Effect of dietary sodium bicarbonate on leg structure in Duroc swine that differ genetically for leg weakness

Catherine W. Ernst  
_Iowa State University_

Max F. Rothschild  
_Iowa State University_, mrothsc@iastate.edu

L. L. Christian  
_Iowa State University_

R. C. Ewan  
_Iowa State University_

Follow this and additional works at: http://lib.dr.iastate.edu/ans_pubs

Part of the Agriculture Commons, and the Animal Sciences Commons

The complete bibliographic information for this item can be found at http://lib.dr.iastate.edu/ans_pubs/322. For information on how to cite this item, please visit http://lib.dr.iastate.edu/howtocite.html.
Effect of dietary sodium bicarbonate on leg structure in Duroc swine that differ genetically for leg weakness

Abstract
Two trials were conducted to evaluate the effect of dietary replacement of .30% sodium chloride (NaCl) with a sodium-equivalent amount of sodium bicarbonate (NaHCO3) on leg weakness in swine. Three lines of Duroc swine established by six generations of divergent selection for front leg structure were used. In the first trial, a total of 80 low-line (increased leg weakness), 75 high-line (decreased leg weakness), 80 control-line (intermediate leg weakness) and 80 high x low pigs were used. Pigs were assigned within litter to an experimental or control diet and tested from approximately 37 to 104 kg live weight. The experimental diet contained .43% NaHCO3, replacing .30% NaCl in the control diet. Pigs had ad libitum access to feed. In the second trial, 48 high- and 48 low-line pigs were fed the same diets from 29 to 104 kg. At the completion of each trial, pigs were scored for various leg traits. The model used for statistical analyses included the effects of replicate, genetic line, dietary treatment and the dietary treatment x genetic line interaction. Trials were analyzed separately. Results indicated that there was no significant improvement in clinical signs of leg weakness due to dietary supplementation with NaHCO3 for front leg structure and movement, rear leg movement or rear toe size. Rear hock angle was improved in Trial 1 (P less than .05) but was reduced in Trial 2 (P less than .10).

Keywords
Pigs, Leg Weakness, Sodium Bicarbonate

Disciplines
Agriculture | Animal Sciences

Comments
This is an article from Journal of Animal Science 68 (1990): 2583, doi:/1990.6892583x. Posted with permission.
EFFECT OF DIETARY SODIUM BICARBONATE ON LEG STRUCTURE IN DUROC SWINE THAT DIFFER GENETICALLY FOR LEG WEAKNESS¹,²

C. W. Ernst³, M. F. Rothschild⁴, L. L. Christian and R. C. Ewan

Iowa State University⁵, Ames 50011

ABSTRACT

Two trials were conducted to evaluate the effect of dietary replacement of .30% sodium chloride (NaCl) with a sodium-equivalent amount of sodium bicarbonate (NaHCO₃) on leg weakness in swine. Three lines of Duroc swine established by six generations of divergent selection for front leg structure were used. In the first trial, a total of 80 low-line (increased leg weakness), 75 high-line (decreased leg weakness), 80 control-line (intermediate leg weakness) and 80 high x low pigs were used. Pigs were assigned within litter to an experimental or control diet and tested from approximately 37 to 104 kg live weight. The experimental diet contained .43% NaHCO₃, replacing .30% NaCl in the control diet. Pigs had ad libitum access to feed. In the second trial, 48 high- and 48 low-line pigs were fed the same diets from 29 to 104 kg. At the completion of each trial, pigs were scored for various leg traits. The model used for statistical analyses included the effects of replicate, genetic line, dietary treatment and the dietary treatment x genetic line interaction. Trials were analyzed separately. Results indicated that there was no significant improvement in clinical signs of leg weakness due to dietary supplementation with NaHCO₃ for front leg structure and movement, rear leg movement or rear toe size. Rear hock angle was improved in Trial 1 (P < .05) but was reduced in Trial 2 (P < .10). Including NaHCO₃ in the diet reduced rate of gain (P < .05) and increased days to 104 kg in Trial 1; growth rate was not affected by NaHCO₃ in Trial 2. Results suggest that genetic differences in leg weakness cannot be altered by adding sodium bicarbonate to the diet; its inclusion tended to be antagonistic toward performance in Duroc swine.

(Key Words: Pigs, Leg Weakness, Sodium Bicarbonate.)


