RESEARCHREPORT

ANIMAL WELFARE

Title: Comparison of Handling Attributes and Physiological Indicators of Stress and Welfare During Marketing of Pigs from Conventional Small Pens and Large Pen Auto Sort – **NPB #05-137**

Investigator: Harold W. Gonyou, Ph.D.

Institution: Prairie Swine Centre, Inc, Saskatoon, Saskatchewan, Canada

Date Submitted: January 4, 2008

I. Abstract

Two hundred forty pigs raised in either conventional small groups (16-18 pigs/pen) or in large groups with auto-sort facilities (approx. 250 pigs/pen) were marketed on 10 days to assess differences in response to handling and meat quality. Pigs were loaded in groups of 4 pigs up a ramp onto a trailer. Transportation to the packing plant was 45 min in length and lairage was approximately 4 hours. Behavioral and physiological measures were taken prior to, during and after the handling and transport process. Standard meat quality assessment was conducted on loins from the animals 24 h after slaughter.

Pigs from small groups evidenced elevated rectal and ear surface temperatures early in the handling process, but no differences were found after arrival at the packing plant. Difficult groups of pigs were encountered when loading in both treatments, and similar levels of force, generally involving the use of the electric prod, were used. Pigs from small groups tended to take longer to load up the ramp than did pigs from large groups (78.7 vs 52.6 sec/group; $P < 0.10$). Meat quality differences were minor, with pigs from small groups having more marbling. No differences in meat quality scores reflective of differential responses to handling were evident. Handling assessments tended to favor pigs from large groups, but differences were minor, and no effect on meat quality was evident.

II. Introduction

To adopt new technologies and production techniques the swine industry must not only understand the impact upon production, transportation and pork quality, but also the welfare implications for the animals. Even though there are some concerns regarding the production and economic impacts of large pen auto-sort (LPAS) technology, it has demonstrated tremendous potential to impact all facets of pork production ranging from feed management to marketing opportunities to environmental impact. The majority of scientific analysis of LPAS technologies completed to date have relied on computer modeling and not on-site comparative evaluation (Li et al, 2003, Preckel et al, 2003, Brumm 2003).

If the projected benefits were fully realized the economic impact on the industry could exceed hundreds of millions of dollars.

Currently there has been extensive on farm anecdotal analysis; however there has been minimal in-depth comparative data in commercial production systems and no comprehensive comparative evaluations of LPAS technology.

However, Brumsted et al. (2004) demonstrated significant reductions in DOA/DIP through a historical analysis of packing plant kill sheets to determine the impact of LPAS technologies on animal welfare and transportation efficiencies. LPAS is reputed to improve the handling attributes of pigs during market, and if this is the case, could improve the welfare of pigs during one of the more stressful events of the production system. A clear demonstration of such improvement would be of benefit to the pigs and the industry as a whole.

III. Objectives

The handling involved in marketing pigs is stressful and challenges their welfare status. Preliminary research and anecdotal evidence suggest that pigs from large pen and automatic sort systems are easier to handle and can significantly reduce the economic impact of the marketing procedure. The objectives of this study are to:

Goal 1: Compare the handling attributes of pigs reared in conventional small pen systems and large pen auto sort systems.

Goal 2: Evaluate physiological indicators of stress and welfare associated with the loading, transport and unloading procedures of animals from conventional and large pen systems, including meat quality conditions reflective of marketing stress.

IV. Materials and Methods

Three grower/finisher rooms were used in the study. One was equipped for conventional small groups of 16-18 pigs/pen, with fully slatted floors, a two-space wet/dry feeder, and thermostatically controlled ventilation. Two rooms were equipped for large pen auto-sort (LPAS), with either central or peripheral feeder locations in the food court. Flooring, space allowance/pig, pig/feeder ratio and ventilation were identical to the small group room. The large groups ranged in size from 200 to 280 pigs. All LPAS pigs were required to pass through the scale to access the food court for at least 4 weeks of each trial.

Ten trial groups were tested in the study. Each trail group consisted of 12 pigs from a LGAS room and 12 pigs from the small group room. All pigs were within normal market weight parameters at the time of test. Pigs were individually identified by ear tag and market tattoo. During each trial the pigs were brought from their production pen to a processing pen in groups of four. After the initial data collection the animals were moved to a holding pen in the loadout area where they were held approximately 30 minutes before loading. They were loaded in groups of four, within treatment, up a ramp into a transport trailer. Once all pigs had been loaded, into a single transport group, additional data were collected from the pigs prior to transport. On several occasions this set of data collections were abbreviated in order to maintain the overall schedule. Pigs were then transported for approximately 45 min to the commercial slaughter facility. Upon unloading the pigs were held in a separate holding pen for data collection and until slaughter approximately 4 hours later.

