Livestock Science 160 (2014) 124–131

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Water sprinkling market pigs in a stationary trailer. 2. Effects on selected exsanguination blood parameters and carcass and meat quality variation

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ARTICLE INFO

Article history:
Received 15 July 2013
Received in revised form
6 November 2013
Accepted 22 November 2013

Keywords:
Pigs
Transportation
Heat stress
Blood
Meat quality
Water sprays

ABSTRACT

In each of 12 weeks between May and September, 2011, two identical pot-belly trailers were loaded with 208 pigs each and transported to the slaughter plant (2 h trip). One of the two trailers was equipped with a water sprinkling system (WS) installed inside the truck compartments whereas the other one transported pigs under standard commercial conditions (control, CONT). The water sprinkling system was activated for 5 min in the stationary truck, both at the farm (at the end of loading) and at the plant (immediately before unloading). Blood lactate levels at exsanguination, carcass and meat quality traits were assessed on a sub-sample of randomly selected pigs ($n=384/576$). Exsanguination lactate levels were lower ($P=0.02$) in WS pigs compared to CONT, regardless of ambient temperature. Concurrently, the pH value of the *Longissimus dorsi* (LD) muscle at 1 h post-mortem (pH1) was greater ($P=0.009$) in WS pigs compared to CONT, regardless of ambient temperature. The effect of water sprinkling interacted with location inside the truck and ambient temperature. Water sprinkling reduced exsanguination lactate levels in pigs transported in compartments 5 and 8 (which are located at the front and at the rear of the middle deck, respectively) such that lower lactate was observed in compartment 5 at 15 °C ($P=0.03$) and 18 °C ($P=0.009$), and in compartment 8 at 22 °C ($P=0.03$) and 25 °C ($P=0.04$). In compartment 5, the pH1 value in the LD muscle of WS pigs was higher than in the CONT group at 18 °C ($P=0.002$), 22 °C ($P<0.001$) and 25 °C ($P=0.005$); pH1 in the SM muscle of WS pigs was lower at 18 °C ($P=0.01$) and 22 °C ($P=0.02$); and drip loss in the WS group was lower than in the CONT group at 22 °C ($P=0.01$), and at 25 °C ($P=0.02$). No significant effect was detected in compartment 4 (which is located at the rear of the top floor), or in compartment 9 (which is located at the front to the bottom deck). The results of this study showed that the sprinkling protocol applied was effective, particularly in some trailer compartments, in reducing stress response and improving pork quality of pigs transported in pot-bellied trailers.

DOI of original article: 10.1016/j.livsci.2013.12.019
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http://dx.doi.org/10.1016/j.livsci.2013.11.022

1. Introduction

In Canada, animal losses during transport increase during the summer months (Haley et al., 2008) as a result of the limited capability of pigs to cope with hot temperatures (Warriss, 1998). Truck design usually ensures adequate natural ventilation to prevent the internal temperature from reaching the upper threshold of thermal tolerance when the truck is moving, but when it is stationary, the internal temperature can rapidly increase (Marchant-Forde and Marchant-Forde, 2009). According to Weschenfelder et al. (2012), the compartments in the middle and bottom front of a stationary pot-belly (PB) trailer, the most common vehicle used for pig transportation in Canada, were up to 6 °C warmer than the external ambient temperature during Canadian commercial transports. These environmental conditions may have contributed to a higher incidence of poor quality pork from pigs located in these compartments as reported in previous transport studies using the PB trailer (Correa et al., 2009, 2013).

Recently, the European Food Safety Authority (EFSA) on the welfare of animals during transport recommended the development of water spraying devices to ensure pig comfort during transport (EFSA Panel on Animal Health and Welfare, 2011). Despite the interest in water spraying as a means to reduce thermal stress in pigs during transport, studies demonstrating its effects on animal welfare are few (Christensen and Barton-Gade, 1999; Colleu and Chevillon, 1999; Nanni Costa, 2009). Furthermore, no evidence of its effects on meat quality exists.