Introduction

Leg weakness in swine has been clinically described as the impairment of locomotor ability, structural unsoundness or lameness (Goedegebuure et al., 1980; Nakano et al., 1987) and is moderately heritable (Bereskin, 1979; Webb et al., 1983; Lundeheim, 1987). Lines of Duroc pigs genetically susceptible or resistant to front leg weakness have been established through a divergent selection experiment (Rothschild and Christian, 1988) and are useful to study factors influencing leg weakness.

The effect of numerous nutritional factors on leg weakness have been studied; no differences have been shown between pigs given ad libitum or limited access to food (Grøndalen, 1974b; Calabotta et al., 1982) or different levels of protein (Grøndalen, 1974a), calcium and phosphorus (Kornegay and Thomas, 1981; Calabotta et al., 1982; Mahan and Cera, 1985), vitamin A and D (Reiland, 1976) or vitamin E (Grøndalen, 1974a). Ascorbic

³The authors gratefully acknowledge the assistance of M. Braet, J. Newton and K. Steffensmeier in data collection.
⁴Also, Feed Specialties, Inc., of Des Moines, Iowa, contributed the vitamin-mineral premixes, and Louis Russell of that company kindly provided nutritional advice for formulating the rations used in this research.
⁵Present address: Dept. of Anim. Sci., The Ohio State Univ., Columbus 43210.
⁶To whom correspondence should be addressed.
⁷Dept. of Anim. Sci.
Received August 14, 1989.
Accepted November 28, 1989.

2583
acid may reduce but not eliminate some clinical signs of leg weakness (Nielsen and Vinther, 1982). Van der Wal et al. (1986a) reported a significant reduction in clinical signs of leg weakness in pigs fed a diet in which 30% sodium chloride (NaCl) was replaced with a sodium-equivalent amount (43%) of sodium bicarbonate (NaHCO₃).

The purpose of this investigation was to determine the effects of dietary supplementation of NaHCO₃ on clinical symptoms of leg weakness in genetically sound and unsound Duroc pigs.

Materials and Methods

The lines of Duroc pigs used were from the divergent selection experiment described in Rothschild and Christian (1988). Two separate trials were conducted. Trial 1 utilized animals from generation 6 of the selection experiment. Four lines and three sexes (boars, barrows and gilts) were involved in Trial 1. The lines represented were the high (decreased leg weakness), low (increased leg weakness) and control (intermediate leg weakness) lines, as well as F₁ pigs obtained from matings of high and low parents. Approximately half the males in each litter were castrated.

Trial 1 began in the late fall with 315 pigs (75 high line, 80 low line, 80 control line and 80 F₁), of which 307 (72 high line, 80 low line, 78 control line and 77 F₁) completed the experiment. Within litters, approximately half of each sex were assigned randomly to each dietary treatment group (control or experimental). Sexes were housed together and pigs were assigned within diet, line and replicate to 2.4-m x 6.0-m pens. At least 2 wk before being placed on their respective diets, pigs were sorted into their assigned pens. All replicate 1 pens began with 20 pigs per pen, whereas replicate 2 pens were assigned between 16 and 20 pigs. Pigs were divided into replicates based on their body weights. Because available facilities differed, two replicates were formed for Trial 1, and four were formed for Trial 2. The largest pigs were assigned to the first replicate; smaller pigs were assigned to later replicates.

The control diet was a 16% crude protein swine ration; the experimental diet contained .43% NaHCO₃ in place of .30% NaCl in the control diet (Table 1). The only other difference between the two diets was the chloride (Cl⁻) content. The Cl⁻ concentration of the control diet exceeded NRC (1988) recommendations (.08%) but that of the experimental
TABLE 1. COMPOSITION OF DIETS (AS-FED BASIS)

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount, g/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground #2 yellow corn (8.9%)</td>
<td>763</td>
</tr>
<tr>
<td>Soybean meal (47.5%)</td>
<td>180</td>
</tr>
<tr>
<td>Fat</td>
<td>30</td>
</tr>
<tr>
<td>Vitamin-mineral premixabc</td>
<td>25</td>
</tr>
<tr>
<td>Denagardd</td>
<td>2</td>
</tr>
</tbody>
</table>

aVitamin-mineral premix contributed the following per kg of control diet: 2,756 IU vitamin A, 452 IU vitamin D, 8 IU vitamin E, .83 mg vitamin K, 2.2 mg riboflavin, 17.9 mg niacin, 11.3 mg pantothenic acid, 254 mg choline, 16.5 µg vitamin B12, 5.62 g Ca, 2.26 g P, 1.55 g Na, 2.32 g Cl, 0.01 g K, 1.27 mg Mg, 83 mg Zn, 171 mg Fe, 8.1 mg Cu, 43.2 mg Mn, .15 mg Se, .34 mg I.

