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Effects of Virginiamycin and Fat on Utilization of Grain Sorghum Diets by Swine

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Abstract: A feeding trial and a balance trial were conducted to study the effects of adding virginiamycin and fat to grain sorghum-soybean meal (S-SBM) diets fed to swine. During the feeding trial, 96 crossbred pigs with an average initial bodyweight (BW) of 8.6 kg were assigned to groups of 24 each to be fed one of four S-SBM dietary treatments. Treatment one (T1) consisted of the basal S-SBM mixture and served as the experimental control diet. Treatment two (T2) was the control diet plus 11 ppm virginiamycin. In treatment three (T3), 3% of the S-SBM control diet was replaced with fat. Treatment four (T4) was both virginiamycin and added fat. Average daily gain (ADG), average daily feed intake (ADFI) and the ratio of feed consumed to BW gain (F:G) was not different ($P>0.05$) during the starting and growing periods (8.6-56.9 kg). However, during the finishing period (56.9-95.6 kg), and overall, the addition of 3% fat to T3 and T4 improved ($P<0.05$) F:G by lowering ADFI. Eight crossbred pigs with initial BW of 25.3 kg were used in a balance trial conducted within a 4x4 latin suare statistical design replicated twice to determine the nutrient utilization of the four diets used during the feeding trial. Additions of virginiamycin to T2 and T4 improved ($P<0.05$) intake, digestibility and retention of N. Apparent digestibility of nitrogen free extract (NFE) was also improved ($P<0.05$) in T2 containing virginiamycin but not when the antibiotic was combined with 3% fat in T4. Additions of fat to T3 and T4 increased ($P<0.05$) apparent digestibility of ether extract and crude fiber. Additions of virginiamycin (T2 and T4), fat (T3 and T4) or the combination of the two (T4) improved ($P<.05$) gross energy intake, DE and metabolizable energy (ME). Data from this experiment suggests that utilization of S-SBM diets fed swine was favorably influenced by additions of virginiamycin or fat, but the mode of action for these additives differed.

Key words: Swine, grain sorghum, virginiamycin, fat, performance

Introduction

Grain sorghum (*Sorghum bicolor* L. Moerch) is a popular feed grain for swine production in the Southern United States and a textbook summary of the literature reporting the use of grain sorghum in swine feeds was provided by Pond and Maner (1984). In numerous feeding trials where grain sorghum was compared to corn the growth performance of swine has been reported to be similar. However, feed efficiency was lower for grain sorghum when compared with corn and differences were attributed to increased intake, reduced digestibility of nitrogen (N) and energy (Serra *et al.*, 1982). Moser *et al.*, (1982) reported lower digestibility of dry matter in grain sorghum diets fed to growing pigs. Substituting fat at a level of 2 or 4% in the formulation of a grain sorghum-soybean meal (S-SBM) diet was previously shown to improve feed efficiency by lowering feed intake (Combs and Copelin, 1979; White and Hammell, 1979; White *et al.*, 1986). Tannins in grain sorghum also affected digestibility of N and energy in swine (Cousins *et al.*, 1981). Tannins are classified as a group of closely related polyphenols and are antinutritional factors (Gupta and Haslam, 1979). The condensed tannins in grain sorghum are of particular concern to nutritionists because their astringent taste may lower palatability (Armstrong *et al.*, 1974). Hydrogen bonding of tannins with proteins in the digestive tract was postulated by Butler *et al.*, (1986) to result in complex chemical conglomerates that interfere with digestive enzyme function and lower digestibility.

Virginiamycin is an antibiotic developed as a growth promotant for general use in animal production, and has improved growth performance for swine (White *et al.*, 1986; Shively and Hays, 1992). Virginiamycin has been reported to control non-beneficial intestinal bacteria (Hedde and Lindsey, 1986) and slow the transit time of digesta in swine (Fausch, 1981). The combination of these events is reported by Hedde and Lindsey (1986) to improve digestiblities of N, energy, and fiber. Hendrickx *et al.* (1975 and 1976) reported that the primary action of virginiamycin for pigs was to increase the availability of digestible energy independent of grain type. Therefore, virginiamycin might improve digestibility of grain sorghum by increasing the availability of energy predominately from the carbohydrate fraction and extending the period of time that dietary nutrients are subjected to digestive processes in the intestine.

