

# Effects of transport conditions and vehicle design on the welfare and meat quality of pigs in Western and Eastern Canada

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## SUMMARY

This study examined transport conditions and behavioural and physiological responses of pigs transported in summer and winter, in both Eastern and Western Canada. Data were collected during all stages of transport, including loading, transport, unloading and lairage (waiting) at the abattoir. Measures included truck temperature, pig behaviour, core body temperature, heart rate, blood measures of stress and meat quality. The presence of steep internal ramps in pot belly trailers had a significant impact on the handling behaviour and heart rate of pigs at loading and unloading. Significant variation in temperatures was found between compartments within pot belly trailers during transport, both in summer and winter. The combination of handling conditions and truck temperatures had a significant impact on pork quality. In the winter trials a higher incidence of dark firm and dry (DFD) or moderate DFD pork was found, especially in the west where pigs experienced longer transport times. In the summer trials, a higher incidence of pale, soft and exudative (PSE) or moderate PSE pork was found.

## INTRODUCTION

Transport conditions (including loading and unloading procedures), and the design of transport vehicles can have a significant effect on the welfare of pigs, and on the economics of pork production. A recent Ontario survey found that death losses during transport were 0.17%. The mortality rate across Canada has been estimated at 0.10%, and corresponds to approximately 1.4 million kg of pork lost per year. Most research on the effects of transport conditions on pigs has been done in European countries where moderate temperatures and shorter transport distances prevail. In comparison, swine transport in Canada is highly variable

in terms of the types of vehicles used, distance of transport, and seasonal changes in temperature. The objective of this study was to examine the influence of transport conditions on the behaviour, physiology and welfare of pigs in eastern and western Canada, in both summer and winter. Our goals were to evaluate differences between truck types, truck compartments and seasons in each region, and to use this information to identify problem areas and potential solutions.

*“When transporting hogs to market, pigs in the bottom front compartment had the highest heart rate measures at unloading, and also produced the highest incidence of DFD pork”*

## EXPERIMENTAL PROCEDURES

Trials were conducted both in summer and winter, with 6 trials per season in the east (Quebec) and west (Saskatchewan and Manitoba). Animals transported were market weight pigs, including both males and females, averaging approximately 115 kg liveweight. A total of 24 truckloads (total of 3,756 animals) were transported in the east, and 12 truckloads (total of 2,145 animals) were transported in the west.

In western trials, a dual purpose (cattle and pig) dual-axle pot belly (PB) truck was used to transport pigs, containing 5 internal ramps to move pigs to different levels within the truck. In eastern trials, two types of trucks were used: a double deck



Testing for Meat Quality

10 wheel truck (10W) and a tri-axle potbelly trailer (PB, Figure 1). The 10W truck had no internal ramps, and the PB truck used two internal ramps to move pigs onto the upper and lower decks. Loading density on all trucks was 0.41 m<sup>2</sup>/pig. The western pot belly truck carried 195 pigs per load, while the eastern pot belly truck carried 228 and the 10W truck 85 pigs per load.

Temperatures on trucks were monitored, as was the behaviour of pigs during loading, transport, unloading, and lairage. Behaviour during transport was recorded on all trucks using still image digital cameras to determine the percentage of animals standing, sitting or lying during transit. During the lairage period, behaviour was recorded using video cameras to determine the number of pigs lying. Physiological measures, including core body temperature, heart rate, and blood indicators of stress (lactate and CPK), were collected on a total of 504 animals in the east, and 330 in the west. Carcass and meat quality data were collected on 792 pigs in the east and 495 pigs in the west. Skin damage was assessed as a measure of aggression. Pork quality was assessed in loin and ham muscles, including pH measured at 6 h and 24 h, light reflectance and drip loss.

Data from the western and eastern trials were analyzed separately. Statistical analysis was used to determine differences between seasons and truck compartments, as well as between truck types in the eastern trials.

