



Water sprinkling market pigs in a stationary trailer. 1. Effects on pig behaviour, gastrointestinal tract temperature and trailer micro-climate



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ABSTRACT

Pigs are often transported to slaughter under conditions outside their thermo-neutral zones, which can lead to reduced welfare and increased losses. Water sprinkling in barns is used to control microclimate resulting in pig body temperature reduction and improved welfare; however there is no clear evidence of these effects during transport. The aim of this study was to observe the effect of sprinkling pigs in trailers on behaviour and body temperature during transport and lairage, as well as to observe the effects on trailer microclimate. In each of 12 weeks, 2 pot-belly trailers with 208 pigs each ($n=4992$) were transported from the same farm on the same day 2 h to slaughter. One trailer was equipped with sprinklers that ran for 5 min (~ 125 L) before departure and before unloading, the other trailer served as the control. In each trailer, 4 compartments were outfitted with cameras, ammonia detectors and temperature/humidity data loggers. The gastrointestinal tract temperature (GTT; °C) of 4 randomly chosen pigs ($n=384$) in each test compartment was recorded using orally administered data loggers. Trailer and deck loading order were randomized. Behaviour during transport, unloading and lairage was recorded from video or live observations. Data were analysed through ANOVA with ambient temperature external to the trailer (AmbT) as a covariate. AmbT averaged $19.5\text{ °C} \pm 3.8\text{ °C}$ (range: $13.6\text{--}25.8\text{ °C}$). Sprinkled trailers showed lower ($P=0.002$) increases in internal compartment temperature from loading to unloading, smaller ($P<0.001$) decreases in humidity and no difference in ammonia levels. At $\text{AmbT} > 23\text{ °C}$, there was no effect of sprinkling on behaviour on the trailer, but at $\text{AmbT} < 23\text{ °C}$, more pigs stood on sprinkled trailers ($P<0.05$). Sprinkling did not affect slips or falls during unloading. In lairage, latency to rest was reduced as AmbT increased for all compartments ($P<0.05$); sprinkled pigs spent more time lying ($P<0.05$) and had fewer drinking bouts than controls ($P<0.001$) regardless of AmbT. GTT increased between loading and

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departure and decreased during transit for all pigs ($P < 0.001$); and sprinkling tended to further reduce GTT at arrival at $AmbT > 24^\circ\text{C}$ ($P = 0.08$). These data suggest that sprinkling pigs in a stationary vehicle when $AmbT$ exceeds 23°C has the potential to prevent increases in body temperature during short duration transport without detrimental effects on ammonia levels or behaviour during unloading.

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1. Introduction

Transportation is one of the most stressful experiences in pig's life, particularly when it occurs during environmental extremes (Ritter et al., 2009). As pigs do not sweat, they are limited in their capacity to maintain core body temperature in hot environments and are sensitive to heat stress (Bligh, 1985). In-transit mortality has been reported to increase beyond ambient temperatures of $16\text{--}17^\circ\text{C}$ (Haley et al., 2010; Warriss and Brown, 1994) and increase with increasing temperature (Haley et al., 2010; Sutherland et al., 2009). Furthermore, the frequency of heat stress indicators (e.g. panting, skin discoloration) has been shown to increase in warmer months (Ritter et al., 2008). As ambient temperature increases, pigs modify behaviour to reduce heat production and increase heat dissipation by reducing activity (Brown-Brandl et al., 2001; Hicks et al., 1998) and increasing contact with cool or moist surfaces (Hillmann et al., 2004; Huynh et al., 2005). Water sprinkling systems in barns have been shown to increase the evaporative cooling capacity and decrease the temperature–humidity index (Haussermann et al., 2007), but there are currently few methods available to cool pigs during transport besides natural ventilation. Both active ventilation and water misting in a stationary truck are credited with reducing deaths during transport (Colleu and Chevillon, 1999; Nielsen, 1982). A few studies showed that the effects of mechanical ventilation on the welfare of pigs during transport can be either positive (Nielsen, 1982) or have no effect (Warriss et al., 2006). Colleu and Chevillon (1999) found that sprinkling pigs at an ambient temperature above 10°C in one deck of a trailer helped to reduce skin temperature by 10% compared to the non-sprinkled pigs in another deck on the same trailer. However, considering known differences in micro-climate within a trailer (Brown et al., 2011; Weschenfelder et al., 2012), the effect of sprinkling pigs within compartments in a trailer needs to be determined. The aim of this study was to examine the effect of sprinkling water within full trailers of pigs at the farm before departure and before unloading at the plant on trailer conditions, behaviour and gastrointestinal tract temperature during transport, unloading and lairage. Effects on measures of stress physiology and meat quality are reported elsewhere (Nannoni et al., 2014).

