

# Behavioral Associations during a Human Approach Test and Performance of Barrows Divergently Selected for Residual Feed Intake

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### Summary and Implications

The objective of this experiment was to examine the behavioral metric correlations and growth performance of barrows divergently selected for residual feed intake (RFI) during a Human Approach Test. Forty low- (LRFI, more feed efficient) and 40 high-RFI (HRFI, less feed efficient) barrows from the 8th generation Yorkshire selection lines were randomly selected. Barrows were evaluated in a Human Approach Test for zone crossing, zone 1 (defined as the mouth, nose, and/or face of the pig contact any part of zone 1), escape, freeze, urination and defecation frequencies and their effect on performance measures. Within the HRFI line, urination frequency accounted for 18.5% of the variation in ADG and 10<sup>th</sup>-rib back fat at off test ( $r=0.43$ ;  $P=0.01$ ) and 26% of the variation in loin eye area off test ( $r=0.51$ ;  $P=0.001$ ). Within the LRFI line, behavioral metrics did not significantly correlate with performance measures ( $P \geq 0.07$ ). In conclusion, urination frequency was moderately correlated with ADG, 10<sup>th</sup>-rib backfat- and loin eye area in HRFI barrows during Human Approach Test. Therefore, within the context of the ISU swine genetic selection program for improved lean accretion and feed efficiency, there were no negative behavioral metrics that determinately affected performance measures during the grow-finish period.

### Introduction

Feed is one of the largest costs in pork production; therefore, improving feed efficiency can increase producer profitability. Residual feed intake (RFI) is used to measure feed efficiency. Pigs that consume less feed than expected for maintenance and growth have a lower RFI (LRFI) and are more feed efficient compared to higher RFI (HRFI) pigs. Colpoys and others (2014) reported that LRFI barrows were less reactive to novelty compared to barrows from the HRFI

lines during the Human Approach Test. What remains unknown is how the behavior of LRFI and HRFI lines during a Human Approach Test affect performance during the grow-finish period. Therefore, the objective of this experiment was to examine the behavioral metric correlations and growth performance of barrows divergently selected for RFI during a Human Approach Test.

### Materials and Methods

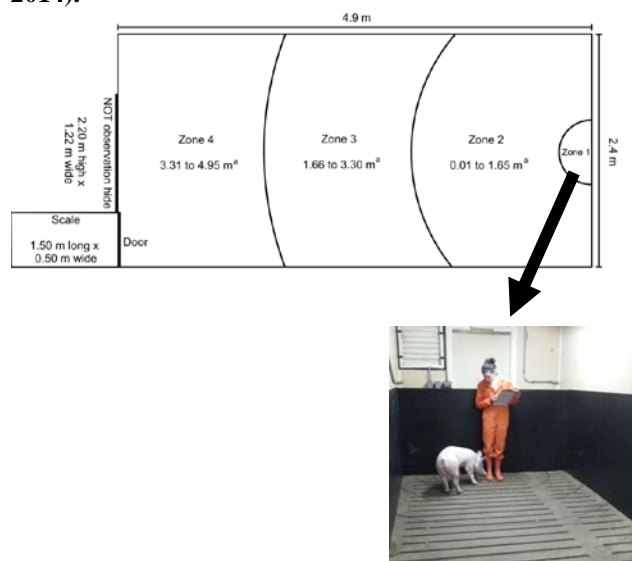
The protocol was approved by the Iowa State University Institutional Animal Care and Use Committee.

**Animals:** Forty low-(LRFI, more feed efficient) and 40 high-RFI (HRFI, less feed efficient) barrows ( $46.5 \pm 8.6$  kg) from the 8th generation Yorkshire selection lines were randomly selected.

**Location:** This work was conducted at the Lauren Christian Swine Research Center at the Iowa State University Bilsland Memorial Farm, near Madrid, IA.

**Human Approach Test:** Barrows were evaluated individually within a 4.9 x 2.4 m test arena. Arena sides were lined with black corrugated plastic at a height of 1.2m. During testing, barrows were individually moved from their home pen to the test arena, which was located in a different room within the same building. Each individual barrow was placed for one minute in a weigh scale where it could not see the arena. At the conclusion of the one minute, the weigh scale door was opened into the back corner of the test arena. An unfamiliar human wearing orange coveralls was standing still at the center of the opposite wall. Each barrow voluntarily approached the human. The Human Approach Test lasted for 10 consecutive minutes (Figure 1).

**Figure 1: Human Approach arena.** <sup>a</sup> Indicates the distance of each zone from the human, located in zone 1. Zones 2, 3, and 4 consisted of equal area (Colpoys et al., 2014).



**Behavioral acquisition:** Three color cameras (Panasonic, Model WV-CP-484, Matsushita Co. LTD., Kadoma, Japan) were placed above the test arena. Video was collected and saved to a computer hard disk using Handy AVI (HandiAvi version 4.3 D, Anderson's AZcendant Software, Tempe, AZ, USA) at 10 frames/seconds.

**Behavioral metrics:** During the 10-minute Human Approach Test, barrows were continuously observed via video analysis for zone crossing, zone 1, escape and freeze frequencies by one observer using Observer software (The Observer XT version 10.5, Noldus Information Technology, Wageningen, The Netherlands). The frequency of urinations and defecations were collected live (Table 1).

