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Abstract

Two experiments were conducted to evaluate the effects of XFE Liquid Energy (XFE Products, Des Moines, IA) and choice white grease (CWG) on growth performance of nursery pigs. In Exp. 1, a total of 150 nursery pigs (TR4 Ã— 1050, initially 27.0 lb) were used in a 21-d experiment. Pens of pigs were balanced by initial BW and randomly allotted to 1 of 5 dietary treatments with 6 replications per treatment. The 5 dietary treatments included a control corn-soybean meal-based diet, the control diet with 2 or 4% CWG, or the control diet with 2 or 4% liquid energy. Overall (d 0 to 21), pigs fed diets containing liquid energy had improved ADG ($P < 0.02$) and ADFI ($P < 0.04$) with no change in F/G compared with control pigs. Pigs fed CWG had greater ($P < 0.04$) ADG and improved ($P < 0.01$) F/G compared with pigs fed the control diet. The responses tended to be linear ($P < 0.09$) for liquid energy and were linear ($P < 0.05$) for CWG. Finally, pigs fed CWG had improved ($P < 0.02$) F/G compared with pigs fed liquid energy.; Swine Day, Manhattan, KS, November 17, 2011

Keywords

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Effects of XFE Liquid Energy and Choice White Grease on Nursery Pig Performance[1]

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Summary

Two experiments were conducted to evaluate the effects of XFE Liquid Energy (XFE Products, Des Moines, IA) and choice white grease (CWG) on growth performance of nursery pigs. In Exp. 1, a total of 150 nursery pigs (TR4 × 1050, initially 27.0 lb) were used in a 21-d experiment. Pens of pigs were balanced by initial BW and randomly allotted to 1 of 5 dietary treatments with 6 replications per treatment. The 5 dietary treatments included a control corn-soybean meal-based diet, the control diet with 2 or 4% CWG, or the control diet with 2 or 4% liquid energy. Overall (d 0 to 21), pigs fed diets containing liquid energy had improved ADG ($P < 0.02$) and ADFI ($P < 0.04$) with no change in F/G compared with control pigs. Pigs fed CWG had greater ($P < 0.04$) ADG and improved ($P < 0.01$) F/G compared with pigs fed the control diet. The responses tended to be linear ($P < 0.09$) for liquid energy and were linear ($P < 0.05$) for CWG. Finally, pigs fed CWG had improved ($P < 0.02$) F/G compared with pigs fed liquid energy.

In Exp. 2, a total of 228 nursery pigs (TR4 × 1050, initially 14.1 lb and 3 d postweaning) were used in 30-d trial. Pigs were randomly allotted to 1 of 6 dietary treatments with 7 pens per treatment. Treatment diets were fed in 2 phases, with Phase 1 diets all containing 4.5% fishmeal and 10% dried whey. The 6 dietary treatments were in a 2 × 3 factorial arrangement with main effects of either 0 or 4% CWG and 0, 2, or 4% liquid energy. Diets were formulated to equal standardized ileal digestible (SID) lysine:ME for each phase. From d 0 to 14, a CWG × liquid energy interaction (quadratic, $P < 0.01$) was observed for ADG, which was the result of 2% liquid energy decreasing ADG when added to diets without CWG but increasing ADG when added to diet containing CWG. Pigs fed CWG had decreased ADG ($P < 0.05$) and ADFI ($P < 0.02$) compared with the pigs fed diets without CWG. Growth in pigs fed liquid energy did not differ. From d 14 to 30, a CWG × liquid energy interaction (quadratic, $P < 0.02$) occurred for ADFI. Pigs fed 2% liquid energy without CWG had lower ADFI compared with other no-CWG treatments; however, pigs fed the CWG diet with 2% liquid energy had greater ADFI than other CWG treatments. The addition of CWG decreased ($P < 0.01$) ADFI but improved ($P < 0.01$) F/G compared with pigs fed no CWG. Growth for pigs fed liquid energy did not differ. Overall (d 0 to 30), CWG × liquid energy interactions were observed for ADG (quadratic, $P < 0.07$) and ADFI (quadratic, $P < 0.03$). Feeding liquid energy in diets without CWG resulted in lower ADG and feed intake; however, addition of liquid energy to diets containing CWG improved ADG and feed consumption compared with the 4% CWG diet without liquid energy. Pigs fed CWG had reduced ($P < 0.01$) ADFI and improved ($P < 0.01$) F/G compared with pigs fed

[1] Appreciation is expressed to XFE Products, Des Moines, IA, for donation of XFE Liquid Energy used in the experiments.