## RESULTS AND DISCUSSION

The comparison of truck types in the eastern trials indicated that, overall, transporting pigs on the 10W truck provided superior results in terms of reduced death losses and improved welfare. Compared to the PB truck, pigs took less time to load and unload on the 10W truck, and showed fewer incidents of slipping, falling, backing and balking during loading and unloading. The 10W truck provided more consistent internal temperatures, whereas temperatures within PB trucks varied significantly. Measures of CPK and lactate were also lower in the 10W truck. Differences between HR and core body temperatures on the two trucks are less clear in terms of their effects on welfare. Pigs on the 10W truck had lower core body

temperatures at the farm, but higher temperatures and HR during transport. These differences are likely due to the study protocol, as the 10W truck was always loaded last, giving pigs on the 10W less time to acclimatize before transport. Thus pigs on the 10W truck experienced the additive effects of loading and transport.

On PB trucks, significant variation was found within the truck, both in terms of truck microclimate and the response of pigs. In both eastern and western trials, compartments that required negotiation of ramps and turns had the greatest impact on physiological measures in pigs. In the western PB truck, the bottom front compartment (or 'nose') was accessed by 2 ramps, and was also the warmest area on the truck. Pigs in the bottom front compartment had the highest HR measures at unloading, and also produced the highest incidence of DFD pork. Pigs in the upper-level compartments had higher HR and core body temperatures during loading and waiting on the farm. The upper compartments were also cooler during the transport period, and this may benefit pigs in summer, but be detrimental in winter. It should be noted that pigs in this study were transported in early morning, and different results may have been found if pigs were transported in midday. Pigs loaded on the middle deck of PB trucks did not have to negotiate any internal ramps, and these animals also showed lower HR during transport, and lower CPK and lactate levels at slaughter.

The effect of season was significant, but the effects varied between eastern and western trials. In western trials, higher HR and core body temperatures were found in winter, and CPK and lactate levels were also higher in winter. Whereas in the eastern trials, HR and core body temperature were higher in summer, as were blood lactate levels. Pigs in the west experienced a much longer transport time (roughly 8 h vs. 2 h in the east) and colder winter temperatures, and thus winter transport may pose a greater challenge in these conditions. In contrast, pigs in the east had a short transport time, and experienced higher summer temperatures and increased death losses in summer (Table 1), suggesting that summer transport may be a greater challenge under these conditions

**Table 1.** Incidence of death losses and compromised animals at unloading in Eastern and Western trials

Region	Western trials		Eastern trials			
	Pot belly		10 Wheel		Pot belly	
Season	Summer	Winter	Summer	Winter	Summer	Winter
N	1167	953	510	512	1368	1367
NANI* (n)	0	0	1	0	7	1
NAI* (n)	0	2	0	0	2	1
Death loss (n)	1	0	1	0	6	1
Rectal pro-lapse (n)	4	2	1	2	2	13

\* NANI: Non-ambulatory, non-injured. NAI: Non-ambulatory, injured

### IMPLICATIONS

Transporting pigs on trucks such as the 10W truck, which do not require the use of internal ramps, provides benefits in terms of improved welfare and ease of loading. Unfortunately these trucks are less economical as they have much reduced capacity compared to PB trucks. In the long run, alternative designs should be sought, such as trucks including hydraulic lifts and/or minimal ramps, to minimize handling stress at loading and unloading.

On the PB trucks, compartments involving ramps and turns had the greatest impact on pig welfare in terms of HR and core body temperature. Further studies will examine the effects of ramp angle and alternative ramp configurations on the stress response of pigs. The PB trucks also showed significant variability in temperature between different compartments. Further research should be done to assess ways of controlling truck conditions to retain heat in winter, while exhausting moisture, and to increase cooling in summer. Potential solutions include adjusting panelling/vent configurations to optimize air flow, addition of insulation, use of fans, adjusting pig density, or sprinkling pigs in hot weather to increase evaporative cooling. Due to the different results observed in eastern and western trials, future studies in the east will focus on ways of cooling pigs in summer, while studies in the west will focus on the effect of transport time on the welfare and meat quality of pigs.

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**Figure 1.** Trucks used for Eastern trials.  
**1a.** Pot-belly truck used in Eastern trials (PB),  
**1b.** Ten wheel truck used in Eastern trials (10W).