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Abstract

A total of 367 weanling pigs (initially 11.8 lb and 21 d of age) was used in a 28 d growth assay to determine the appropriate level of lactose needed in phase I diets containing spray-dried porcine plasma (SDPP) for the early-weaned pig. Pigs were blocked by weight and randomly assigned to one of six experimental diets: a positive control or five diets calculated to contain 7, 11, 15, 19, or 23% lactose. The positive control was a high nutrient density diet (HNDD) containing 7.5% SDPP, 1.75% spray-dried blood meal (SDBM), and 20% edible grade dried whey. The five lactose diets were achieved by adding lactose to a common basal diet containing 10% edible grade dried whey, 7.5% SDPP, and 1.75% SDBM. Because whey contains approximately 72% lactose, total lactose levels of 7, 11, 15, 19, or 23% were achieved by not adding any or adding 4, 8, 12, or 16% lactose, respectively, to the basal diet. All diets contained 1.5% lysine, .9% calcium and .8% phosphorus. Pigs were fed pelleted diets from d 0 to 14 postweaning. On d 14, all pigs were switched to a common phase II diet containing 10% edible grade dried whey and 2.5% SDBM and formulated to contain 1.25% lysine. Pigs were fed this diet in a meal form for the remainder of the trial (d 14 to 28 postweaning). A linear response occurred for average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (F/G) during phase I, with pigs receiving the diet containing the highest level of lactose (23%) having the greatest growth performance. Pigs receiving the diet containing the highest level of lactose also had better daily gains and daily feed intakes when compared to pigs receiving the positive control diet. However, feed efficiency was similar between these two treatments. During phase II, no differences occurred in ADG and F/G, but a linear increase was observed for daily feed intake. Over the total trial, a linear improvement was observed in all performance criteria (ADG, ADFI, and F/G) with increasing dietary lactose. Furthermore, pigs consuming the highest level of lactose had higher daily gain and consumed more feed per day when compared to pigs offered the positive control diet. Results from this research indicate that starter pig performance is improved linearly as lactose levels increase from 7 to 23% in a phase I nursery diet.; Swine Day, Manhattan, KS, November 18,1993

Keywords

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APPROPRIATE LEVEL OF LACTOSE IN A PLASMA PROTEIN-BASED DIET FOR THE EARLY-WEANED PIG[1]

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Summary

A total of 367 weanling pigs (initially 11.8 lb and 21 d of age) was used in a 28 d growth assay to determine the appropriate level of lactose needed in phase I diets containing spray-dried porcine plasma (SDPP) for the early-weaned pig. Pigs were blocked by weight and randomly assigned to one of six experimental diets: a positive control or five diets calculated to contain 7, 11, 15, 19, or 23% lactose. The positive control was a high nutrient density diet (HNDD) containing 7.5% SDPP, 1.75% spray-dried blood meal (SDBM), and 20% edible grade dried whey. The five lactose diets were achieved by adding lactose to a common basal diet containing 10% edible grade dried whey, 7.5% SDPP, and 1.75% SDBM. Because whey contains approximately 72% lactose, total lactose levels of 7, 11, 15, 19, or 23% were achieved by not adding any or adding 4, 8, 12, or 16% lactose, respectively, to the basal diet. All diets contained 1.5% lysine, .9% calcium and .8% phosphorus. Pigs were fed pelleted diets from d 0 to 14 post-weaning. On d 14, all pigs were switched to a common phase II diet containing 10% edible grade dried whey and 2.5% SDBM and formulated to contain 1.25% lysine. Pigs were fed this diet in a meal form for the remainder of the trial (d 14 to 28 post-weaning). A linear response occurred for average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (F/G) during phase I, with pigs receiving the diet containing the highest level of lactose (23%) having the greatest growth performance. Pigs receiving the diet containing the highest level of lactose also had better daily gains and daily feed intakes when compared to pigs receiving the positive control diet. However, feed efficiency was similar between these two treatments. During phase II, no differences occurred in ADG and F/G, but a linear increase was observed for daily feed intake. Over the total trial, a linear improvement was observed in all performance criteria (ADG, ADFI, and F/G) with increasing dietary lactose. Furthermore, pigs consuming the highest level of lactose had higher daily gain and consumed more feed per day when compared to pigs offered the positive control diet. Results from this research indicate that starter pig performance is improved linearly as lactose levels increase from 7 to 23% in a phase I nursery diet.

(Key Words: Lactose, Starter Pigs, Performance.)

Introduction

Recent research at Kansas State University has demonstrated that adding spray-dried porcine plasma to diets for the early-weaned pig increases daily gain and feed intake by approximately 25% compared with pigs fed dried skim milk. In this research, 20% dried skim milk was replaced

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in the high nutrient density diet with 10% spray-dried porcine plasma (SDPP) and 10% lactose. Because SDPP has replaced dried skim milk in the phase I diet, questions have risen concerning the optimal lactose level. Therefore, this experiment was designed to determine the appropriate level of lactose for a plasma protein starter diet for the early-weaned pig.

Procedures

A total of 367 weanling pigs (initially 11.8 lb and 21 d of age) was used on a commercial swine operation to evaluate various levels of lactose in the phase I diet. Pigs were blocked by weight to one of six experimental treatments. Pigs were housed (six to eight pigs per pen with eight pens per treatment) in an environmentally controlled nursery in 5 x 7 ft pens with metal flooring and allowed ad libitum access to feed and water. Pigs and feeders were weighed weekly after weaning to determine ADG, ADFI, and F/G.