One objective of the present study was to evaluate the effects of virginiamycin on growth, feed efficiency and the digestibilities of dietary N, energy and fiber for swine fed S-SBM diets. A second objective was to evaluate the potential additive effects of virginiamycin and 3% supplemental fat in S-SBM diets.

Materials and Methods

Feeding Trial: Ninety-six crossbred pigs with an average initial body weight (BW) of 8.63 kg were assigned randomly to four equal-sized groups of 24 on the basis of litter origin, BW and sex in that order, and each group was fed one of four dietary treatments (Table 1). Treatment one (T1) consisted of ground grain sorghum in a basal S-SBM mixture containing NRC (1988) recommended levels of vitamins and minerals. Treatment one served as the control diet and was formulated to contain 1.10% lysine during the starting period (8.6-24.8 kg BW), 0.75% lysine during the growing period (24.8-56.9 kg BW) and 0.60% lysine during the finishing period (56.9-95.6 kg BW). Treatment two (T2) consisted of the control diet to which was added 10 g/ton (11 ppm) active ingredient (AI) virginiamycin. In treatment three (T3), 3% of the S-SBM control diet was replaced with fat. Solka Floc, a purified powdered cellulose product, was added to T3 at the level of 24.5 kg/ton of feed to adjust the energy component to a level that was isocaloric with diets fed in T1 and T2. Treatment four (T4) was identical to T3 except that 11 ppm virginiamycin was added. Allotment of pigs to dietary treatments was randomized and, as closely as possible, treatments contained equal numbers of barrows and gilts. To minimize the intra-litter effect on growth and feed efficiency, littermates were separated by allotting them across treatments and pen units. Each treatment was replicated four times in pen units containing six pigs/pen. Pigs were housed in temperature-controlled nursery pens on woven wire mesh flooring coated with plastic. Each pen allowed 0.5 m^2/animal until they reached an average of 24.8 kg BW. Thereafter, they were housed in a modified open-front finishing barn in pens on concrete-slatted flooring allowing 0.9 m^2/animal. Pigs were weighed biweekly and feed intake was calculated as the difference between total feed offered the pen unit minus that remaining in feeders. Average daily gain (ADG), average daily feed intake (ADFI) and the ratio of feed consumed to body weight gain (F:G) were used as criteria to compare growth performance among treatments.

Balance Trial: Four littermate barrows and four littermate gilts with an average BW of 25.3 kg were used in a 4 x 4 latin square balance trial to determine the nutrient digestibility of the four S-SBM diets fed during the growing period of the feeding trial. Pigs were acclimated to their assigned metabolism crates for a period of 5-d. Thereafter, pigs (one of each sex/diet) were acclimated to one of the four diets for a period of 5-d. Feed and water were offered ad libitum. On d-4 of the 5-d feed acclimation period, 0.1% ferric oxide (Fe_2O_3)was added to 0.4 kg of the daily feed ration and the subsequent appearance of red marker in the feces (approximately 1-d later) determined the beginning of the collection period. Following 4-d of total collection, ferric oxide was again added to feed to provide the signal which ended the 5-d collection period. Feces were collected daily and refrigerated in heavy duty plastic bags. At the end of each collection period, fecal collections from each pig were combined with enough distilled water to make an homogenate when vortexed with a high speed commercial blender. The homogenate of feces was weighed and two 250 g subsamples were transferred into plastic bags and frozen at -20 °C until analyzed. Urine was collected in plastic containers containing 10 ml of 10% HCl to prevent volatilization of ammonia. Daily collections of urine were filtered through glass wool and refrigerated in polypropylene bottles. Urine samples from each pig were combined on d-5 and vortexed. The volume of the resulting mixture was measured and two 250 ml subsamples were decanted into polypropylene bottles and frozen at -20°C until analyzed. Refused feed was recovered from each feeder on a daily basis. Orts wasted by pigs during mastication

Table 1: Composition of diets

	Treatments 1 and 2[a]			Treatments 3 and 4[a]		
Item	Starting	Growing	Finishing	Starting	Growing	Finishing
Ingredient, %						
Ground grain sorghum	61.58	77.95	83.20	55.55	71.91	77.06
Soybean meal (48%)	35.89	19.82	14.50	36.30	20.21	14.86
Fat[b]				3.00	3.00	3.00
Solka Floc				2.65	2.65	2.65
Deflourinated phosphate	1.14	0.89	1.00	1.24	1.00	1.07
Ground limestone	0.54	0.49	0.45	0.43	0.40	0.51
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin premix[c]	0.25	0.25	0.25	0.25	0.25	0.25
Mineral premix[d]	0.10	0.10	0.10	0.10	0.10	0.10
Lysine, %	1.20	0.75	0.60	1.10	0.75	0.60
Ca, %	0.80	0.60	0.60	0.80	0.60	0.60
P, %	0.60	0.50	0.50	0.60	0.50	0.50