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diets without CWG. Feeding liquid energy had no significant influence on any growth criteria.

Feeding CWG improved F/G as expected in both experiments. Although ADG was improved in one experiment for pigs fed liquid energy, no differences were found in feed efficiency. These trials indicate additional research is needed to understand the effects of XFE liquid energy in nursery diets.

Key words: choice white grease, liquid energy, nursery pig

Introduction

Adding energy to nursery diets via fat sources is a common practice. For diets immediately postweaning, this is done primarily to aid in pellet quality and prevent burning of specialty protein and lactose ingredients. When added to diets during the middle to late nursery period, added fat can help improve ADG and F/G; however, with the increased price of added fat, many producers have reduced or removed fat from non-pelleted nursery diets. Thus, other sources of energy for nursery pigs are being sought.

One potential alternative is XFE Liquid Energy (XFE Products, Des Moines, IA), which is an alcohol-based liquid product. Research to determine the effect of alcohol in diets for nursery pigs has been limited; therefore, the objective of these 2 experiments was to evaluate the effects of XFE Liquid Energy and compare XFE Liquid Energy and choice white grease (CWG) on the growth performance of nursery pigs.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved all experimental procedures. Both experiments were conducted at the K-State Swine Teaching and Research Center in Manhattan, KS.

In Exp. 1, a total of 150 nursery pigs (TR4 × 1050, initially 27.0 lb) were used in a 21-d experiment. Pigs were weaned at 21 d of age and fed common starter diets until the beginning of the experimental period. Pigs were allotted to 1 of 5 treatments with 5 pigs per pen and 6 pens per treatment. Dietary treatments included a control corn-soybean meal-based diet or the control diet with 2 or 4% liquid energy or 2 or 4% CWG. Diets were formulated to the recommended standardized ileal digestible (SID) lysine:ME ratio (3.81 g/Mcal) for pig weight (Table 1). The ME of liquid energy used in diet formulation was equal to that of CWG (3.62 Mcal/lb). All experimental diets were fed in meal form. Pigs were weighed and feed disappearance was determined on d 0, 7, 14, and 21 of the trial to calculate ADG, ADFI, and F/G.

In Exp. 2, a total of 228 nursery pigs (TR4 × 1050, initially 14.1 lb and 3 d postweaning) were used in 30-d trial. Pigs were weaned at 21 d of age and fed a common diet for 3 d. At weaning, pigs were randomly allotted to pens by initial BW. On d 3 postweaning, pigs were weighed and pens were randomly allotted and assigned to 1 of 6 dietary treatments with 7 pens per treatment. Experimental diets were fed in 2 phases. The 6 dietary treatments were in a 2 × 3 factorial arrangement with 0 or 4% CWG and 0, 2, or 4% liquid energy (Table 2). Diets were formulated to the recommended SID lysine:ME for each phase. The ME of liquid energy used in diet formulation was equal to that of CWG (3.62 Mcal/lb). All experimental diets were fed in meal form. Pigs were weighed and feed disappearance was determined on d 0, 7, 14, 21, and 30 of the trial to calculate ADG, ADFI, and F/G.

Data were analyzed using the MIXED procedure in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Contrast statements were used to compare diets containing liquid energy or CWG with the control diet and with each other. Contrasts were also used to test the linear and quadratic effects of increasing the additions of liquid energy and CWG in the diets with the control diet used as the lowest dosage level. In addition, the interactions between liquid energy and CWG were tested in Exp. 2.

Results and Discussion

In Exp. 1, pigs fed diets containing liquid energy had improved ADG ($P < 0.02$) and ADFI ($P < 0.04$), but no difference in F/G compared with pigs fed the control diet (Table 3). Pigs fed CWG had greater ($P < 0.04$) ADG and improved ($P < 0.01$) F/G than pigs fed the control diet. Increasing dietary liquid energy tended to increase ADG (linear, $P < 0.08$) and ADFI (linear, $P < 0.09$), with pigs fed increasing CWG showing improved ADG (linear, $P < 0.05$) and F/G (linear, $P < 0.01$). Finally, pigs fed CWG tended to have lower ($P < 0.08$) ADFI but improved ($P < 0.02$) F/G compared with pigs fed liquid energy.

