EFFECTS OF DIETARY ELECTROLYTE BALANCE AND MOLASSES IN DIETS WITH DRIED DISTILLERS GRAINS WITH SOLUBLES ON GROWTH PERFORMANCE IN NURSERY AND FINISHING PIGS

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Summary

Two experiments were conducted to determine the effects of dietary electrolyte balance (dEB) and(or) molasses in diets with dried distillers grains with solubles (DDGS) on growth performance of nursery and finishing pigs. For Exp. 1, 126 nursery pigs (35 d old and average wt of 22.5 lb) were used with six pigs/pen and seven pens/treatment. Treatments were a corn-soybean meal-based control and diets with 30% DDGS without and with 0.93% sodium bicarbonate to adjust the dEB back to that of the control diet. Pigs fed the control diet had greater ADG ($P<0.03$) and ADFI ($P < 0.08$) but did not differ ($P>0.58$) in F/G compared to pigs fed diets with DDGS. Addition of sodium bicarbonate to nursery diets with 30% DDGS did not improve ($P>0.3$) growth performance.

For Exp. 2, a total of 70 gilts (average wt of 196 lb) were assigned with two pigs/pen and five pens/treatment. The pigs were fed experimental diets for 26 d, a common diet for 6 d, and then reassigned to a different treatment for an additional 26-d assay. The end result was 10 pens/treatment. Treatments were a corn-soybean meal-based control and diets with 40% DDGS without and with molasses (5%) and sodium bicarbonate (none, 1, and 2%). Pigs fed the control diet had greater ($P<0.001$) ADG, ADFI, and better ($P<0.03$) F/G compared to those fed diets with DDGS. Adding molasses and(or) sodium bicarbonate did not affect ADG ($P>0.26$), ADFI ($P>0.16$), or F/G ($P>0.24$). In conclusion, adding sodium bicarbonate and(or) molasses to diets with high inclusion of DDGS did not improve growth performance in nursery or finishing pigs.

(Key words: DDGS, dietary electrolyte balance, feed ingredients, molasses.)

Introduction

Previous data from our laboratory suggested poor feed consumption in sows fed corn-soy diets with low dietary electrolyte balance (dEB). Addition of dried distillers grains with solubles (DDGS) into swine diets results in reduced dEB. It seems plausible that balancing diets with DDGS for dEB and(or) adding a flavor enhancer might have a positive effect on feed intake and, thus, growth performance. Therefore, the objectives of the experiments reported herein were to determine the effects of dEB and(or) molasses in diets with high inclusion of DDGS on growth performance of nursery and finishing pigs.

Procedures

For Exp. 1, 126 nursery pigs (35 d old and average initial wt of 22.5 lb) were used in a

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24-d growth assay. The pigs were sorted by sex and ancestry, blocked by weight, and assigned to pens. There were six pigs/pen and seven pens/treatment. The pigs were housed in an environmentally-controlled nursery having 4-ft × 4-ft pens with woven-wire flooring. Each pen had a self-feeder and nipple waterer to allow *ad libitum* consumption of feed and water, with pigs and feeders weighed on d 0 and 24 to allow calculation of ADG, ADFI, and F/G.

Treatments (Table 1) were a corn-soybean meal-based control and diets with 30% DDGS (Sioux River Ethanol, Hudson, SD) without and with 0.93% sodium bicarbonate to bring dEB to 64 mEq/kg [(Na + K) – (Cl + S)] as calculated for the control diet. All diets were formulated to 1.4% lysine, 0.75% Ca, and 0.35% available P. Data were analyzed as a randomized complete block design using the MIXED procedure of SAS. Orthogonal contrasts were used to separate treatment means with comparison of the control vs DDGS diets and none vs 0.93% sodium bicarbonate.

For Exp. 2, a total of 70 gilts (average initial wt of 157 lb for the first replication and 235 lb for the second replication) were used in a 58-d growth assay to determine the effects of molasses and dEB on palatability of diets with 40% DDGS in finishing pigs. The pigs were sorted by ancestry, blocked by location, and assigned to pens. There were two pigs/pen and five pens/treatment. The pigs were fed experimental diets for 26 d, a common diet for 6 d, and then reassigned to a different treatment for an additional 26 d. The end result was 10 pens/treatment. The pigs were housed in an environmentally-controlled finishing facility having 5-ft × 5-ft pens with slatted concrete flooring. Each pen had a self-feeder and nipple waterer to allow *ad libitum* consumption of feed and water. Pigs and feeders were weighed at d 0 and 26 of each replication to allow calculation of ADG, ADFI, and F/G.

Treatments (Table 2) were a corn-soybean meal-based control, and diets with 40% DDGS without and with 5% molasses and sodium bicarbonate (none, 1, and 2%). Thus, the treatments were arranged as a 2 × 3 factorial plus control. All diets were formulated to 0.90% lysine, 0.60% Ca, and 0.22% available P. Data were analyzed as a randomized complete block design with initial weight as a covariate using the MIXED procedure of SAS. Orthogonal contrasts and polynomial regression were used to separated treatment means with comparisons of control vs DDGS treatments, none vs 5% molasses, linear and quadratic effects of sodium bicarbonate, and interactions among the molasses and sodium bicarbonate main effects.

