio, %	30	30
Met & Cys:lysine ratio,%	57	57
Threonine:lysine ratio, %	65	65
Tryptophan:lysine ratio, %	18	19
ME, kcal/lb	1,595	1,559
Protein, %	22.4	22.5
Calcium, %	.90	.90
Phosphorus, %	.80	.80
Available phosphorus, %	.66	.59
Lysine:calorie ratio, g/Mcal ME	4.83	4.66

[a]In Exp.1, 1 lb per head of SEW diet was fed, then pigs were fed the transition diet for the remainder of the 10 d period. For Exp. 2, pigs consumed SEW diet for 5 d, then were fed the experimental diets.

[b]Provided 50 g per ton carbadox.

Table 2. Compositions of Experimental Diets (Exps. 1 and 2)

Ingredient, %	Exp. 1[a]		Exp. 2[b]	
	No Blood Meal	Added Blood Meal	No Blood Meal	Added Blood Meal
Corn	46.51	51.38	45.68	53.62
Soybean meal (46.5%)	33.82	26.35	39.45	26.43
Spray-dried whey	10.00	10.00	10.00	10.00
Choice white grease	5.00	5.00	—	—
Spray-dried blood meal	—	2.50	—	5.00
Monocalcium phosphate (21% P)	1.60	1.60	1.84	1.86
Medication[c]	1.00	1.00	1.00	1.00
Limestone	.85	.90	.82	.79
Salt	.35	.35	.36	.30
Vitamin premix	.25	.25	.25	.25
Zinc oxide	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15
Calcium chloride	—	—	.11	.18
L-Lysine HCl	.15	.15	—	—
DL-Methionine	.07	.12	.08	.13
L-Threonine	—	—	.01	.03
L-Isoleucine	—	—	—	.01
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
Lysine, %	1.35	1.35	1.40	1.40
Met:lysine ratio, %	32	29	31	33
Met & Cys:lysine ratio,%	56	56	60	60
Isoleucine:lysine ratio, %	67	56	67	67
Threonine:lysine ratio, %	59	62	74	60
Tryptophan:lysine ratio, %	19	20	22	21
ME, kcal/lb	1,559	1,565	1,458	1,449
Calcium, %	.82	.82	.90	.90
Phosphorus, %	.74	.77	.86	.81
Available phosphorus, %	.48	.48	.54	.54
Sodium, %	.26	.29	.26	.26
Chloride, %	.42	.46	.43	.43

[a]Diets fed from 10 d until 31 d postweaning.

[b]Diets fed from 5 d until 19 d postweaning.

[c]Provided 50 g per ton carbadox.

Table 3. Effects of Spray-Dried Blood Meal pH on Growth Performance in Phase II Nursery Pigs (Exp. 1)[a,b]

		Blood Meal pH					Probability
Item	No Blood Meal	7.4	6.7	6.4	5.9	SE	No Blood Meal vs Others[c]
Initial weight, lb[d]	15.59	15.13	15.69	15.10	15.38	.20	.24
Day 0 to 7							
ADG, lb	.61	.62	.63	.68	.66	.04	.28
ADFI, lb	.93	.93	.97	1.02	.98	.04	.27
F/G	1.52	1.50	1.54	1.50	1.48	.05	.91
Day 7 to 14							
ADG, lb	.94	1.03	1.02	.99	.98	.04	.16
ADFI, lb	1.38	1.47	1.48	1.46	1.48	.03	.02
F/G	1.47	1.43	1.45	1.47	1.51	.05	.91
Day 14 to 21							
ADG, lb	1.28	1.32	1.31	1.30	1.36	.03	.28
ADFI, lb	1.82	1.93	1.92	1.97	1.96	.05	.03
F/G	1.42	1.46	1.47	1.52	1.44	.04	.19
Day 0 to 21							
ADG, lb	.95	.99	.97	.99	1.00	.01	.02
ADFI, lb	1.38	1.44	1.46	1.48	1.47	.03	.02
F/G	1.45	1.45	1.51	1.49	1.47	.03	.35
Final weight, lb	35.07	36.32	35.73	35.96	36.33	.35	.02

[a]A total of 240 pigs (eight pigs per pen and six pens per treatment) with an average initial BW of 15.4 lbs. at the beginning of phase II. All pigs were fed common SEW and transition diets for the first 10 days. Thus, d 0 of the experiment is actually 10 days after weaning.

[b]Growth performance for the first 10 d after weaning was: ADG = .41 lb, ADFI = .43 lb, and F/G = 1.05.

[c]No blood meal pH effects, P>.10.

[d]Initial pig weight (d 10 postweaning) was used as a covariate in the statistical analysis of growth performance.

Table 4. Effects of Blood Meal pH on Growth Performance in Weanling Pigs (Exp. 2)[a,b]

Item	No Blood Meal	Blood Meal pH 7.6	6.9	6.0	5.9	SE	Probability No Blood Meal vs Others[c]
Initial weight, lb[d]	14.66	15.11	14.92	15.00	15.16	.18	.08
d 0 to 7							
ADG, lb	.30	.34	.31	.33	.31	.04	.62
ADFI, lb	.68	.64	.68	.65	.58	.04	.32
F/G	2.27	1.88	2.19	1.96	1.87	.38	.15
d 7 to 14							
ADG, lb	.63	.74	.71	.74	.69	.05	.13
ADFI, lb	.89	.94	.83	.89	.86	.06	.87
F/G	1.41	1.27	1.17	1.20	1.25	.06	.02
d 0 to 14							
ADG, lb	.47	.54	.51	.54	.50	.04	.18
ADFI, lb	.78	.79	.76	.77	.72	.04	.56
F/G	1.66	1.46	1.49	1.42	1.44	.06	.004

[a]A total of 180 pigs (five pigs per pen and six pens per treatment) with an average initial BW of 14.95 lb at the beginning of phase II. All pigs were fed a common SEW diet for the first 5 days. Thus, d 0 of the experiment is actually 5 d after weaning.

[b]Growth performance for the first 5 d after weaning was: ADG = .24 lb, ADFI = .23 lb, and F/G = .96.

[c]No blood meal pH effects, P>.15.

[d]Initial pig weight (d 5 postweaning) was used as a covariate in the statistical analysis of growth performance.

Table 5. Effect of Blood Meal pH on Bacterial Concentration (Exp. 2)

Item	Blood Meal pH 7.6	6.9	6.0	5.9
Total Plate Count	3.7×106	1.1×10^7	1.2×107	6.6×106
Total Coliform Count	0	0	0	0