[a]Treatments 2 and 4 contained 11 ppm active virginiamycin. Stafac-22. Smithkline Corp, Philadelphia, PA, USA.
[b]High Energy Fat (HEF), Buckeye Cellulose, Memphis, TN, USA.
[c]provided per kilogram of diet: 7,700 IU vitamin A; 1,100 IU vitamin D_3; 16.5 IU vitamin E; 26.5 μg vitamin B_{12}; 5.5 mg riboflavin; 33 mg niacin; 22 mg pantothenic acid; 275 mg choline; 4 mg menadione; 0.7 mg folic acid; 2.2 mg pyridoxine; 1.1 mg thiamine; and 110 μg biotin. Swine Premix. Hoffmann-LaRoche Inc., Nutley, NJ, USA.
[d]Provided (mg/kg of diet): zinc, 150; manganese, 60; iron, 175; copper 17.5; iodine, 2; and calcium, 40. Mineral Premix 2105. J.M. Huber Corp., Quincy, IL, USA.

were captured below the feed compartment and included with the refused feed. Feed intake was calculated as the difference between feed offered minus feed refused for each collection period. Pigs were weighed prior to receiving each dietary treatment and again at the end of the collection period to assess weight gain. The entire protocol was repeated until each pig had been fed each of the four S-SBM diets in rotation. Animals were housed in a room where temperature was maintained at 21 °C and subject to natural photoperiods.

Sample Analyses: Sorghum and commercial SBM used to prepare the feed mixture were analyzed for moisture, fat, N, fiber and ash (AOAC, 1980). The amino acid profiles of these ingredients were also determined. The commercial fat product was analyzed for relative concentrations of saturated and unsaturated fatty acids, moisture, volatiles, insoluble impurities and unsaponifiable matter. Values for amino acids and fat are presented in Table 2. Analysis of Solka Floc revealed the composition to be 100% cellulose and the test for starch was negative. Analyses of amino acids, fat and Solka Floc used in diets were provided by an independent laboratory. Fecal and urine samples were lyophilized to dryness prior to proximate determinations. Gross energy (GE) of feed, fecal and urine samples was determined by adiabatic calorimetry (ASTM, 1981) using a Parr Model 1241 oxygen calorimeter interfaced with a Parr Model 1710 calorimeter controller. These values were used in calculating digestible energy (DE) and metabolizable energy (ME) components for the dietary treatments. Nitrogen in feed, fecal and urine samples was determined by the Kjeldahl procedure (AOAC, 1965). Ether extract was determined gravimetrically using a modified soxhlet extractor which accommodated multiple one gram samples of feed or feces batched together by treatment and extracted for 24 h with refluxed boiling anhydrous ethyl ether. Crude fiber was determined by the standard detergent method (AOAC, 1965). Values for the nitrogen free extract (NFE) represented the difference of 100 minus the collective sums of other proximate partitions.

Statistical Analyses: Data for both trials were analyzed using the general linear model (GLM) procedures of the Statistical Analysis System (SAS, 1979). The feeding trial was conducted within a complete random design. The GLM compared pen unit means for ADG, ADFI and F:G among treatments. A 2x2 factorial analysis was conducted to identify main effects

Table 2:Amino acid and fat analyses

Item	Grain sorghum	Soybean meal	Fat
Ingredient, % as Fed			
Amino acids, % of protein			
Arginine	0.44	3.93	
Histidine	0.23	1.25	
Isoeucine	0.44	2.37	
Leucine	1.50	4.04	
Lysine	0.23	3.09	
Methionine	0.13	0.56	
Phenylalanine	0.56	2.61	
Threonine	0.33	1.92	
Tryptophan			
Valine			
Fatty acids, % of total fat	0.57	2.53	
C12:0, lauric			0.94
C14:0, myristic			1.60
C16:0, palmitic			19.95
C16:1, palmitoleic			0.67
C16:2, hexadecadienoic			0.22
C17:1, margaroleic			0.14
C18:0, stearic			7.63
C18:1, oleic			29.11
C18:2, linoleic			34.81
C18:3, linolenic			3.22
C20:0, arachidic			0.31
C20:1, gadoleic			0.66
C20:2, eicosadienoic			0.34
C22:0, behenic			0.38