Based on the results of Exp. 1, the addition of dietary liquid energy improved ADG through an increase in ADFI, but did not change F/G, whereas the improvement in ADG from CWG was due to an improvement in F/G. Therefore, the objective of Exp. 2 was to determine the effect of combination of CWG and liquid energy in nursery diets on growth performance.

In Exp. 2, from d 0 to 14, a CWG × liquid energy interaction (quadratic, $P < 0.01$) was observed for ADG, which was the result of pigs fed 2% liquid energy showing lower ADG than pigs fed 0 or 4% liquid energy when added to diets without CWG but higher ADG when added to diets containing CWG. For the main effects, pigs fed diets containing CWG had decreased ADG ($P < 0.05$) and ADFI ($P < 0.02$), but adding liquid energy to the diet did not influence growth performance (Table 4).

From d 14 to 30, a CWG × liquid energy interaction (quadratic, $P < 0.02$) was observed for ADFI. Adding 2% liquid energy to the diet resulted in lower feed ADFI when added to diets without CWG, but resulted in greater ADFI when added to diets containing CWG. The addition of CWG decreased ($P < 0.01$) ADFI but improved ($P < 0.01$) F/G compared with pigs fed diets without CWG.

Overall (d 0 to 30), a tendency (quadratic, $P < 0.07$) was found for a CWG × liquid energy interaction for ADG and an interaction (quadratic, $P < 0.03$) for ADFI. Adding liquid energy to diets without CWG reduced ADG and feed intake; however, adding liquid energy to diets containing CWG increased ADG and ADFI. Neither the addition of CWG nor liquid energy increased ADG compared with the control pigs. For main effects, pigs fed CWG had reduced ($P < 0.01$) ADFI and improved ($P < 0.01$)

F/G compared with pigs fed the control diet. Feeding liquid energy did not influence ADFI or F/G.

Similar to the tendencies for interactions for ADG from d 0 to 14 and overall, a tendency occurred for a CWG × liquid energy interaction (quadratic, $P < 0.08$) for body weight on d 14 and 30 because adding 2% liquid energy to diets without CWG decreased weight on d 14 and 30 whereas adding 2% liquid energy to diets with CWG increased weight on 14 and 30. Neither CWG nor liquid energy increased BW compared with pigs fed the control diet.

In conclusion, feeding CWG improved F/G as expected in both experiments. Although ADG was improved in the first experiment for pigs fed liquid energy, no differences in F/G were found. These trials indicate additional research is needed to understand the effects of XFE liquid energy in nursery diets.

Table 1. Composition of experimental diets (Exp. 1, as-fed basis)[1]

		CWG[2]		Liquid energy[3]	
Item	Control	2%	4%	2%	4%
Ingredient, %					
Corn	65.00	61.50	58.15	61.50	58.13
Soybean meal, 46.5% CP	31.40	32.85	34.20	32.85	34.20
CWG	--	2.00	4.00	--	--
Liquid energy[3]	--	--	--	2.00	4.00
Monocalcium P, 21% P	1.10	1.10	1.10	1.10	1.10
Limestone	1.03	1.03	1.00	1.03	1.00
Salt	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15	0.15
L-Lysine HCl	0.35	0.355	0.36	0.355	0.36
DL-Methionine	0.135	0.15	0.16	0.15	0.165
L-Threonine	0.135	0.145	0.15	0.145	0.15
Phytase[4]	0.125	0.125	0.125	0.125	0.125
Total	100.0	100.0	100.0	100.0	100.0
Calculated analysis					
Standardized ileal digestible (SID) amino acids					
Lysine, %	1.26	1.30	1.33	1.30	1.33
Isoleucine:lysine, %	60	60	60	60	60
Methionine:lysine, %	34	34	35	34	35
Met & Cys:lysine, %	58	58	58	58	58
Threonine:lysine, %	63	63	63	63	63
Tryptophan:lysine, %	17.2	17.2	17.2	17.2	17.2
Valine:lysine, %	67	67	66	67	66
Total lysine, %	1.39	1.43	1.47	1.43	1.47
ME, kcal/lb	1,502	1,543	1,584	1,543	1,584
SID lysine:ME, g/Mcal	3.81	3.81	3.81	3.81	3.81
CP, %	20.6	21.0	21.4	21.0	21.4
Ca, %	0.72	0.72	0.72	0.72	0.72
P, %	0.63	0.63	0.63	0.63	0.63
Available P, %	0.43	0.43	0.43	0.43	0.43

[1] A total of 150 nursery pigs (TR4 × 1050, initially 27.0 lb) were used in a 21-d study with 5 pigs per pen and 6 replications per treatment.
[2] Choice white grease.
[3] XFE Products, Des Moines, IA.
[4] Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO), providing 231 FTU/lb, with a release of 0.10% available P.

