

The Impact of Housing System on the Determination of Apparent Total Tract Digestibility of Energy and Dry Matter

A.S. Leaflet R2929

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Summary and Implications

The performance and growth of 176 gilts in three different housing systems was observed over a 7-day trial at the Iowa State Swine Nutrition Farm. Pigs were split into one of three systems, group pens (GP) with 20 pigs in each, individual pens (IP), or metabolism crates (MC). Pigs started with an initial weight of 48.5 kg, \pm 0.31, and were fed and watered *ad libitum*. Pigs in the GP systems had less apparent total tract digestibility (ATTD) than those in IP, which also had less ATTD than those in MC. This indicates that digestibility trials held in MC may be over-estimating ATTD of feed sources that are to be applied to a commercial or GP environment.

Introduction

Swine digestibility trials are primarily held in metabolism crates, which provide the most accurate data on total input and output. However, this limits research facilities that own crates and are capable to maintain them, in addition to studying a relatively small group of pigs. These limitations may lead to potential issues due to the differences between the metabolism crates, which are in a controlled setting, and a commercial facility, where the hogs have more space to move and interact with each other. If researchers were able to run digestibility studies on a larger scale, the data may be more reflective of a commercial setting.

Materials and Methods

One hundred seventy six gilts (48.5 kg, \pm 0.31) were randomly allotted into different housing systems (GP, IP, MC), with adjustments to the randomized groups in order to

achieve similar body weights across treatments. Feed and water were provided *ad libitum*.

Fecal collections were held twice a day for three days in each of the systems. Feed was also measured through the duration of the trial in order to determine average daily gain (ADG), average daily feed intake (ADFI), and gain to feed ratio (G:F).

Upon collection, fecal samples were frozen and at completion of the collection period samples were homogenized and subsampled. Both feed and fecal samples were assayed for dry matter content (DM), and gross energy (GE). Apparent total tract digestibility of dry matter and energy were calculated according to Oresanya et al. (2007).

ANOVA was carried out on the data using the MIXED procedure of SAS (Version 9.3; SAS Inst. Inc., Cary, NC) according to randomized complete block design with pen as experimental unit, housing system as a fixed effect, and ADG, ADFI and G:F as random effects.

Results and Discussion

Housing system did not significantly impact body weight ($P=0.40$) or ADFI ($P=0.15$). ATTD of DM increased as pen size decreased (MC=83.53%, IP=80.40%, GP=79.13%; $P<0.001$). Similarly, ATTD of GE matched this trend, increasing as pen size decreased (MC=84.08%, IP=81.29%, GP=79.96%, $P<0.001$). However, DE was different between MC and IP ($P=0.002$); there was no significant difference between IP and GP ($P=0.60$). There was also a difference in pen environment regarding ADG between GP and MC, and GP and IP, ($P<0.01$), but there was no significant difference between IP and MC ($P=0.96$). Data is summarized in Table 1. This indicates that collecting feces in group systems will result in lower estimates in ATTD. Therefore, it may be advantageous for applied research to be done in both metabolism crates and group penning in order to have the most accurate assessment of ATTD of a diet prior to applying it to a commercial setting.

Iowa State University Animal Industry Report 2014

Table 1. Effect of Housing Setting on pig ATTD.

	GP	IP	MC	SEM	P-Value
Start Weight, kg	48.68	48.28	48.43	0.31	0.88
Final Weight, kg	55.36	54.45	54.70	0.35	0.58
ADG, kg	1.06 ^a	0.88 ^b	0.90 ^b	0.03	0.01
ADF, kg	2.10	1.89	1.85	0.06	0.15
G:F, kg	0.50	0.49	0.49	0.02	0.93
Concentration, feces					
TiO ₂ , g/kg	2.54 ^b	2.70 ^b	3.19 ^a	0.06	<0.01
DM, g/kg	990.3 ^a	988.2 ^a	983.3 ^b	0.08	0.01
GE, Mcal/kg	4.91	4.87	4.91	0.01	0.36
ATTD, %					
DM	79.13 ^c	80.40 ^b	83.53 ^a	0.35	<0.01
GE	79.96 ^c	81.29 ^b	84.08 ^a	0.33	<0.01
DE, Mcal/kg					
DM	3.93 ^b	3.96 ^b	4.13 ^a	0.02	<0.01
As-Fed	3.53 ^b	3.56 ^b	3.71 ^a	0.02	<0.01

^{a,b,c} Symbolize statistical differences or trends among treatments $P \leq 0.05$ or $P \leq 0.10$ respectively.