and interactions resulting from additions of either fat or virginiamycin. An analysis for simple effects was conducted to interpret the interaction of fat with virginiamycin which occurred only for F:G during the finishing period. The balance trial was conducted as a 4x4 latin square replicated twice; once with barrows and once with gilts. Means for digestibilities of nutrients revealed no difference (P>0.05) between barrows and gilts, therefore, data sets were combined.

Results

Feeding Trial: Data from the statistical GLM which compared the effects of individual dietary treatments on ADG, ADFI and F:G are presented in Table 3. During the starting and growing periods there were no effects (P>0.05) on diet. However, during the finishing period, ADFI was lower (P<0.05) for pigs receiving 3% fat. When compared with other treatments, the reduction in ADFI for pigs on T3 during the finishing period resulted in a reduction (P<0.05)in F:G. Overall growth performance (8.6-95.6 kg BW) was similar to the finishing period with the exception that pigs receiving fat had improved (P<0.05) F:G when compared to controls (T1). Results of the 2x2 factorial analysis for main effects which compared growth performance of pigs fed diets containing fat with those containing virginiamycin are summarized in Table 4. Average daily gain was not improved (P>0.05) by additions of fat or virginiamycin. However, ADFI was lower (P<0.05) and F:G improved (P<0.05) during the finishing period and overall (P<0.05) when diets contained added fat.

Total feed intake among treatments, expressed as a percentage of feed consumed during the finishing period by pigs allotted to T1 (control diet) is summarized in Table 5. These values show that pigs in T2 fed the diet containing 11 ppm virginiamycin consumed 14.6% less feed/kg of BW gain than those in T1. Pigs in T3 and T4 consumed 20.2 and 19.4% less feed, respectively, than those in T1.

Balance Trial: Table 6 presents a summary of nutrient digestibilities by dietary treatment. Intake and digestion of N by pigs were improved (P<0.05) when virginiamycin was included in T2 and the combination of virginiamycin and fat in T4 improved (P<0.05) N retention. The apparent digestibility of NFE by pigs was also improved (P<0.05) by virginiamycin (T2), compared to fat (T3) or virginiamycin and fat (T4). The presence of fat in T4 in some way interfered with the mode of action of virginiamycin.

Additions of fat to T3 and T4 had the effect of increasing (P<0.05) intake and apparent digestibility of ether extract. In T2, virginiamycin increased apparent digestibility of either extract but values were not different (P>0.05) from T1. The daily intake and apparent digestibility of crude fiber were approximately twice as high for diets T3 and T4 than for T1 and T2 (P<0.05). This observation might be explained in view of the analysis of diets given in Table 1 which shows that dietary treatments T3 and T4 contained approximately twice the concentration of crude fiber as did T1 and T2. Part of the observed difference in apparent digestibility of crude fiber reflected increased (P<0.05) ADFI of T3 and T4 which contained added fat.

Table 3: Effects of grain sorghum diets containing virginiamycin and(or) fat on growth performance of swine

	Treatment[a]			
Growth Period	T1	T2	T3	T4
Starting (8.6 - 24.8 kg)				
ADG	0.47	0.47	0.47	0.47
ADFI	0.97	0.97	0.92	0.94
F:G	2.06	2.06	1.95	2.00
Growing (24.8 - 56.9 kg)				
ADG	0.71	0.74	0.74	0.73
ADFI	2.21	2.32	2.26	2.12
F:G	3.11	3.13	3.05	2.90
Finishing (56.9 - 95.6 kg)				
ADG	0.70	0.74	0.71	0.66
ADFI	2.80[b]	2.74[b]	2.40[c]	2.48[C]
F:G	4.07[b]	3.71[bc]	3.47[c]	3.77[bc]
Overall (8.6 - 95.6 kg)				
ADG	0.65	0.67	0.66	0.64
ADFI	2.16[b]	2.13[b]	1.98[c]	1.96[c]
F:G	3.33[b]	3.17[bc]	2.99[C]	3.06[c]

[a]T1, S-SBM control diet; T2, T1 plus 11 ppm virginiamycin; T3, T1 with 3% fat; T4, T1 with 3% fat and 11 ppm virginiamycin.