2. Materials and methods

All experimental procedures performed in this study were approved by Agriculture and Agri-Food Canada (AAFC) Animal Care Committee in Sherbrooke (QC) based on the current guidelines of the Canadian Council on Animal Care (2009).

2.1. Experimental design and sprinkling treatment

On the same day in each of 12 weeks from May to September 2011, 2 naturally ventilated pot-belly trailers of 208 market-weight pigs each ($\sim 115\text{ kg}$ live weight, $n = 4992$) were shipped 2 h from a commercial finishing farm to a slaughter plant within Ontario (Canada) in a randomized complete block design. The trailers were loaded with pigs from the same farm, shipped on the same morning to the same plant in each of the weeks. Pigs were withdrawn of feed for approximately 18 h before transport and 22 h before slaughter. One of the trailers was equipped with a custom-made water sprinkler system (Weeden Environments, Woodstock, Canada) and the other identical trailer served as the control. The sprinkler system was made primarily of plastic piping mounted on the outside of the trailer. A total of 22 nozzles, each with a 180° spray pattern, faced into the trailer through the side vents and distributed water evenly across the compartments. Droplet size of the water was $900\text{--}1000\text{ }\mu\text{m}$. Water was supplied by an external well water source through a garden hose attachment. The treatment consisted of sprinkling all pigs in the trailer for 5 min immediately before departure from the farm and for 5 min immediately before unloading, after a 30 min wait in the receiving yard of the slaughter plant in order to gain the benefit of evaporative cooling during transport and lairage at the plant. Five minutes of sprinkling has been used previously (Colleu and Chevillon, 1999) and was determined to be sufficient to wet the skin of the pigs without creating unmanageable water runoff from the trailer for the current study. Pigs were not sprinkled immediately upon arrival since there was no forced air ventilation available to remove excess humidity. Each sprinkling session delivered approximately 125 L of water evenly throughout the trailer.

Four compartments on each of the trailers were chosen for data collection based on previous results showing compartmental variations in microclimate with warmer temperatures being reported in the front and bottom compartments (Brown et al., 2011). Test compartments were compartment 4 (top deck, back; L-shaped, 2.51 m wide $\times$ 5.18 m long $\times$ 1.32 m high); less the vacant space left for ramp loading: $1.26 \times 2.59\text{ m}^2$, compartment 5 (middle deck, front; 2.51 m wide $\times$ 3.05 m long $\times$ 1.27 m high), compartment 8 (middle deck, back; 2.51 m wide $\times$ 5.18 m long $\times$ 1.52 m high) and compartment 9 (bottom deck, front; 2.51 m wide $\times$ 3.76 m long $\times$ 0.99 m high) (Fig. 1). Side panels were not used at all throughout the study. Trailer decks were bedded evenly with wood shavings approximately $0.5\text{--}1.0\text{ cm}$ deep. Stocking density was $\sim 245\text{ kg/m}^2$, resulting in 21 pigs in compartment 4, 16 pigs in compartment 5, 28 pigs in compartment 8 and

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