**Table 1: Ethogram of behavioral metrics recorded during the Human Approach Test.**

Frequency (n)	Description
Zone crossing	Sum of the total number of zone 4, 3, and 2 entrances
Zone 1	The mouth, nose, and/or face of the pig contact any part of zone 1 (defined as the human)
Escape	The front two or all four pig's hooves were off the arena floor in attempt to remove itself from the test arena
Freeze	No movement of any portion of the pig's body was visible for $\geq 3$ seconds
Urination	Excreting urine
Defecation	Excreting feces

**Performance measures:** Performance measures were collected over the grow-finish period, and included ADG, feed conversion ratio, live weight, 10<sup>th</sup>-rib backfat-and loin eye area off test. The ADG was estimated as the slope from simple linear regression of weekly body weight on number of days on test. Feed conversion ratio was a rate measuring of the efficiency with which the body of barrows convert feed into the desired output. The 10<sup>th</sup>-rib backfat- and loin eye area were measured by ultrasound using an Aloka 500V SSD ultrasound machine fitted with a 3.5-MHz, 12.5-cm, linear array transducer (Corometrics Medical Systems Inc., Wallingford, CT).

**Statistical analysis:** All data were evaluated using the correlation procedure of SAS<sup>®</sup> (version 9.3, SAS Inst. Inc., Cary, NC). Data were sorted by line and then within lines. Pearson correlation coefficients were determined among behavioral metrics and performance measures. Relationships were considered statistically significant at the  $P \leq 0.05$  level. For significant values the percent variation accounted for by the performance measure was calculated as the correlation coefficient ( $r$ ) raised to the second power and multiplied by 100 ( $r^2 \times 100$ ).

### Results and Discussion

Within the HRFI line, urination frequency accounted for 18.5% of the variation in ADG and 10<sup>th</sup>-rib back fat at off test ( $r = 0.43$ ;  $P = 0.01$ ) and 26% of the variation in loin eye area off test ( $r = -0.51$ ;  $P = 0.001$ ; Table 2). Within LRFI line, behavioral metrics did not significantly correlate with performance measures ( $P \geq 0.07$ ; Table 3).

### Conclusion

In conclusion, urination frequency was moderately correlated with ADG, 10<sup>th</sup>-rib backfat- and loin eye area in HRFI barrows during Human Approach Test. Therefore, within the context of the ISU swine genetic selection program for improved lean accretion and feed efficiency,

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movement, escape, freezing, urination and defecation responses made by LRFI barrows during the Human Approach Test did not detrimentally effect these performance measures.

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**Table 2: Pearson correlations (r) among HRFI<sup>1</sup> barrow performance and behavioral metrics during Human Approach Test.**

Behavioral metrics (n)		Performance measures				
		ADG	Feed conversion ratio <sup>2</sup>	Live weight <sup>3</sup>	10th-rib backfat <sup>4</sup>	Loin eye area <sup>4</sup>
Zone crossing	r	0.04	0.22	-0.15	0.12	-0.22
	P-value	0.80	0.19	0.38	0.46	0.17
Zone 1	r	0.02	-0.03	0.14	-0.06	0.18
	P-value	0.89	0.88	0.43	0.74	0.27
Escape	r	-0.03	-0.05	-0.09	0.08	-0.05
	P-value	0.85	0.76	0.59	0.65	0.75
Freeze	r	-0.02	0.08	0.02	-0.02	0.11
	P-value	0.89	0.62	0.92	0.91	0.52
Urination	r	0.43	-0.10	0.09	0.43	-0.51
	P-value	0.01	0.54	0.59	0.01	0.001
Defecation	r	-0.20	0.20	-0.15	-0.19	-0.03
	P-value	0.22	0.23	0.39	0.25	0.84

<sup>1</sup>High residual feed intake pigs consume more feed than expected for a given population.

<sup>2</sup>The ratio between feed intake and weight gain

<sup>3</sup>Off-test live weight data were collected prior to barrows leaving the farm. Targeted market weight was 118 kg or greater.

<sup>4</sup>10<sup>th</sup>-rib back fat and loin eye area measurements occurred when mean barrow body weight was 121.5 ± 7.2 kg at 241 ± 7 d of age.

**Table 3: Pearson correlations (r) among LRFI<sup>1</sup> barrow performance and behavioral metrics during Human Approach Test.**

Behavioral metrics (n)		Performance measures				
		ADG	Feed conversion ratio <sup>2</sup>	Live weight <sup>3</sup>	10th-rib backfat <sup>4</sup>	Loin eye area <sup>4</sup>
Zone crossing	r	-0.12	-0.23	-0.21	-0.15	0.20
	P-value	0.49	0.18	0.25	0.40	0.23
Zone 1	r	-0.01	-0.15	-0.31	-0.14	-0.01
	P-value	0.94	0.38	0.09	0.42	0.94
Escape	r	0.11	-0.17	0.09	-0.07	0.01
	P-value	0.51	0.33	0.63	0.71	0.94
Freeze	r	0.09	0.08	-0.01	0.27	-0.19
	P-value	0.59	0.63	0.96	0.11	0.27
Urination	r	-0.07	0.00	-0.10	0.31	-0.20
	P-value	0.69	0.99	0.58	0.07	0.25
Defecation	r	-0.20	0.02	0.07	0.08	0.17
	P-value	0.24	0.93	0.73	0.63	0.33

<sup>1</sup>Low residual feed intake pigs consume less feed than expected for a given population.

<sup>2</sup>The ratio between feed intake and weight gain.

<sup>3</sup>Off-test live weight data were collected prior to barrows leaving the farm. Targeted market weight was 118 kg or greater.

<sup>4</sup>10<sup>th</sup>-rib back fat and loin eye area measurements occurred when mean barrow body weight was 121.5 ± 7.2 kg at 241 ± 7 d of age.