[b,c]Means in rows with different superscripts differ (P<0.05)

Table 4: Factorial analysis for main effects of adding virginiamycin or fat to swine diets (8.6 - 95.6 kg)

Item	Fat		Virginiamycin	
	T1 and T2	T3 and T4	T1 and T3	T2 and T4
ADG, kg	0.66	0.65	0.65	0.65
ADFI, kg	2.15[a]	1.97[b]	2.07	2.05
F:G	3.25[a]	3.03[b]	3.16	3.11

[a,b]Means in rows with different superscripts differ (P<0.05)

Table 5: Influence of virginiamycin and(or) fat on performance of finishing swine (56.9 - 95.6 kg) fed sorghum diets

	Treatments[a]			
	T1	T2	T3	T4
Pigs per treatment	24	24	24	24
Av. Gain, kg	41.8	39.2	39.2	36.4
Total feed intake, kg	4085	3488	3260	3291
T1 intake, %	100.0	85.4	79.8	80.6
Improvement in F:G, %		14.6	20.2	19.4

[a]T1, control diet; T2, T1 with 11 ppm virginiamycin; T3, T1 with 3% fat; T4, T1 with 3% fat and 11 ppm virginiamycin

Table 6: Balance trial for swine fed sorghum diets with virginiamycin and(or) fat

Item	Treatments[a] T1	T2	T3	T4	SE
Partition, g/d					
Nitrogen					
Intake	41.3[c]	47.1[b]	43.9[bc]	43.7[bc]	1.17
Digested	26.7[c]	31.9[b]	29.2[bc]	29.3[bc]	1.01
Retained	16.0[c]	19.1[bc]	17.9[bc]	20.0[b]	1.15
NFE					
Intake	1061	1157	1055	1064	28.79
Digested	957[c]	1048[b]	932[c]	947[c]	25.83
Fat					
Intake	43.1[c]	47.7[c]	69.4[b]	68.3[b]	1.63
Digested	22.7[c]	26.6[c]	44.8[b]	44.4[b]	1.46
Fiber					
Intake	56.8[c]	52.8[c]	96.5[b]	94.8[b]	2.21
Digested	30.9[c]	26.1[c]	50.2[b]	52.7[c]	1.92

[a]T1, control diet; T2, T1 with 11 ppm virginiamycin; Te, T1 with 3% added fat; T4, T1 with 3% added fat and 11 ppm virginiamycin

Table 7: Utilization of energy[a] from sorghum diets containing virginiamycin and(or) fat

Item	Treatments[b] T1	T2	T3	T4	SE
Intake	6701[d]	7344[c]	7463[c]	7547[c]	192.6
Fecal	1330[d]	1380[d]	1551[c]	1486[c]	53.2
Digestible	5371[d]	5964[c]	5912[c]	6061[c]	163.8
Urinary	124	161	122	111	13.3
Metabolizable	5247[d]	5803[c]	5790[c]	5950[c]	164.6

[a]Kcal/d
[b]T1, control diet; T2, T1 with 11 ppm virginiamycin; T3, T1 with 3% added fat; T4, T1 with 3% added fat and 11 ppm virginiamycin.
[c,d]Means in rows with different superscripts differ (P<0.05)

Table 8: Energy[a] partitions of sorghum diets containing virginiamycin and(or) fat

	Treatments[b]				
Item	T1	T2	T3	T4	SE
Gross	4449	4477	4720	4760	
Digestible	3570[e]	3637[e]	3730[d]	3823[c]	0.68
Metabolizable	3487[e]	3538[e]	3654[d]	3753[c]	0.63

[a]Kcal/kg diet.

[b]T1, control diet; T2, T1 with 11 ppm virginiamycin; T3, T1 with 3% added fat; T4, T1 with 3% added fat and 11 ppm virginiamycin

[c,d,e]Means in rows with different superscripts differ ($P<0.05$)

Table 7 summarizes energy utilization by dietary treatment. Intake of energy was less ($P<0.05$) for pigs consuming the basal (T1) as compared to other treatments. Excretion of fecal energy was greatest ($P<0.05$) when pigs were fed T3 and T4 containing added fat. The DE component of grain sorghum was also improved ($P<0.05$) by additions of virginiamycin, fat or the combination of virginiamycin and fat. Urinary energy did not differ by treatment ($P>0.05$), therefore, values for ME followed the same statistical trend within dietary treatments as those for DE.

