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Effects of applying preslaughter feed withdrawal at the abattoir on behaviour, blood parameters and meat quality in pigs

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ABSTRACT

To study the effects of starting time of feed withdrawal on behaviour during loading and lairage, and meat quality (pH, colour and drip loss) in pigs, a total of 700 pigs were distributed into two groups. One group (FARM) was fasted for 18 h at the farm before transport and for 6 h before slaughter (including 2 h transport and 4 h lairage), while for the other group (PLANT) fasting time started at the departure from the farm (2 h transport plus 22 h lairage). Total fasting time was 24 h before slaughter for both groups. Fasting treatments did not influence blood parameters. PLANT pigs had longer fights ($P < 0.05$) than FARM pigs during lairage and produced darker ($P = 0.02$) and drier ($P = 0.03$) loins. Based on the results of this study, it may be preferable to commence feed withdrawal at the farm.

1. Introduction

Feed withdrawal is a recommended practice for on-farm preparation of pigs before slaughter in order to prevent animal losses or travel sickness during transport (Averós, Knowles, Brown, Warriss, & Gonsálvez, 2008; Bradshaw et al., 1996; National Farm Animal Care Council, 2014), to reduce carcass contamination due to lower risk of gut contents spillage during carcass evisceration (Saucier et al., 2007) and to improve pork quality (Faucitano, Chevillon, & Ellis, 2010). A feed withdrawal time between 16 and 24 h appears to be an acceptable compromise to obtain optimal carcass yield and pork quality and safety (Eikelenboom, Hoving-Bolink, & Sybesma, 1991; Faucitano et al., 2010). The application of this on-farm fasting interval has been also reported to decrease the proportion of dead-on-arrival (DOA; Guàrdia, Gispert, & Diestre, 1996) and total transport losses (DOA and non-ambulatory pigs; Stewart, Ritter, Culbertson, Mann, & Wofford, 2008).

Despite these potential advantages, however, fasting is sometimes only applied from the departure from the farm to the abattoir in Canadian swine farms (Aalhus et al., 1992; Viau & Champagne, 1998). The reason for this misapplication is the producers' concern about the risk of slower growth rate of pigs remaining in the pen and the lack of a shipping room where the heaviest pigs can be transferred to ahead of loading time and feed be withdrawn at the same time (Viau & Champagne, 1998). If, on one hand, this practice may still prevent the risk of full stomachs at slaughter, provided the 16–24 h fasting time is respected by imposing longer lairage time at the abattoir, on the other hand, it may reduce the welfare of pigs during transport and handling (Guàrdia et al., 1996; Stewart et al., 2008). Furthermore, longer lairage time is known to result in higher risk of fighting in mixed groups of pigs leading to higher incidence of dark, firm and dry (DFD) pork (Faucitano et al., 2010; Guàrdia et al., 2005, 2009).

The objectives of this study were to study the effects of starting time of fasting preslaughter, either on-farm or at the departure from the farm, on behaviour during loading and lairage, blood parameters and carcass and meat quality in pigs.

2. Material and methods

All experimental procedures performed in this study were approved by the institutional animal care committee on the basis of the current guidelines of the Canadian Council on Animal Care (2009).

2.1. Animals and treatments

In this study, a total of 700 crossbred pigs raised at a commercial swine growing-finishing farm and fed a standard commercial diet were randomly selected, tagged, weighed and distributed into two groups of 350 pigs each (BW: 123.7 ± 4.0 kg and 123.2 ± 3.9 kg; $P = 0.25$) on the day before the departure from the farm to the abattoir.

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The first group (FARM) had feed withdrawn for 18 h at the farm before the transport (feeder locked at 1 pm), loaded at 7 am, transported for 2 h and kept in lairage at the abattoir for 4 h before slaughter, whereas the second group (PLANT) had access to the feeder until start of loading (1 pm), was transported for 2 h and kept in lairage at the abattoir for 22 h. Overall, a 24 h feed withdrawal time prior to slaughter was applied for both groups. At the time of loading for each transport (7 trips in terms of one per week) one batch of 50 pigs per fasting treatment was formed by collecting pigs randomly (or mixed) from 11 pens within each treatment based on the slaughter weight. Pigs were thus shipped to the abattoir over 7 slaughter days (weeks or replicates; 50 pigs × 2 treatments × 7 replicates). Pigs were loaded onto two similar trucks (one truck/treatment) in groups of 5 pigs by a trained handler using paddles and boards and transported at a loading density of 0.43 m^2/pig. The handler at the farm, and the two drivers and trucks were the same throughout the 7 weeks. A randomization of truck loading order and drivers was done at each load to avoid the confounding effect of the truck and driver on the response of the pigs to transport, as reported in previous studies (Peeters et al., 2008; Schwartzkopf-Genswein et al., 2012).

On arrival at the abattoir, pigs were unloaded using a whip only and driven to separate lairage pens on the basis of the treatment group as they were in the truck (25 pigs; no mixing). In each lairage pen, pigs were kept at a stocking density of 0.58 m^2/pig. At the end of the lairage period, pigs were driven to a CO_2 stunner and exsanguinated in the prone position.