bVitamin-mineral premix for experimental diet contributed 4.3 g/kg diet NaHCO3 in place of 3.0 g/kg diet NaCl of control diet as the major source of sodium. Therefore, the amount of chloride contributed by the premix for the experimental diet was .58 g/kg. All other vitamins and minerals were the same as in the premix for the control diet.

cInitial premixes did not contain inorganic phosphorus.

dContributed 38 ppm tiamulin.

diet (.07%) was slightly below the minimum recommended level. The antibiotic tiamulin6 was added to both diets at a level of 38 ppm. Feed was available to pigs ad libitum throughout both experiments.

Because of a technical error in preparation of the vitamin-mineral base mixes, the base mixes used for the control diet during the first 17 wk and the experimental diet during the first 18 wk of Trial 1 were not formulated properly. The source(s) of inorganic phosphorus (P) needed to balance the P requirement were inadvertently omitted from the base mixes, causing the dietary levels of P to be slightly below those levels recommended by the National Research Council (NRC, 1988). Analysis of 13 feed samples from each ration indicated that the control diet averaged .393 ± .096% P and that the experimental diet averaged .345 ± .038% P. The NRC (1988) recommendations for P are .5% for growing pigs (18 to 50 kg) and .4% for finishing pigs (50 to 109 kg).

This formulation error was corrected when a second batch of base mixes was made. Therefore, the properly formulated ration was provided to pigs in the latter part of Trial 1 and throughout Trial 2. Compared with pigs of previous generations of these divergent lines, pigs in these trials exhibited no obvious P deficiency symptoms (reduced growth rate or abnormal bone growth). The formulation error was made in both diets, and, although the diets contained a suboptimal level of P, dietary treatment comparisons of the traits measured were considered reliable.

Pigs from both trials were visually evaluated for five leg structure traits by three observers working independently. The observers had no prior knowledge of each pig’s line or diet. Scores of the three observers were averaged. The traits scored included front leg structure (FS), front leg movement (FM), rear hock angle (RH), rear leg movement (RM) and rear toe size (RTS). A description of these scores for each trait was reported by Rothschild and Christian (1988). Scores for FS, FM, RM and RTS ranged from 1 to 9, with 9 considered best. Scores for RH ranged from 1 to 9, with intermediate scores between 4 and 5 considered best.

Several performance traits were evaluated for the pigs in these trials. These included average daily gain on test (ADG), adjusted backfat thickness (ABF), days to 104 kg (DAYS) and pen feed conversion efficiency (FE). The ABF was the average of three measurements taken ultrasonically at points adjacent to the shoulder (5th rib), last rib and last lumbar vertebrae 5 cm from the midline on the right side by using an ultrasound device7. Both ABF and DAYS were adjusted to a constant weight of 104 kg according to the National Swine Improvement Federation Guidelines (Weber, 1987).

Efficiency of feed conversion (FE) ratios (kg feed/kg gain) were computed on a per-pen basis for 28-d intervals during the testing period, as well as for the overall period. Feed weights were recorded as feed was added to the feeders and feeders were weighed back at the time pigs were weighed. Pigs removed because of death or illness were weighed at the time they were removed from pens.

Blood samples were collected from the orbital sinus of each pig at the time pigs were removed from test. One sample was collected in tubes containing an anticoagulant (EDTA for Trial 1 and heparin for Trial 2) and used for measuring whole-blood pH values within 1 h of collection. In Trial 1, serum was removed from a second sample and frozen for future chemical analysis. Serum phosphorus was

7ILIS preg chek®, ILIS Corporation, Ames, IA.
TABLE 2. EFFECT OF NaHCO3 ON FIVE LEG STRUCTURE TRAITS