Recommendations on the cut-off ambient temperature to consider for the effective application of this procedure in a stationary truck are contradictory. Colleu and Chevillon (1999) and Ritter (2011) recommend to cool pigs using water sprinkling after loading at environmental temperatures starting from 10 °C. A 5-min water sprinkling at these ambient conditions appeared to reduce pigs' body temperature by 10% (3–4 °C), resulting in 25% lower mortality rate (Colleu and Chevillon, 1999). Whereas, Christensen and Barton-Gade (1999) and Grandin (2002) recommend to sprinkle pigs during truck stops when temperature is over 25–27 °C. Keeping pigs in a stationary vehicle prior to unloading has been shown to increase animal losses and the incidence of PSE (pale, soft, exudative) pork, especially when the temperature is over 20 °C (Driessen and Geers, 2001; Ritter et al., 2006), but sprinkling pigs prior to unloading at the slaughter plant is not a common practice and its impact on animal welfare and meat quality has never been assessed as yet.

The objective of this study was to evaluate the effectiveness of water sprinkling in a stationary truck (prior to transport and before unloading at the slaughter plant) at warm climate conditions, in terms of blood lactate and packed cell volume at exsanguination and carcass and meat quality parameters.

2. Materials and methods

2.1. Transport and water sprinkling protocol

A total of 4992 Duroc × (Yorkshire × Landrace) crossbred pigs (115 ± 10 kg) of mixed genders originating from a single commercial finishing farm were transported for the same distance (176 km) on the same morning to the same slaughter plant (average trip duration: 120 ± 13 min) using 2 tri-axle, dual purpose pot-belly (PB) trailers over a 12 week period (a trip or replicate/trailer/week) between June and mid-September 2011. Both PB trailers transported 208 pigs distributed across three decks and comprising 10 compartments (4 in the upper and middle decks and 2 in the bottom deck; Fig. 1) at a density of 0.40 m^2/100 kg (245 kg/m^2). Of the two trailers, one was equipped with a custom-made water sprinkling (WS) system (Weeden Environments, Woodstock, Canada), while the other had no sprinkling system installed (control, CONT). The sprinkling system was operated when the PB trailer was stationary for 5 min after the end of loading (i.e. immediately prior to departure from the farm) and during the last 5 min of the 30 min wait at the plant before unloading. Pigs were not sprinkled immediately upon arrival since there was no forced air ventilation available to remove excess humidity. Each 5 min sprinkling session delivered approximately 125 L of water evenly throughout the trailer through twenty two 180° spreader nozzles spraying inwards from each side of the trailer. Droplet size of the water was 900–1000 μm. Although this droplet size would apply more to the definition of water misting, in terms of very fine droplets that evaporate while in the air thereby reducing air temperature, in this paper the term water sprinkling, which is defined as coarse droplets that fall and wet the objects and the environment (NFPA, 2010), will be used based on the observation of the real water jet pattern through the sprinklers used in this study. In each replicate (or journey), test pigs (6 per compartment) were distributed into 4 separate compartments in each trailer, namely C4 (upper rear), C5 (middle front), C8 (middle rear) and C9 (bottom front) (Fig. 1). These 4 compartments were chosen based on previous results showing compartmental variations in microclimate (Brown et al., 2011b; Weschenfelder et al., 2012). Loading and unloading order between trailers and decks were randomized each week (by alternately loading either the top or the bottom deck first) in order to avoid the confounding effect of the outside temperature variation and wait time in each deck (or compartment). Environmental temperature during transport was recorded according to the hourly data from a nearby Environment Canada Weather station. The average ambient temperature registered between loading and unloading for each journey was 19.5° ± 3.8 °C, ranging from 13.6 to 25.8 °C. Loading took on average 34.2 min (range: 27.0 to 44.6 min), whereas unloading took 17.5 min (range: 14.6 to 20.4 min). With the objective to simulate standard transport conditions, once arrived at the slaughter plant trucks waited 35.5 min (range: 29.0 to 39.6 min) before being unloaded.

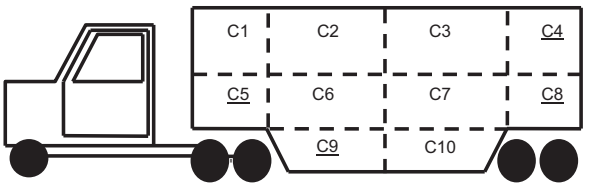

Fig. 1. Compartment position inside the Pot-Belly trailer. Test compartments are underlined.