Physiological sampling occurred in the processing pen after removal from the animals' home pens, on the transport trailer after loading, and in the holding pen at the abattoir immediately after unloading. Measures consisted of salivary cortisol, rectal temperature, surface temperature behind the ears based on infrared measurement, a breathing score and a skin blotchiness score. During the loading of each group of 4 pigs we recorded the degree of force required to load (board only, voice and slapping, or electric prod). When the prod was used we recorded the number of shocks given to the group. Time required to load each group was also recorded. Loins from the pigs were obtained 24 h post-slaughter and assessed using standard meat quality procedures. These included pH, Minolta Color Analysis, Japanese color score, and drip loss.

V. Results

Objective 1. Pigs from large groups tended to load more quickly (Table 2, $P < 0.10$). Although the time taken to load a group of 4 pigs varied considerably, it took approximately 50% longer to run pigs from small groups up the loading ramp. The need for electric prods, as defined in this study, was similar for both treatments, with virtually all groups requiring their use (after 30 sec of loading without prods). However, the number of shocks applied to a group, although similar statistically, reflected the amount of time needed to load pigs from each treatment.

Objective 2. Ear and rectal temperatures, and breathing and skin scores, should be reflective of heat balance within the pigs, with higher values for any of these variables indicative of increased heat generation. The only differences observed were early in the handling of the pigs, with an increase in rectal temperature after removal from the pen, and an increase in ear temperature once on the transport trailer for the pigs from small groups (Table 1, $P < .05$). Cortisol levels, reflective of acute stress, increased approximately 3-fold from in the barn prior to loading, to after unloading at the plant. However, these values did not differ between large and small group treatments.

Meat quality measures evidenced significant differences between treatments for marbling, and three of the Minolta light variables. Pigs from small groups had a higher degree of marbling and higher light reflectance (L*), but also a redder colour (a*), (Table 3, $P < 0.05$). The trends, although not statistically significant, among other meat quality scores would suggest slightly less response to stress in large group pigs (see pH, color, and Japanese color).

VI. Discussion

The differences observed between the group size treatments in handling, physiological responses, and meat quality were few and minor in magnitude. Some evidence of increased heat generation was evident during the early portions of handling in pigs from small groups. Pigs from large groups tended to load more quickly, and perhaps as a result the number of electric shocks applied was numerically fewer. Both treatments responded to the loading/transport/unloading stress with increased levels of cortisol, with a trend to higher responses in pigs from large groups. Meat quality results reflected few differences that could be attributed to differential responses to handling. Rather, differences in marbling and light reflectance could indicate differences in the rearing environment.

This study represents a comparison of responses to handling of pigs from large and small groups on the same farm, and through the same loadout and transportation vehicle. As such, confounding that may occur when analysing treatments when farms represent different treatments was avoided. Under these conditions we found only minor differences in handling, although pigs from large groups did tend to load more quickly.

Meat quality effects due to handling stress may have been masked by the 3-4 hour lairage time used in this study. This length of holding is preferred within the industry because it does attenuate problems during marketing, particularly if short transportation times are involved.

VII. Lay Interpretation

When handled through the same facilities, pigs from large and small groups required similar levels of force during handling. Difficult groups of pigs were encountered in both treatments. However, pigs from large groups tended to load more quickly. Pigs from the two treatments had similar physiological responses to handling. When given adequate lairage time to recover from handling and transportation, meat quality was similar between group size treatments.

Table 1: Physiological Data

Prehandling (Barn)

	Group Size			
	Large	Small	SE	*P*
Ear Temp	34.0	34.5	0.33	0.18
Rectal Temp	39.2	39.5	0.09	0.02*
Cortisol	11.4	10.4	0.70	0.32
Breathing Score	1.0	1.02	0.03	0.34
Skin Score	1.01	1.11	0.08	0.21

Truck

	Group Size			
	Large	Small	SE	*P*
Ear Temp	32.2	33.8	1.19	0.01*
Rectal Temp	40.0	40.1	0.26	0.68
Breathing Score	1.08	1.1	0.05	0.68
Skin Score	1.20	1.21	0.10	0.93

Plant

	Group Size			
	Large	Small	SE	*P*
Ear Temp	32.7	33.5	0.66	0.10
Rectal Temp	39.1	39.1	0.12	0.95
Cortisol	31.8	27.1	3.25	0.13
Breathing Score	1.07	1.04	0.03	0.35
Skin Score	1.38	1.33	0.08	0.64

Table 2: Loading Process

	Group Size			
	Large	Small	SE	*P*
Level of Encouragement	2.83	2.90	0.08	0.47
Number of Shocks	8.30	12.03	3.37	0.21
Duration of Loading	52.58	78.71	10.84	0.09

Table 3: Meat Quality

	Group Size			
	Large	Small	SE	*P*
pH	5.75	5.71	0.02	0.12
Texture	3.36	3.25	0.08	0.29
Colour	3.43	3.24	0.08	0.08
Marbling	2.51	2.71	0.13	0.04*
L*	51.8	53.4	0.91	0.02*
a*	2.60	2.95	0.23	0.05*
b*	10.25	10.18	0.72	0.92
Japanese Colour	3.45	3.36	0.12	0.21
Drip Loss	9.74	9.88	0.45	0.77