015 Development of equations to predict the influence of floor space on average daily gain, average daily feed intake, and gain-to-feed ratio of finishing pigs.

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Data from existing literature examining the influence of floor space allowance on the growth of finishing pigs was used to develop prediction equations for ADG, ADFI, and G:F. Two databases were used: the first included information from studies examining the influence of floor space allowance, and the second included the aforementioned papers along with papers examining the impact of floor space after pigs were removed from the pen. The first database included 27, 25, and 25 papers for ADG, ADFI, and G:F, respectively, and the second database contained 30, 28, and 28 papers for ADG, ADFI, and G:F, respectively. The predictor variables tested were floor space (m^2/pig), k (floor space/final $BW^{0.67}$), initial BW, final BW, feed space (pigs per feeder hole), water space (pigs per waterer), group size (pigs per pen), gender, floor type, and study length (d). Floor space treatments within each experiment were the experimental unit and random effects of decade, paper within decade, and experiment within paper × decade interactions were included in the statistical model. A weighted variance term was included in the statistical model to account for heterogeneity of experimental designs and replication across the existing literature. The statistical significance for inclusion of terms in the model was determined at $P < 0.10$. Further evaluation of models with significant terms was then conducted based on the Bayesian information criterion (BIC). Once the ADG and ADFI models for each respective database were determined, then the G:F model was evaluated as the predicted ADG/predicted ADFI. The optimum equations to predict finishing ADG, ADFI, and G:F for the first database were ADG, g = 395.57 + (15,727 × k) − (221,705 × k^2) − (3.6478 × initial BW, kg) + (2.209 × final BW, kg) + (67.6294 × k × initial BW, kg); ADFI, g = 802.07 + (20,121 × k) − (301,210 × k^2) − (1.5985 × initial BW, kg) + (11.8907 × final BW, kg) + (159.79 × k × initial BW, kg); and G:F = predicted ADG/predicted ADFI. The optimum equations to predict ADG, ADFI, and G:F for the second database were ADG, g = 337.57 + (16,468 × k) − (237,350 × k^2) − (3.1209 × initial BW, kg) + (2.569 × final BW, kg) + (71.6918 × k × initial BW, kg); ADFI, g = 833.41 + (24,785 × k) − (388,998 × k^2) − (3.0027 × initial BW, kg) + (11.246 × final BW, kg) + (187.61 × k × initial BW, kg); and G:F = predicted ADG/predicted ADFI. All multiterm models improved BIC values compared with single-term predictor models, signifying that multiterm models proved to better fit their respective databases.

Key Words: finishing pigs, models, stocking density

016 Evaluating the effects of floor space allowance and pig removal from a group on the growth of finishing pigs.

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A total of 1092 finishing pigs (initially 36.3 ± 1.2 kg BW) were used in a 117-d study to evaluate the impact of initial floor space allowance and removal strategy on the growth of finishing pigs up to 140 kg. There were 4 experimental treatments with 14 pens per treatment. The first treatment stocked pigs at 0.91 m^2 (15 pigs/pen) throughout the duration of the study. The other 3 treatments initially stocked pigs at 0.65 m^2 (21 pigs/pen) and were subject to 1 of 3 removal strategies. The second treatment (2:2:2) removed the 2 heaviest pigs from pens on d 64, 76, and 95. Treatment 3 (2:4) removed the 2 heaviest pigs on d 76 and the 4 heaviest pigs on d 105. Treatment 4 (6) removed the heaviest 6 pigs on d 105. All pigs remaining in pens after removals were fed to d 117. Overall (d 0 to 117), pigs initially provided 0.91 m^2 of floor space had increased ($P < 0.05$) ADG compared with pigs in pens on the 2:4 or 6 removal strategy. Pigs initially provided 0.91 m^2 of floor space had increased ($P < 0.05$) ADFI compared with pigs initially provided 0.65 m^2 of floor space. Feed efficiency was poorer for pigs initially provided 0.91 m^2 of floor space compared with pigs on the 2:2:2 or 2:4 removal strategy. Total BW gain per pen was greater ($P < 0.05$) for pens initially stocked at 0.65 m^2 compared with pens initially stocked at 0.91 m^2. Feed usage per pen was less ($P < 0.05$) for pens initially stocked at 0.91 m^2 compared with pens initially providing 0.65 m^2 of floor space and on removal strategies. Feed usage per pen was less ($P < 0.05$) for pigs on the 2:2:2 removal strategy compared with pigs on the 2:4 or the 6 removal strategy. In conclusion, increasing the floor space allowance

Table 016.

	Treatments				
	Initial floor space, m^2				
	0.91	0.65	0.65	0.65	
	Marketing strategy				
Item	None	2:2:2	2:4	6	SEM
d 0 to 117					
ADG, kg	0.92	0.90	0.88	0.87	0.008
ADFI, kg	2.58	2.40	2.39	2.39	0.022
G:F	0.358	0.377	0.370	0.364	0.002
d 0 BW, kg	36.4	36.3	36.3	36.3	0.32
Average BW at time of removal, kg	144.8	132.3	134.9	136.6	0.87
Total BW gain, kg/pen	1603	2032	2077	2083	27.4
Feed usage, kg/pen	4537	5349	5566	5730	46.1

or the time points at which pigs are removed from the pen improved the growth of pigs remaining in the pen.