2.2. Behavioural observations

2.2.1. Behaviour at loading

Behaviour of pigs during loading was recorded using three digital camcorders (DCR-HC48; Sony, Sony of Canada Ltd., Toronto, Canada), two installed in the alley to the loading ramp and one in the loading ramp. All occurrences of pig behaviours and handler interventions (Table 1) were counted for each loading group of 5 pigs from a predetermined start gate in the farm alley up to the trailer gate for an overall distance of 12 m. Video recordings were analyzed by two trained observers using a handheld Psion Workabout computer (HC-110, Psion Inc., Mississauga, Canada). Inter-observer agreement was 91.8%. The total time taken to load the treatment pigs from the starting gate to the trailer gate averaged 25.6 ± 3 min.

2.2.2. Behaviour during lairage

Behaviour during lairage was recorded using video cameras (WV-BP50, Panasonic Canada Inc., Mississauga, Canada) installed over the pens and connected to a digital encoder (Nextiva S5712e, Verint, Melville, NY). Images were captured by the Omnicast system (version 4.0; Genetec Inc., Montreal, Canada) at a frequency of 5 to 7 images/s during two periods of lairage which excluded the time of showering (first 20 min and last 40 min of lairage time) to avoid the confounding effect of this practice on pig behaviour (Weeding, Guise, & Penny, 1993). The first period was of 2 and 3 h for FARM and PLANT pigs, respectively, and started from the end of the first shower, while the second period covered the last 2 h of lairage before the start of the last shower. Scan sampling was used at 2 min intervals to determine the number of pigs lying down. Number and duration of fights were determined at the group level using continuous sampling. A fight was considered when two or more animals performed a sequence of the following behaviours for >3 s.: biting, head knocking, pushing and shoving each other, with no greater intervals than 10 s. between behaviour occurrences (D'Eath, 2002; Pitts, Weary, Pajor, & Fraser, 2000). Proportion of pigs lying down, and number and duration of fights were calculated per period of 30 min. in two ways: forward from the beginning of lairage and backward prior to slaughter. To assess the recovery rate of the pigs after transport, the time necessary for 75% of the pigs from the same pen to rest (latency to rest) was also determined by the percentage of pigs lying down. Video recordings were analyzed by two trained observers and inter-observer agreement was 94.2%.

2.3. Blood parameters

Blood samples were collected from the bleeding wound of 210 pigs (15 pigs/treatments/replicates) in a plastic cup and lactate values were immediately assessed in duplicate with the Lactate Scout Analyzer (Lactate Scout, EKF Diagnostic GmbH, Magdeburg, Germany) by dipping two test strips (two strips/animal) in the collected sample. Later on, 10 mL of blood were collected in a tube (BD Vacutainers; VWR International Ltd., Montreal, Canada) to extract the serum for creatine kinase (CK) analysis. Serum samples were kept at room temperature (~23 °C) for 1 h before refrigeration at 4 °C. The next day, serum samples were centrifuged at 4 °C for 12 min at 1400 *g*, transferred to Eppendorf tubes (1.5 mL), and stored at −80 °C until analysis. CK concentrations were measured with a creatine kinase-sl kit (Creatine Kinase-SL Assay of Chemicals Diagnostic Limited, Vancouver, Canada). The intra-assay coefficient of variation for CK was 5.49%.

2.4. Carcass and meat quality measures

After slaughter, carcasses were eviscerated, split and chilled according to standard commercial practices. Hot carcass weight (HCW) was recorded and used to calculate carcass yield. Lean yield was obtained by measuring carcass fat and lean depth at the 3rd/4th last rib level by a Destron optical probe.

Meat quality was assessed in the carcass of the same pigs that were blood sampled (210 or 15 carcasses/treatments/replicates) by measuring pH at 1 h (pH_1) and 24 h (pHu) *post-mortem* with a pH meter

Table 1
Description of pig behaviours and interventions of the handler during loading (adapted from Weschenfelder et al., 2012).

	Description
Pig behaviour	
Slip/fall	Leg of pig splits away from the other legs or pig falls down (at least 2 legs buckled under)
Overlap	Pig mounts another pig, with its 2 front legs on the back of the other pig
180° turn	Pig makes a 180° turn, ending with its rear extended in the direction of intended movement
Back-up	Pig moves at least 2 steps rearward, opposite the direction of intended motion
Backward	Pig moves in the intended direction with its body oriented in the opposite direction
Underlap	Head of pig goes under the body of another pig
Vocalize	Pig vocalizes
Balk	Pig stops for >2 s.
Squeeze	Pig is squeezed at the door, corridor, or the exit of the ramp (or at the trailer door, when unloading)
Intervention of handler	
Vocal sound	Handler uses his voice to encourage forward movement of 1 or a group of pigs
Rattle noise	Handler uses the paddle to produce noise (one time)
Physical contact	Handler uses his hands, paddle, or board (or whip at unloading) to push and encourage forward movement of 1 or a group of pigs