Table 2. Composition of experimental diets (Exp. 2, as-fed basis)[1]

	Phase 1[2]						Phase 2[3]					
CWG, %[4]	0	0	0	4	4	4	0	0	0	4	4	4
Item — Liquid energy, %[5]	0	2	4	0	2	4	0	2	4	0	2	4
Ingredient, %												
Corn	55.25	51.90	48.45	48.45	45.00	41.75	65.00	60.15	58.15	58.15	54.60	51.05
Soybean meal, 46.5% CP	27.45	28.75	30.25	30.25	31.65	32.85	31.40	32.85	34.20	34.20	35.75	37.30
Select menhaden fish meal	4.50	4.50	4.50	4.50	4.50	4.50	--	--	--	--	--	--
Spray-dried whey	10.00	10.00	10.00	10.00	10.00	10.00	--	--	--	--	--	--
Choice white grease	--	--	--	4.00	4.00	4.00	--	--	--	4.00	4.00	4.00
Liquid energy[3]	--	2.00	4.00	--	2.00	4.00	--	2.00	4.00	--	2.00	4.00
Monocalcium P, 21% P	0.45	0.45	0.45	0.45	0.45	0.45	1.10	1.10	1.10	1.10	1.10	1.10
Limestone	0.65	0.65	0.63	0.63	0.63	0.63	1.13	1.00	1.00	1.00	1.00	0.98
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Zinc oxide	0.275	0.275	0.275	0.275	0.275	0.275	--	--	--	--	--	--
Vitamin premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
L-Lysine HCl	0.265	0.275	0.28	0.28	0.29	0.30	0.35	0.355	0.36	0.36	0.36	0.36
DL-methionine	0.14	0.155	0.17	0.17	0.185	0.20	0.135	0.15	0.165	0.16	0.175	0.18
L-Threonine	0.125	0.145	0.15	0.145	0.155	0.165	0.125	0.145	0.15	0.15	0.15	0.15
L-Valine	--	--	--	--	0.005	0.0075	--	--	--	--	--	--
Phytase[6]	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

continued

Table 2. Composition of experimental diets (Exp. 2, as-fed basis)[1]

	Phase 1[2]						Phase 2[3]					
CWG, %[4]	0	0	0	4	4	4	0	0	0	4	4	4
Item / Liquid energy, %[5]	0	2	4	0	2	4	0	2	4	0	2	4
Calculated analysis												
Standardized ileal digestible (SID) amino acids												
Lysine, %	1.35	1.39	1.42	1.42	1.46	1.50	1.26	1.30	1.33	1.33	1.37	1.40
Isoleucine:lysine, %	61	60	60	60	60	60	60	60	60	60	60	60
Methionine:lysine, %	35	36	36	36	36	37	34	34	35	34	35	35
Met & Cys:lysine, %	58	58	58	58	58	58	58	58	58	58	58	58
Threonine:lysine, %	64	64	64	64	64	64	63	63	63	63	63	62
Tryptophan:lysine, %	17	17	17	17	17	17	17.2	17.2	17.2	17.2	17.3	17.4
Valine:lysine, %	67	66	66	66	66	65	67	67	66	66	66	66
Total lysine, %	1.49	1.52	1.56	1.56	1.61	1.64	1.39	1.43	1.47	1.47	1.50	1.54
ME, kcal/lb	1,496	1,537	1,579	1,579	1,620	1,661	1,502	1,543	1,584	1,584	1,625	1,667
SID lysine:ME, g/Mcal	4.09	4.09	4.09	4.09	4.09	4.09	3.81	3.81	3.81	3.81	3.81	3.81
CP, %	21.9	22.2	22.7	22.7	23.0	23.4	20.6	21.0	21.4	21.4	21.8	22.2
Ca, %	0.75	0.75	0.75	0.75	0.75	0.75	0.72	0.72	0.72	0.72	0.72	0.72
P, %	0.65	0.65	0.65	0.65	0.65	0.65	0.63	0.64	0.63	0.63	0.63	0.63
Available P, %	0.48	0.48	0.48	0.48	0.48	0.48	0.43	0.43	0.43	0.43	0.43	0.43

[1] A total of 228 weanling pigs (TR4 × 1050, initially 14.1 lb and 3 d postweaning) were used in a 30-d study with 7 replications per treatment.
[2] Phase 1 diets were fed from d 0 to 14.
[3] Phase 2 diets were fed from d 14 to 30.
[4] Choice white grease.
[5] XFE Products, Des Moines, IA.
[6] Phyzyme 600 (Danisco, Animal Nutrition, St. Louis, MO), providing 231 FTU/lb, with a release of 0.10% available P.