Key Words: finishing pig, marketing, stocking density

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017 Effect of lameness on hock angles of replacement gilts. J. M. Mumm*, K. J. Stalder, J. D. Stock, J. A. Calderon Diaz, *Department of Animal Science, Iowa State University, Ames*.

The objective of this study was to investigate whether hock angles significantly differ between lame and sound legs in replacement gilts. Thirteen gilts lame on the rear right leg were moved to a pen where digital images (i.e., still pictures) were recorded while the gilt walked to capture images of the leg flexing forward and backward on both profile views. Standing images were also captured. On average, 9 high-quality images per gilt were used for analysis. Hock angles were measured for both lame and sound rear legs. Angles were measured by tracing the front and back of the joint between the fibula/tibia and tarsals, with the anterior and posterior positions acting as the anchor. Flank-to-flank measurement was recorded to estimate BW. Data were analyzed using mixed model methods with leg (sound or lame), leg position (forward, standing, or backward), and their interaction included as fixed effects. Estimated BW was included as a linear covariate. Gilt was included as a random effect. Hock angle varied between the sound and lame leg. When accounting for the average angle of all 3 positions, lame legs had wider hock angles when compared with the sound leg (141.1 vs. 136.9 ± 1.9 degrees, respectively; $P < 0.05$). Hock angles did not differ between lame and sound legs when the leg was positioned forward ($P > 0.05$). However, while standing and while flexing legs backward, hock angles were greater on the lame leg when compared with the sound leg (136.7 vs. 132.7 ± 2.1 and 145.4 vs. 136.1 ± 2.1 degrees, respectively; $P < 0.05$). Body weight was not a significant source of variation for any traits evaluated ($P > 0.05$). Straighter hock angles on the lame leg could indicate an effort of the gilt to balance her body while moving due to the discomfort she might be experiencing in the lame leg.

Key Words: hock angle, lameness, replacement gilts

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018 Understanding tail biters and victimized pigs during outbreaks of tail biting. Y. Li[1,*], J. Anderson[2], A. Holten[2], A. M. Hilbrands[1], J. Holen[1], L. J. Johnston[1], [1]*West Central Research and Outreach Center, University of Minnesota, Morris,* [2]*University of Minnesota–Morris, Morris*.

Tail biting is a common problem in growing–finishing pigs, which can compromise health, growth, and welfare of pigs. Because tail biting is an abnormal behavior performed by tail biters toward victimized pigs, understanding these pigs may help us solve the problem. This study was conducted to evaluate immune function of tail biters and victimized pigs. Pigs (n = 240; 25.7 ± 2.9 kg initial weight) were housed in 8 pens of 30 pigs for 16 wk. Once visible blood on a tail appeared, pigs in that pen were assessed daily for tail score (0 = no damage, 1 = healed lesions, 2 = visible blood without swelling, 3 = swelling and signs of infection, and 4 = partial or total loss of the tail). Victimized pigs were defined as pigs with tail scores equal to or greater than 2. Meanwhile, a 2-h observation was conducted for 2 consecutive days to identify tail biters. In each pen in which tail biting occurred, blood samples were collected from victimized pigs on the day that tail biting was first observed as well as from tail biters and 2 control pigs with no sign of tail damage. Fourteen biters (6 barrows and 8 gilts), 30 victimized pigs (21 barrows and 9 gilts), and 28 control pigs (14 barrows and 14 gilts) were identified for blood sampling. Total serum protein and IgG concentrations were analyzed using the spectrophotometric method. Data were analyzed using the Glimmix model of SAS (SAS Inst. Inc., Cary, NC). Compared with control and victimized pigs, tail biters had lower total serum protein ($P = 0.01$; Table 018) and IgG concentrations ($P = 0.01$), suggesting poor immunity. There were no differences in total serum protein or IgG concentrations between control and victimized pigs. These preliminary results suggest that tail biters may experience compromised immunity.

Table 018. Total serum protein, IgG, and tail scores of control pigs, victimized pigs, and tail biters

Item	Control	Victims	Biters	$P <$
No.	28	30	14	
Total serum protein, g/L	66.1 ± 1.1[a]	64.5 ± 1.1[a]	60.3 ± 1.5[b]	0.01
IgG, g/L	14.0 ± 0.6[a]	13.1 ± 0.6[a]	10.6 ± 0.9[b]	0.01
Tail score	0.1 ± 0.1[b]	2.5 ± 0.1[a]	0.2 ± 0.1[b]	< 0.001

[a,b]Means within a row without a common superscript differ (P < 0.05).

Key Words: immunity, pigs, tail biting

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019 An assessment of swine marketed through buying stations and development of fitness for transport guidelines. M. McGee[1,*], A. K. Johnson[2], A. M. O'Connor[1], K. R. Tapper[1,3], S. T. Millman[1,3], [1]*Department of Veterinary Diagnostic and Production Animal Medicine, Iowa State University, Ames,* [2]*Iowa State University, Ames,* [3]*Department of Biomedical Science, Iowa State University, Ames*.

Culled breeding animals represent 3% of swine slaughtered in the United States. Pigs are culled for multiple reasons including body condition, injury, and poor performance. There are concerns that culled pigs face higher risks of becoming fatigued or nonambulatory during marketing and transport. The objectives of this study were to 1) explore the welfare of culled swine marketed through buying stations, 2) characterize the prevalence of different types of compromised swine, and 3) identify potential risk factors associated with fatigued and nonambulatory pigs. A survey was conducted at