Results and Discussion

In the nursery experiment, pigs fed the control diet had greater ADG ($P<0.03$) and ADFI ($P<0.08$) but did not differ ($P>0.58$) in F/G compared with pigs fed diets with DDGS. Addition of sodium bicarbonate to diets with 30% DDGS did not improve ($P>0.3$) growth performance. For the finishing experiment, pigs fed the control diet had greater ($P<0.001$) ADG and ADFI, and better ($P<0.03$) F/G compared with those fed diets with 40% DDGS. Adding molasses and(or) sodium bicarbonate did not affect ADG ($P>0.26$), ADFI ($P>0.16$), or F/G ($P>0.24$). In conclusion, adding sodium bicarbonate to adjust dEB and(or) molasses to enhance flavor of diets with high inclusion of DDGS did not improve growth performance in nursery or finishing pigs.

Table 1. Composition of Nursery Diets, % [a]

Ingredient	Corn-Soy	DDGS	DDGS Adjusted
Corn	63.11	43.03	42.00
DDGS	---	30.00	30.00
Soybean meal (47.5% CP)	32.60	22.90	23.00
Limestone	1.11	1.50	1.50
Monocalcium P (21% P)	1.30	0.65	0.65
Salt	0.36	0.35	0.35
L-lysine HCl	0.32	0.53	0.53
DL-methionine	0.12	0.03	0.03
L-threonine	0.09	0.05	0.05
Vitamin premix	0.11	0.11	0.11
Trace mineral premix	0.08	0.05	0.05
Copper sulfate	0.10	0.10	0.10
Antibiotic [b]	0.70	0.70	0.70
Sodium bicarbonate	---	---	0.93
Dietary electrolyte balance, mEq/kg [c]			
Calculated	64	-45	64
Analyzed	103	-33	25

[a]Diets were formulated to 1.40% lys, 0.75% Ca, and 0.35% available P.
[b]To supply 140 g/ton oxytetracycline and 140 g/ton neomycin.
[c]Formula used to calculate dEB was (Na + K) – (Cl + S).

Table 2. Composition of Finishing Diets, % [a]

		No Molasses			5% Molasses		
Ingredient	Control	0% Bicarb	1% Bicarb	2% Bicarb	0% Bicarb	1% Bicarb	2% Bicarb
Corn	77.48	50.36	50.26	50.10	45.20	45.10	44.99
DDGS	-	40.00	40.00	40.00	40.00	40.00	40.00
Soybean meal (47.5% CP)	18.10	5.25	5.35	5.50	5.50	5.60	5.70
Limestone	1.08	1.52	1.51	1.51	1.40	1.39	1.39
Monocalcium P (21% P)	0.76	0.05	0.06	0.07	0.08	0.09	0.10
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-lysine HCl	0.20	0.47	0.47	0.47	0.47	0.47	0.47
L-threonine	0.03	---	---	---	---	---	---
Vitamin premix	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Trace mineral premix	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium bicarbonate	---	---	1.00	2.00	---	1.00	2.00
Sand [b]	2.00	2.00	1.00	---	2.00	1.00	---
Molasses	---	---	---	---	5.00	5.00	5.00
Dietary electrolyte balance, mEq/kg [c]							
Calculated	33	-112	6	124	-81	37	155
Analyzed	69	-107	9	88	-91	-33	47

[a]Formulated to 0.90% lysine, 0.60% Ca, and 0.22% available P.
[b]Non-nutritive ingredient replaced by sodium bicarbonate.
[c]Formula used to calculate dEB was (Na + K) – (Cl + S).

Table 3. Effect of dEB in Diets with DDGS on Growth Performance in Nursery Pigs [a]

					P value	
Item	Corn-Soy	DDGS	DDGS Adjusted [b]	SE	Corn-soy vs DDGS	Bicarb effect
ADG, lb	1.34	1.26	1.29	0.02	0.03	- [c]
ADFI, lb	2.01	1.91	1.95	0.04	0.08	-
F/G	1.50	1.52	1.51	0.01	-	-

[a]A total of 126 nursery pigs (initial wt of 22.5 lb) with six pigs/pen and seven pens/treatment.
[b]Electrolyte balance was adjusted to that of the control diet through the addition of sodium bicarbonate (Bicarb) to the DDGS diet.
[c]Dashes indicate $P>0.15$.

Table 4. Effects of dEB and Molasses in Diets with DDGS on Growth Performance in Finishing Pigs [a]

		40% DDGS									
		No molasses			5% Molasses						
	Corn-	0%	1%	2%	0%	1%	2%		*P* value[c]		
Item	Soy	Bicarb[b]	Bicarb	Bicarb	Bicarb	Bicarb	Bicarb	SE	DDGS	Molasses	Bicarb
ADG, lb	2.46	2.07	1.95	1.94	2.00	1.97	1.94	0.25	0.001	-	-
ADFI, lb	7.43	6.44	6.26	6.31	6.68	6.57	6.42	0.19	0.001	-	-
F/G	3.11	3.28	3.29	3.33	3.40	3.35	3.41	0.30	0.03	-	-

[a]A total of 70 finishing gilts (average initial wt of 157 lb for the first replication and 235 lb for the second replication), with two pigs/pen and five pens/treatment in each of two replicates for a total of 10 observations/treatment.
[b]Bicarb is used as the abbreviation for sodium bicarbonate.
[c]Dashes indicate $P>0.15$. There were no molasses × Bicarb interactions or linear or quadratic effects of Bicarb.