



Short communication

Effects of diet form and corn particle size on growth performance and carcass characteristics of finishing pigs



J.E. Nemechek^a, M.D. Tokach^a, S.S. Dritz^b, R.D. Goodband^{a,*}, J.M. DeRouchey^a, J.C. Woodworth^a

^a Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS 66506-0201, USA

^b Department of Diagnostic Medicine/Pathobiology, Kansas State University, Manhattan, KS 66506-0201, USA

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ABSTRACT

A total of 960 crossbred pigs, initially 34.3 ± 0.50 kg, were used in a 101-day trial to determine the effects of corn particle size and diet form on growth performance and carcass characteristics of finishing pigs. Pens were randomly allotted by initial weight to 1 of 6 experimental treatments with 8 pens per treatment and 20 pigs per pen. The 6 experimental treatments were arranged in a 2×3 factorial with main effects of final feed form (meal vs. pellet) and corn particle size (650 μm , 350 μm , or an equal blend of the 650 μm and 350 μm ground corn). The 650 μm corn was ground using a two-high roller mill, and the 350 μm corn was ground using a full circle hammer-mill equipped with a 1.59 mm screen. After all corn was ground, the diet containing the blend of particle sizes was manufactured by adding equal portions of the 2 at the mixer. Overall (day 0–101), linear particle size \times diet form interactions were observed ($P < 0.05$) for average daily feed intake (ADFI) and gain:feed ratio (G:F), because ADFI decreased and G:F increased as particle size was reduced for pigs fed meal diets but was unchanged for pigs fed pelleted diets. Pigs fed pelleted diets had increased ($P < 0.05$) average daily gain (ADG) compared with pigs fed meal diets. As corn particle size decreased, ADG decreased (linear; $P < 0.05$). Pigs fed pelleted diets had increased ($P < 0.05$) hot carcass weight compared with pigs fed meal diets, but no other effects on carcass characteristics were observed. In summary, grinding corn finer than 650 μm decreased ADFI and improved G:F for pigs fed meal diets, but did not affect performance of pigs fed pelleted diets. Pigs fed pelleted diets had improved ADG compared with those fed meal-based diets. Thus, grinding corn finer than 650 μm improved feed efficiency for pigs fed meal diets, but provided no benefit in pelleted diets.

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1. Introduction

Pelleting swine diet is an effective processing method for improving growth performance of pigs. Consistent improvements in feed efficiency when feeding pelleted diets have been reported (Hanke et al., 1972; Medel et al., 2004; Nemechek et al., 2013) and are often accompanied by increased average daily gain (ADG; Wondra et al., 1995; Paulk et al., 2011). These

Abbreviations: ADFI, average daily feed intake; ADG, average daily gain; G:F, gain:feed ratio; PDI, pellet durability index; SID, standardized ileal digestible.

* Corresponding author. Fax: +1 7855327059.

E-mail address: goodband@ksu.edu (R.D. Goodband).

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improvements in growth performance may result from multiple factors including decreased feed wastage (Hanrahan, 1984), increased nutrient digestibility (Wondra et al., 1995), and improved palatability (Skoch et al., 1983).

Fine grinding is another feed processing method that improves feed efficiency. Wondra et al. (1995) observed improved feed efficiency as corn particle size decreased from 1000 to 400 μm . The improvements were attributed to increased nutrient digestibility. Other research conducted with cereal grain particle sizes ranging from 1200 to 600 μm has been conducted primarily with meal-based diets (Ohh et al., 1983; Seerley et al., 1988). There is much less information available on the impact of feeding pelleted diets containing corn ground finer than 700 μm in finishing pigs.

Therefore, the objective of the experiment was to determine the effect of corn particle size (650 μm , 350 μm , or an equal blend of the 650 μm and 350 μm ground corn) and diet form (meal vs. pellet) on finishing pig growth performance and carcass characteristics.

2. Materials and methods

All experimental procedures and animal care were approved by the Kansas State University Institutional Animal Care and Use Committee.

