PE4.80 Animal welfare and meat quality of pigs being transported long distance using a pot-belly trailer during two seasons of the year 280.00

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Abstract—The present study assessed the effects of vehicle design on the stress response and meat quality variation in pigs transported long distance in two different seasons of the year. During six weeks per season (summer and winter), 1,170 pigs were transported 8 hours on a pot-belly trailer. A sub-sample of 180 pigs, randomly distributed through all compartments, was equipped with heart rate monitors and blood sampled at exsanguination for the analysis of lactate concentration. Another sub-sample of 270 pigs (including those used for the physiology study) was used for meat quality evaluation. Meat quality parameters such as pH, light reflectance and drip loss were assessed in the longissimus dorsi (LD) and semimembranosus (SM) muscles, and pHu in the adductor (AD) muscle. In summer, pigs located in the bottom nose (BN) compartment presented the highest heart rate and pigs in the belly (BD) the lowest during loading (P<0.05). Blood lactate levels at exsanguination were also higher (P<0.05) in pigs transported in the BN compared to those located in the upper (UD), middle (MD) and BD decks. A higher pHu and lower drip loss were also found in this season in meat from pigs located in the BN compared to those transported in the other trailer locations (P<0.05). More pronounced differences among trailer locations were found in the winter season. Heart rate and blood lactate levels were higher (P<0.05) in pigs located in the BN. This higher stress response resulted in higher (P<0.05) pHu value in all muscles and lower (P<0.05) drip loss in the LD and SM muscles. As expected, higher stress response and pHu values and drier pork were found in the winter season as a result of cold stress. The contribution of vehicle design to these results is shown by the similar, although lower, stress response and meat quality variation in the summer transports.

Index terms - Stress response, meat quality, pig transport.

I. INTRODUCTION

Transport is a very stressful phase of the pre-slaughter period for pigs as it disrupts their homeostasis in response to several potentially stressful factors, such as interaction with humans, unfamiliar noises and smells, vibrations and sudden speed changes of the truck, variations in environmental temperature and lower individual social space. Poor welfare of pigs during transportation results in animal losses (deads-on-arrival and downers), carcass condemnations and poor meat quality. In Western Canada, the large extension of the territory and the centralization of the slaughter industry, with more pigs being killed in fewer larger plants, force pig producers to transport animals for long distances. This has resulted in the increased use of pot-belly (PB) trailers that can transport large loads (up to 230 pigs) in a single journey. However, this vehicle is criticized for the difficult handling at loading and unloading due to the presence of multiple steep internal ramps resulting in higher risk of animal losses during transport. The objective of this study was to evaluate the effects of pot-belly design on animal welfare and meat quality in pigs being transported long distance in two different seasons of the year.

II. MATERIALS AND METHODS

A. Animals and treatments

This study was conducted in Western Canada in the summer and winter of 2008. A total of 1,170 crossbred pigs (116±8 and 121±5 kg body weight in winter and summer, respectively) were transported in each season (6 weeks or journeys per season) from Saskatoon (Saskatchewan) to Brandon (Manitoba) for 8 h using a

PB trailer accommodating 195 pigs on 4 decks (upper or UD, bottom nose or BN, middle or MD and belly or BD decks). Pigs were loaded and unloaded through three steep internal ramps: a first one of 22˚ slope going to the UD (compartments 1, 2, 3 and 4), a second one of 32˚ slope going to the BN (compartment 5) and a third one of 22˚ slope going to the B (compartments 9 and 10). Pigs were loaded in groups of six. Within each group, one pig was chosen for the physiological study (30 pigs/journey) and one for the meat quality assessment (45 pigs/journey including pigs used for the physiological study). Selected pigs were randomly distributed through the compartments. Pigs were fasted for 8-9 h before transport and for a total of 21 h before slaughter, were kept in lairage for 1.5 h and were slaughtered by cardiac arrest stunning and exsanguination in the prone position. Following slaughter, carcasses were split in two halves, eviscerated and blast chilled for two hours. At 24 h post mortem, the left loins and hams were transported to the cutting room for meat quality assessment.