<table>
<thead>
<tr>
<th>Leg structure trait</th>
<th>Trial 1</th>
<th>Dietary treatment</th>
<th>Trial 2</th>
<th>Dietary treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NaHCO3</td>
<td>Control</td>
<td>SE</td>
<td>NaHCO3</td>
</tr>
<tr>
<td>FS</td>
<td>5.65</td>
<td>5.61</td>
<td>.12</td>
<td>5.30</td>
</tr>
<tr>
<td>FM</td>
<td>5.66</td>
<td>5.68</td>
<td>.11</td>
<td>5.30</td>
</tr>
<tr>
<td>RH</td>
<td>5.39</td>
<td>5.54</td>
<td>.03</td>
<td>6.07</td>
</tr>
<tr>
<td>RM</td>
<td>4.82</td>
<td>4.82</td>
<td>.05</td>
<td>4.32</td>
</tr>
<tr>
<td>RTS</td>
<td>4.97</td>
<td>4.90</td>
<td>.06</td>
<td>4.72</td>
</tr>
</tbody>
</table>

aFront leg structure (FS), front leg movement (FM), rear hock angle (RH), rear leg movement (RM) and rear toe size (RTS).

bEffect of NaHCO3 was significant (P < .05).

determined in Trial 1 by an automated method of Fiske and Subbarow (1925).

Carcass data also were obtained on 70 barrows from Trial 1. Carcass length (LENGTH), carcass average backfat (CABF), loin muscle area (LMA), quality scores for loin muscle color (COL) and loin muscle marbling (MARB), carcass yield (YIELD) and grams of lean gain per day of age (LDOA) were determined according to Procedures to Evaluate Market Hog Performance (National Pork Producers Council, 1983). Quality scores were assigned at the time other measures were taken by visual appraisal of the loin muscle at the 10th rib. Scores for COL ranged from 1, very pale, to 5, dark red, with a score of 3, pink, being preferred. Scores for MARB ranged from 1, practically devoid, to 5, very abundant, with an intermediate score of 3 being moderate and preferred.

Results from the two trials were analyzed separately. Analyses were made on pen means by using least squares analysis of variance. The model used to analyze the five leg structure traits, the performance traits, the blood parameters and YIELD and LDOA also included the regression of pen average weight at slaughter to account for live-weight differences before slaughter that could have affected carcass measurements. Weight at slaughter was not included in the evaluation of YIELD or LDOA. The effect of gender on leg structure traits, performance traits (with the exception of FE) and blood parameters was also evaluated by using pen-sex means. The model used for this analysis included the effects of replicate, genetic line, dietary treatment, the diet line interaction, the replicate line diet interaction, sex, the sex line interaction, the sex line diet interaction and the sex line diet interaction. Dietary treatment means and their standard errors are presented.

Results

Dietary treatment did not affect (P > .10) FS, FM, RM or RTS in either trial (Table 2). Although the dietary treatment for RH was significant in Trial 1 and approached significance in Trial 2 (P < .10), the response to dietary treatment was opposite in the two trials, raising a question as to whether dietary treatment has an effect on RH. In Trial 1, pigs consuming the control diet had straighter rear legs (i.e., lower RH equates to a lesser angle at the hock) than those consuming the diet containing NaHCO3; however, in Trial 2, pigs consuming the NaHCO3 diet had straighter rear legs than pigs consuming the control diet.

Line effects were found (P < .01) for all
SODIUM BICARBONATE AND LEG WEAKNESS

TABLE 3. EFFECT OF NaHCO3 ON PERFORMANCE TRAITS

<table>
<thead>
<tr>
<th>Leg structure traita</th>
<th>Dietary treatment</th>
<th>Trial 1</th>
<th>NaHCO3</th>
<th>Control</th>
<th>SE</th>
<th>Trial 2</th>
<th>NaHCO3</th>
<th>Control</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG, g/day</td>
<td></td>
<td></td>
<td>578</td>
<td>612</td>
<td>8b</td>
<td></td>
<td>700</td>
<td>713</td>
<td>2b</td>
</tr>
<tr>
<td>ABF, mm</td>
<td></td>
<td></td>
<td>28.8</td>
<td>29.1</td>
<td>.22</td>
<td></td>
<td>28.5</td>
<td>28.9</td>
<td>.43</td>
</tr>
<tr>
<td>FE</td>
<td></td>
<td></td>
<td>3.40</td>
<td>3.28</td>
<td>.03</td>
<td></td>
<td>3.03</td>
<td>2.98</td>
<td>.04</td>
</tr>
</tbody>
</table>

aAverage daily gain on test (ADG), average backfat thickness (ABF) and feed efficiency over the entire test period (FE).
bEffect of NaHCO3 was significant (P < .05).

five leg structure traits in both trials and were similar to those published previously (Rothschild and Christian, 1988). High-line pigs scored better (P < .01) and low-line pigs scored worse (P < .01) than other lines for all traits in Trials 1 and 2 (data not shown). The control line and F1 crosses were intermediate (P < .01) to the high and low lines in all cases. The control-line pigs tended to score more poorly than the F1 pigs, although this difference was significant only for RH (P < .01) and RM (P < .05). Results of the analysis of variance of pen-sex means for the five leg structure traits did not detect any gender × dietary treatment interactions or sex × line interactions in either trial.