Table 3. Effects of XFE Liquid Energy and choice white grease on nursery pig performance (Exp. 1)[1]

							Probability, P <						
		CWG[2]		Liquid energy[3]				Liquid energy	CWG		Liquid energy		CWG vs. liquid
Item	Control	2%	4%	2%	4%	SEM	CWG vs. control	vs. control	Linear	Quad	Linear	Quad	energy
d 0 to 21													
ADG, lb	1.38	1.45	1.47	1.48	1.46	0.03	0.04	0.02	0.05	0.52	0.08	0.12	0.75
ADFI, lb	2.12	2.20	2.11	2.24	2.23	0.04	0.53	0.04	0.83	0.11	0.09	0.22	0.08
F/G	1.54	1.52	1.43	1.51	1.52	0.02	0.01	0.41	<0.01	0.18	0.65	0.40	0.02
BW, lb													
d 0	27.0	27.1	27.0	27.1	27.0	0.4	0.98	0.98	1.00	0.97	1.00	0.96	0.99
d 21	56.1	57.6	58.0	58.2	57.8	0.8	0.10	0.07	0.11	0.59	0.15	0.21	0.80

[1] A total of 150 pigs (TR4 × 1050, initially 27.0 lb) were used with 5 pigs per pen and 6 pens per treatment.
[2] Choice white grease.
[3] XFE Products, Des Moines, IA.

Table 4. Effects of XFE Liquid Energy and choice white grease on nursery pig performance (Exp. 2)[1]

									Probability, $P <$					
									CWG × liquid energy		Main effects		Liquid energy	
	CWG, %[2]	0	0	0	4	4	4							
Item	Liquid energy, %[3]	0	2	4	0	2	4	SEM	Linear	Quad	CWG	Liquid energy	Linear	Quad
d 0 to 14														
ADG, lb		0.60	0.53	0.59	0.48	0.57	0.55	0.03	0.14	0.01	0.05	0.33	0.19	0.73
ADFI, lb		0.85	0.83	0.87	0.73	0.80	0.76	0.04	0.98	0.29	0.02	0.47	0.55	0.67
F/G		1.42	1.58	1.47	1.55	1.41	1.39	0.06	0.10	0.10	0.45	0.68	0.38	0.48
d 14 to 30														
ADG, lb		1.14	1.11	1.12	1.11	1.17	1.15	0.04	0.44	0.42	0.54	0.82	0.88	0.84
ADFI, lb		1.87	1.71	1.81	1.63	1.72	1.67	0.05	0.28	0.02	<0.01	0.65	0.85	0.55
F/G		1.64	1.55	1.63	1.47	1.48	1.46	0.04	0.93	0.13	<0.01	0.52	0.82	0.38
d 0 to 30														
ADG, lb		0.89	0.84	0.87	0.81	0.89	0.87	0.03	0.22	0.07	0.69	0.55	0.49	0.99
ADFI, lb		1.39	1.30	1.37	1.21	1.29	1.24	0.04	0.48	0.03	<0.01	0.93	0.84	0.87
F/G		1.57	1.56	1.58	1.49	1.46	1.44	0.04	0.41	0.83	<0.01	0.52	0.56	0.79
BW, lb														
d 0		14.1	14.1	14.1	14.1	14.1	14.1	0.1	0.96	0.93	0.99	0.95	0.94	0.99
d 14		22.5	21.4	22.4	20.7	22.0	21.8	0.4	0.19	0.02	0.08	0.38	0.24	0.77
d 30		40.7	39.2	40.3	38.5	40.7	40.1	0.9	0.24	0.08	0.70	0.56	0.51	0.99

[1] A total of 228 pigs (TR4 × 1050, initially 14.1 lb) were used in a 30-d trial with 7 pens per treatment. Phase 1 diets were fed from d 0 to 14, and Phase 2 diets were fed from d 14 to 30.

[2] Choice white grease.

[3] XFE Products, Des Moines, IA.