2.1. General

A total of 960 crossbred pigs (Pig Improvement Company [Hendersonville, TN] TR4 \times Fast Genetics [Saskatoon, SK] \times Pig Improvement Company Line 02, initially 34.3 ± 0.50 kg) were used in a 101-day trial. The study was conducted at the New Fashion Pork Research Facility (Round Lake, MN) in a commercial research-finishing barn located in northwest IA. The double-curtain-sided barn was tunnel-ventilated with completely slatted flooring and deep pits for manure storage. Each pen (2.4 m \times 17.8 m) was equipped with a 5-hole stainless steel dry self-feeder and a cup waterer for ad libitum access to feed and water. Daily feed additions to each pen were made by a robotic feeding system (FeedPro; Feedlogic Corp., Willmar, MN) capable of providing and measuring feed deliveries for individual pens.

Pens were randomly allotted by initial weight to 1 of 6 experimental treatments with 8 pens per treatment and 20 pigs per pen. The 6 experimental treatments were arranged in a 2 \times 3 factorial with main effects of final feed form (meal vs. pellet) and corn particle sizes (650 μm , 350 μm , or an equal blend of the 650 μm and 350 μm ground corn). Diets were fed in 4 phases, with Phase 1 through 4 fed from day 0 to 26, 26 to 46, 46 to 73, and 73 to 101, respectively (Table 1). Within each phase, the same corn-soybean meal-based diet containing 30% dried distillers grains with solubles (Phases 1 through 3) or 15% dried distillers grains with solubles (Phase 4) was used for all 6 experimental treatments.

All diets were prepared at New Fashion Pork's commercial feed mill in Estherville, IA. The 650 μm corn was ground using a two-high roller mill (RMS Roller Grinder, Tea, SD), and the 350 μm corn was ground using a full circle hammer-mill (Jacobsen Machine Works, Minneapolis, MN) equipped with a 1.59 mm screen. After all corn was ground, the diet containing the blend of the 650 μm and 350 μm ground corn was manufactured by adding equal portions of the 2 at the mixer. For all pelleted diets, the complete feed was pelleted with a CPM pellet mill (California Pellet Mill, San Francisco, CA) equipped with a 4.3 mm die. Pelleting temperature was 50 °C with a 1 min retention time.

Pigs were weighed and feed disappearance measured approximately every 2 weeks to calculate average daily gain (ADG), average daily feed intake (ADFI), and gain:feed ratio (G:F). On day 87 of the trial, pens were weighed and the 6 heaviest pigs (selected by the marketing serviceman) were removed and transported 560 km to Triumph Foods (St. Joseph, MO) for harvest. The remaining pigs were transported to Triumph Foods on day 101 for harvest. Carcass yield was calculated using live weight at the farm and hot carcass weight at the plant. At the plant, backfat and loin depth were measured.

Samples of corn and complete diets were collected at the feeder during each phase. Corn particle size of the diets containing a 50:50 mixture of 650 and 350 μm ground corns could not be determined; therefore, whole diet particle size was measured. Particle size of corn samples and diets in meal form was determined at the K-State Swine Laboratory using the ASAE (1996) standard method for determining particle size. Tyler sieves (numbers 6, 8, 10, 14, 20, 28, 35, 48, 65, 100, 150, 200, 270, and a pan) and a Ro-Tap shaker (W.S. Tyler, Mentor, OH) were used. The Ro-Tap was equipped with a hammer used to tap the sieve stack approximately 150 times per minute during the shaking process. One hundred-gram samples were sifted for 10 min without a flow agent, and the weight on each screen was used to calculate the mean particle size and standard deviation (Table 2). Pellet durability index (PDI) was determined using the standard tumbling-box technique (S269.4; ASAE, 1996). Percentage fines (ASAE, 1987) were also determined for all pelleted diets, with fines characterized as material that would pass through a #6 sieve (3360 μm openings). All pellet quality measurements were analyzed at the K-State Grain Sciences and Industry Feed Mill.

2.2. Statistical analysis

Experimental data were analyzed using analysis of variance as a 2 \times 3 factorial in a completely randomized design using the MIXED procedure of SAS (SAS Inst., Inc., Cary, NC). Pen was the experimental unit for all data analysis. Data analysis included main effects of 2 diet forms and 3 corn particle sizes. Linear and quadratic effects of decreasing particle size were determined as well as interactive effects of corn particle size and diet form. Significant differences were declared at $P < 0.05$ and trends at $P < 0.10$.

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