Pigs in Trial 1 consuming the control diet grew 35 g per day faster (P < .05) than pigs consuming the experimental diet (Table 3) and, although differences between treatment groups were in the same direction in Trial 2, they were not significant (Table 3). No significant differences in ABF due to diet were found in either trial.

Feed efficiency (FE) ratios were evaluated for 28-d periods up to 84 d, (data not shown) for the period from 84 d until the pens were removed from test (data not shown) and for the overall test period for both trials (Table 3). For Trial 1, pigs consuming the control diet were more efficient (P < .05) than those consuming the experimental diet during the period from 84 d to the end of the test and for the overall test period. In Trial 2, however, differences in FE approached significance (P < .10) during the second 28-d period of the test. In other periods or over the entire test, no other differences (P > .10) in FE were observed in Trial 2.

Analyses of carcass traits of the castrated males in Trial 1 indicated that dietary treatment did not significantly affect LENGTH, CABF, LMA, YIELD or LDOA (Table 4). Dietary sodium bicarbonate did, however, increase MARB (P < .05), and differences in COL approached significance (P < .10). Results for COL and MARB indicated that barrows in the control group had less (P < .05) intramuscular fat and paler (P < .10) loin muscles than did barrows in the NaHCO3 group.

TABLE 4. EFFECT OF NaHCO3 ON CARCASS TRAITS OF BARROWS FOR TRIAL 1

<table>
<thead>
<tr>
<th>Carcass traita</th>
<th>Dietary treatment</th>
<th>NaHCO3</th>
<th>Control</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH, cm</td>
<td></td>
<td>82.3</td>
<td>82.6</td>
<td>.22</td>
</tr>
<tr>
<td>CABF, mm</td>
<td></td>
<td>35.1</td>
<td>35.6</td>
<td>.6</td>
</tr>
<tr>
<td>LMA, cm²</td>
<td></td>
<td>30.4</td>
<td>31.1</td>
<td>.5</td>
</tr>
<tr>
<td>COL</td>
<td></td>
<td>2.94</td>
<td>2.70</td>
<td>.08</td>
</tr>
<tr>
<td>MARB</td>
<td></td>
<td>3.05</td>
<td>2.56</td>
<td>.13b</td>
</tr>
<tr>
<td>YIELD, %</td>
<td></td>
<td>73.44</td>
<td>73.03</td>
<td>.24</td>
</tr>
<tr>
<td>LDOA, g/d</td>
<td></td>
<td>131</td>
<td>143</td>
<td>5</td>
</tr>
</tbody>
</table>

aCarcass length (LENGTH), carcass average backfat (CABF), loin muscle area (LMA), color score (COL) and marbling score (MARB). Scores for COL and MARB ranged from 1 to 5, with 3 most desirable, carcass yield (YIELD) and lean gain per day of age (LDOA).
bEffect of NaHCO3 is significant (P < .05).
Discussion

Dietary supplementation of NaHCO3 did not affect the phenotypic expression of leg structure traits in lines of Duroc pigs divergently selected for front leg structure in two separate trials. These results disagree with those obtained by van der Wal et al. (1986a), who reported that clinical symptoms of leg weakness were significantly improved by replacing .30% NaCl with .43% NaHCO3 in the diet. Differences in the two experimental situations should be considered as possible explanations for the discrepancy between the results obtained in the current study and the Dutch results.

The current research used purebred Duroc pigs from the sixth (Trial 1) and seventh (Trial 2) generations of divergent selection for front leg structure. Van der Wal et al. (1986a) used both purebred Dutch Landrace and Landrace × Yorkshire crossbreds of pigs without specific prior selection. Significant breed differences in degree of leg weakness were reported for both Landrace and Large White boars (Webb et al., 1983), but no significant differences have been found between Duroc and Yorkshire gilts (Bereskin, 1979). Reports in the literature have not compared Duroc and Landrace breeds directly, though Duroc leg problems tend to be in the front legs, whereas Landrace have more rear leg problems. Other differences between the current experiment and that of van der Wal et al. (1986a) include initial weight, pen size, and density and floor type. How these factors may have influenced the outcome of the experiments is unknown.