Experimental diets (Table 1) were fed in two phases. During phase I, pigs were offered one of six dietary treatments. Experimental treatments consisted of a positive control diet (equivalency of 14.5% lactose from dried whey) and five other diets containing 7, 11, 15, 19, or 23% total lactose. The positive control diet was a HNDD containing 7.5% SDPP, 1.75% SDBM, and 20% edible grade dried whey. Total lactose levels (7, 11, 15, 19, and 23%) were achieved by not adding any or adding increasing levels of dried lactose (4, 8, 12, 16%) to a common basal diet containing 10% edible grade dried whey, 7.5% SDPP, and 1.75% SDBM. The diet with no added lactose (negative control) contained a total of 7% lactose because whey (present in basal diet) contains approximately 72% lactose. A constant level of soybean meal (21.54%) was added to each diet, and thus, synthetic lysine and methionine were added to all experimental treatments to ensure that all phase I diets contained 1.5% lysine and .38% methionine.

A common diet was fed to all pigs during phase II (d 14 to 28 postweaning). It was corn-soybean meal- based and contained 2.5% SDBM and 10% edible grade edible grade dried whey. All phase I diets were pelleted, whereas the common phase II diet was offered in a meal form.

Results and Discussion

During phase I (d 0 to 14 postweaning), linear ($P<.01$) improvements occurred for ADG, ADFI, and F/G, with pigs receiving the highest level of lactose (23%) having the greatest performance (Table 2). Additionally, pigs receiving the highest level of lactose (23%) had greater daily gain ($P<.05$) and consumed more feed per day ($P<.08$) when compared to pigs consuming the positive control diet. However, no differences occurred in feed efficiency between pigs receiving these two treatments.

During phase II, when a common diet was fed, no differences occurred in growth performance with the exception of ADFI. A linear improvement was observed in ADFI ($P<.05$), which was similar to results observed during phase I. Also, pigs consuming the diet containing the highest level of lactose (23%) during phase I continued to consume more feed per day ($P<.07$) during phase II than pigs fed the positive control diet during phase I.

Over the entire trial, a linear improvement ($P<.01$) was observed in all performance criteria (ADG, ADFI and F/G) with increasing lactose levels. Pigs consuming the diet with the 23% lactose had greater daily gains ($P<.03$) and consumed more feed per day ($P<.04$) when compared to pigs receiving the positive control diet.

Results from this research indicate that during phase I and from 0 to 28 d postweaning, pig performance is improved linearly as lactose levels increase from 7 to 23% of the diet. In order to meet the highest level of lactose (23%) with edible grade dried whey, a diet needs to contain at

least 32% edible grade dried whey. However, the price of products supplying lactose will dictate the level added in the phase I diet. Also, because a quadratic response was never achieved, additional research is needed addressing the optimal level of lactose needed in the phase I HNDD to provide optimal growth performance.

Table 1. Diet Composition[a]

Item	Positive Control	Lactose,% - Phase I 7	11	15	19	23	Phase II
Corn	42.07	46.83	42.78	38.73	34.68	30.62	58.92
Edible grade dried whey	20.00	10.00	10.00	10.00	10.00	10.00	10.00
Soybean meal, 48.5%	16.39	21.54	21.54	21.54	21.54	21.54	21.03
Soy oil	8.00	8.00	8.00	8.00	8.00	8.00	3.00
Lactose	--	--	4.00	8.00	12.00	16.00	--
Porcine plasma	7.50	7.50	7.50	7.50	7.50	7.50	--
Monocalcium phosphate	1.95	2.09	2.14	2.19	2.25	2.30	1.97
Spray dried blood meal	1.75	1.75	1.75	1.75	1.75	1.75	2.50
Antibiotic[b]	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Limestone	.67	.76	.74	.71	.69	.67	.83
Vitamin premix	.25	.25	.25	.25	.25	.25	.25
Mineral premix	.15	.15	.15	.15	.15	.15	.15
L-lysine HCl	.10		.01	.03	.04	.05	.15
DL-methionine	.10	.05	.06	.07	.08	.08	.06
Copper sulfate	.08	.08	.08	.08	.08	.08	.08
Isoleucine	--	--	--	--	--	.01	--
Total	100	100	100	100	100	100	100

[a]Diets were formulated to contain 1.5% lysine, at least .81% isoleucine, and at least .37% methionine in Phase I and 1.25% lysine in Phase II.
[b]Provided 150 g/ton apramycin in Phase I and 50 g/ton carbadox in Phase II.

Table 2. Growth Performance of Pigs Fed the Positive Control Diet and Pigs Fed Diets Containing Various Levels of Lactose[a]

Item	Positive Control	Lactose,% 7	11	15	19	23	CV
d 0 to 14							
ADG[b,d]	.51	.44	.46	.54	.52	.58	12.5
ADFI[b,e]	.58	.54	.59	.59	.60	.63	9.7
F/G[b]	1.15	1.27	1.30	1.14	1.16	1.11	13.6
d 14 to 28[f]							
ADG	1.01	.97	1.04	1.01	.99	1.07	9.3
ADFI[c,e]	1.53	1.51	1.53	1.56	1.55	1.64	7.5
F/G	1.51	1.57	1.49	1.54	1.56	1.52	5.0
d 0 to 28							
ADG[b,d]	.77	.71	.75	.78	.76	.83	7.3
ADFI[b,d]	1.06	1.04	1.07	1.09	1.09	1.15	7.2
F/G[b]	1.39	1.48	1.42	1.40	1.42	1.38	3.6

[a]A total of 367 weanling pigs was used (initially 11.8 lbs and 21 d of age), 6 to 8 pigs/pen with 8 pens per treatment.
[b,c]Linear effects of lactose (P<.01) and (P<.05), respectively.
[d,e]Positive control vs 23% lactose (P<.05) vs (P<.10), respectively.
[f]Common diet was fed to all pigs from d 14 to 28 postweaning.