B. Physiological measurements

Each pig used for the physiological study was equipped with a Polar monitor (Polar Electro Canada) recording heart rate at 5 sec. intervals during the pre-transport and transport periods. Blood samples were also collected from these animals at exsanguination for the analysis of lactate concentration in plasma. Lactate levels were measured using a commercially available kit (Lactate Assay Kit; Biomedical Research Service Center, University of Buffalo, Buffalo, NY).

C. Meat quality measurements

Muscle pH was evaluated at 6 h and 24 h (pHu) in the longissimus dorsi (LD) muscle at the 3rd/4th last rib level, in the semimembranosus (SM) muscle and in the adductor (AD) muscle at 24 h using a pH meter (Oakton Instruments Model pH 100 Series, Nilis, IL) fitted with a Cole Parmer spear type electrode (Cole Palmer Instrument Company, Vernon Hills, IL) and an automatic temperature compensation (ATC) probe by insertion. Other measurements taken at 24 h post-mortem in the LD and SM muscles were: light reflectance by a Minolta Chromameter CR 300 according to the reflectance coordinates (CIE L*, a*, b*) and drip loss according to a modified ”juice container” procedure [1].

D. Statistical analysis

The experimental design was a one-way factorial (with the compartments as the levels of the factor to be compared) in a randomized complete block design (weeks as blocks). Specific contrasts were used to compare groups of compartments or sections of the truck.

III. RESULTS AND DISCUSSION

During summer, pigs loaded in the BN presented higher ($P<0.05$) heart rate at loading compared to those located in the BD, with heart rate of pigs loaded in the MD and UD being intermediate (Figure 1). During the waiting at loading, pigs from BN showed a lower ($P<0.05$) heart rate compared to pigs loaded in the other compartments as they were the first to be loaded and thus had the time to recover from loading stress before departure. Overall, during transport, pigs loaded in the UD and MD had higher ($P<0.05$) heart rate compared to those transported in the BD, with heart rates of pigs located in the BN being intermediate. Blood lactate levels at exsanguination were higher ($P<0.05$) in pigs transported in the BN compared to pigs loaded in the other compartments (Table 1). The higher heart rate and lactate levels may indicate the higher physical effort of pigs to negotiate the very steep ramp (32°) giving access to this deck. Meat quality was somewhat affected by this physical effort as showed by the higher pHu value in the AD muscle and lower drip loss in the SM muscle ($P<0.05$). During winter, pigs loaded in the BN showed a higher ($P<0.05$) heart rate at loading compared to pigs loaded in the MD, with pigs located in the BD and UD showing intermediate values (Figure 2). The initial stress showed by pigs in the different compartments during loading was reflected in the overall heart rate of pigs during transport, which confirms the effect of handling at loading on the pigs’ response to transport stress [2]. Similarly, blood lactate levels were higher ($P<0.05$) in pigs transported in the BN, compared to those located in the MD. Meat quality was also affected by animal location during transport in winter with pigs transported in the BN showing higher ($P<0.05$) pHu values and lower drip loss values in the LD and AD muscles (Table 1) compared to pigs located in the UD and MD.

IV. CONCLUSIONS

This study confirms that the design of the pot-belly trailer, which is the most common vehicle for swine transportation in North America, imposes a certain

level of stress on pigs due to the need to negotiate multiple internal steep ramps at loading and unloading as showed by the heart rate, blood lactate concentration and pHu increase. Although the effect of the season has not been studied, it seems that this effect on the physiological response and meat quality variation is more pronounced in the winter due to the additive effect of cold stress [3, 4].

ACKNOWLEDGEMENTS

Authors wish to thank Ontario Pork, Maple Leaf Pork, Natural Sciences and Engineering Research Canada, Alberta Pork, SaskPork, Manitoba Pork and the Agricultural Development Fund of Saskatchewan for the financial support. The authors also would like to thank all the students and technicians that helped conduct these experiments. J.A Correa thanks F. Ménard Inc. for allowing him pursue his Ph.D. studies during the working hours.

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