An attempt was made to consider what effects, if any, the suboptimal level of P in the diets during the first part of Trial 1 had on the results obtained for leg structure scores. Data from individual animals were blocked into two groups: responses of pigs removed from test before correction of the diet formulation and responses of pigs that received the corrected diet for at least 2 wk. No significant group × diet interactions were detected for any of the leg structure traits. This result suggested that the suboptimal level of P in the ration had no effect on either performance or on dietary treatment comparisons for leg structure scores. Kornegay and Thomas (1981) and Mahan and Cera (1985) both reported that dietary Ca and P levels above and below NRC (1979) recommendations had no effect on leg soundness in swine.

Results for ADG and DAYS, especially in Trial 1, suggest that dietary supplementation of NaHCO3 had an adverse effect on growth rate. These results are in contrast to those obtained by van der Wal et al. (1986a), who reported that inclusion of NaHCO3 in the ration had no significant influence on daily weight gain. Van der Wal et al. (1986a) considered this to be proof that a Cl- deficiency had not existed. The Cl- level in the experimental ration used in the current study was only .07%. A Cl- deficiency may have contributed to the reduced growth response observed. In a recent report, Honeyfield et al. (1985) tested three dietary levels of Na+ (.03, .09 and .18%) arranged factorially with three levels of Cl- (.08, .17 and .32%) fed to growing-finishing pigs (36 to 89 kg) and concluded that .08% Cl- was adequate to support growth. Meyer et al. (1950) reported that .03% Cl- led to daily weight gains for growing pigs that were significantly lower than those of control animals fed .33% Cl-. It is impossible to conclude from this information whether or not .07% Cl- was low enough to retard growth of our animals.

An attempt also was made to consider the effects of the suboptimal level of P in the diets during the first part of Trial 1 on pig performance. When pigs were grouped according to those that received the corrected diet formulation vs those that did not, no group differences on performance or dietary treatment interactions were found, suggesting that the suboptimal level of P had no effect on dietary treatment group comparisons for performance traits. Tanksley (1977) and Pond et al. (1978) found that level of dietary Ca and P had no influence on daily weight gain.

Treatment effects for FE for the two trials were inconclusive. For Trial 1, FE ratios for the period from 84 d to the end of the test and the overall test period suggested that pigs consuming the control diet were more efficient than those consuming the experimental diet.
No significant dietary treatment group differences in FE were seen in Trial 2. Van der Wal et al. (1986a) reported that dietary NaHCO₃ did not influence feed conversion.

Whole-blood pH values were determined to assess the effect of dietary NaHCO₃ supplementation on blood acid-base balance. No significant dietary treatment group differences were found for either trial. These results are in agreement with those reported by van der Wal et al. (1986b), who also found no significant differences between pigs consuming a ration containing NaHCO₃ and pigs consuming a control ration. Similarly, dietary supplementation of NaHCO₃ to humans did not alter blood pH (Lutz, 1984). Van der Wal et al. (1986b) concluded that at least some compensation in acid-base balance by the pigs was present. They suggested that alterations in the predominant blood buffering systems may have been involved because concentrations of hemoglobin were significantly lower in pigs supplemented with NaHCO₃. For Trial 1, levels of serum phosphorus were measured for all pigs that completed the experiment. No significant dietary treatment group differences were observed for this trait.

When Trial 1 pigs removed from the test before the correction of the diet formulation were grouped and compared with pigs that received correct diet, the group × dietary treatment interactions were not significant for either pH or serum phosphorus. This result again suggested that the suboptimal level of P in the ration during the first part of Trial 1 did not alter the dietary treatment comparisons for the traits measured.

Results for carcass traits for the castrated males in Trial 1 agree with those of van der Wal et al. (1986a), who reported that only minor carcass differences existed between dietary treatment groups. The only trait they found to be significantly affected was dressing percentage, which showed significant but inconsistent differences.

Implications

Contrary to previous literature reports, including NaHCO₃ in the diet did not reduce clinical symptoms of leg weakness in Duroc swine but tended to reduce growth rate. Therefore, its use in swine diets for the improvement of clinical leg weakness is not recommended. These results for NaHCO₃ are similar to those of many past studies that have demonstrated that, within a wide range around recommended levels, dietary effects on structural soundness are minimal. Leg weakness is inherited, suggesting that producers can avoid structural soundness problems by selecting breeding animals free of leg weakness.

Literature Cited


Nielsen, N. C. and K. Vinther. 1982. Influence of dietary...