The values of GE, DE and ME for the four dietary treatments are presented in Table 8. Values for T1 represent the energy partitions when the basal S-SBM control diet was fed to growing swine. Values for T2 represent the trend for improvement ($P<0.05$) associated with addition of 11.0 ppm virginiamycin. Values for T3 represent the improvement ($P<0.05$) associated with addition of 3% fat, and T4 the improvement ($P<0.05$) associated with the additions of 11 ppm virginiamycin and 3% fat, respectively.

Discussion

From the feeding trial virginiamycin, fat and the combination of virginiamycin and fat were without effect on ADG, ADFI or F:G when added to S-SBM diets during the starting and growing periods, and on ADG during the finishing period. However, during the finishing period, the addition of fat improved ($P<0.05$) F:G by lowering ADFI. The effect of fat additions in improving F:G was apparent with or without additions of virginiamycin but the greatest improvement in F:G was in T3 which contained added fat without virginiamycin. Vervaeke *et al.* (1979) reported that virginiamycin decreased lactic acid production from intestinal microorganisms in vitro and when combined with in vivo data from the same study, virginiamycin was credited with sparing dietary carbohydrates which resulted in higher net energy (NE) required for growth.

Results of the balance trial supported those of the feeding trial. When pigs were fed T2 which contained 11 ppm virginiamycin, there was a significant improvement in the apparent digestibilities of N and energy originating from carbohydrates. Hedde and Lindsey (1986) reported that in growing and finishing pigs, virginiamycin is effective in shifting glucose and protein utilization away from intestinal bacteria, thereby sparing these nutrients for use by the host. March (1979) suggested that when antibiotics are fed at low levels, control is exerted on sensitive intestinal bacteria that are unfavorable to the host or, alternately, antibiotics lack control of nonsensitive intestinal bacteria that are favorable to the host. When 11 ppm virginiamycin was added to T4, which contained 3% added fat, the virginiamycin-induced improvement in apparent digestibility of NFE largely disappeared although the retention of N was significantly improved. The reduced digestibility of NFE in T4 resulted from an interaction between virginiamycin and fat. Although it is speculative, the interaction from the combination of fat and virginiamycin may have been influenced by the antinutritional effects of tannins typically associated with grain sorghum. It is equally speculative but the interaction between virginiamycin and fat might be unique to grain sorghum and may not exist for other grains; e.g., corn, wheat, barley, that are used in swine feeds. The main effect of supplementing S-SBM diets with fat was to improve apparent digestibility of dietary fat but apparent digestibilities of N and NFE were not affected. Since all diets were isocaloric, improvements in F:G were not associated with dietary caloric density but with the form in which energy was present in the diet; i.e., fat or complex carbohydrate. When compared with T1, pigs fed diets T2, T3 and T4 had higher ($P<0.05$)values for utilization of DE and ME in kcal/d (Table 7). However, DE and ME expressed as a percentage of energy intake suggest that utilization of energy among treatments was similar. The energy values for S-SBM diets in kcal/kg (Table 8) were highest ($P<0.05$) for T3 and T4 which contained added fat as expected. But, DE and ME expressed as a percent of GE, were not affected by treatment, indicating that diets with the highest energetic values also had the highest DE and ME values. The higher DE and ME values of T3 and T4 most likely contributed to the lower ADFI and improved F:G for pigs in T3 and T4 during the overall feeding trial. Results of the present study support those of Boyd *et al.*(1982) in that dietary energy required to provide a unit of ME may vary significantly with energy source, and isocaloric diets containing carbohydrate or fat may not contain equivalent units of NE for growth.

The implications from this study are that feeding value of grain sorghum can be improved by addition of virginiamycin or fat to a basal S-SBM formulation fed to finishing swine. The effect of virginiamycin in S-SBM diets similar to that reported previously for other feed grains in that digestibilities of NFE and N were improved. The addition of fat to S-SBM diets improved energy and fiber digestibilities. Virginiamycin and fat in S-SBM diets improved digestibilities of energy and N to a greater extent than either ingredient alone, but feed conversion was not improved. The reduction in F:G for pigs in T4 suggested that fat may interfere with the activity of virginiamycin, that is unrelated to the beneficial effects of improving NFE and N digestibilities. This occurrence may exist only with feeds containing grain sorghum which indicates the need for further evaluation.

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