Transport of early weaned piglets

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Abstract

Millions of segregated early weaned (SEW) piglets are transported each year. Problems affecting even a small percentage of these piglets may have a significant welfare impact. The Recommended Codes of Practice for the Care and Handling of Farm Animals [CARC, 2001. Recommended Code of Practice for the Care and Handling of Farm Animals: Transportation. CFIA, Nepean, Ontario; CARC, 2003. Recommended Code of Practice for the Care and Handling of Farm Animals: Pigs, Addendum Early Weaned Piglets. Canadian Pork Council, Ottawa, Ontario] recognize SEW piglets as having special requirements. However, these are not well understood. It can be assumed that SEW piglets will be affected by transport stressors similar to those affecting older pigs. In addition, weaning which coincides with transport, is likely to have additive affects, resulting in a complex of stressors affecting the early weaned piglet.

Only a few studies have been conducted on transport of early weaned piglets. These studies have indicated that transport of early weaned piglets for up to 24 h is not more detrimental than early weaning with respect to early feed consumption, as both transported and control piglets lose similar body reserves and recover at the same time. However, if temperatures during transport are high (35 °C) recovery may be delayed. Following early weaning piglets lose an average of 6.9 ± 2.4% of their body weight and recover weaning weight at 3.7 ± 0.98 days. ‘Poor doers’, piglets below weaning weight at 7 days post-transport, are an important exception to these averages. While most piglets learn to feed within 2–3 days, ‘poor doers’ are still not meeting their physiological requirements after 7 days, an indication of poor welfare. Piglets transported for longer durations (12, 24 h) spend more time drinking after transport and are therefore at higher risk for dehydration than non-transported piglets. Winter transport may be an important risk factor. Air temperature in unheated trucks is often well below comfort levels. Winter transport was observed to result in more ‘poor doers’, lower ear skin surface temperatures, delayed establishment of the dominance hierarchy and increased fatigue. These findings are consistent with higher stresses during winter transport.

Temperature and duration of transport have additive effects and put piglets at risk for dehydration, low feed consumption and fatigue. Every effort should be made to avoid transport at temperatures above 30 °C.

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1. Introduction

The swine industry in North America has adopted a segregated early weaning (SEW) management system. In this system young (14–19 days) piglets are transported to facilities separate from housing for older pigs, at a time when maternal antibodies are protective. This segregation breaks the cycle of diseases passed from sow to piglet. However, SEW necessitates the transport of piglets, which may be stressed by both early weaning and transport. Millions of piglets are transported each year typically for 4–20 h. Problems affecting even a small percentage of these piglets may have a large impact on welfare and economics. Transport is generally accepted as a stressor affecting both the physiology and behaviour of pigs (Stephens and Perry, 1990; Bergeron and Lewis, 1997; Warriss, 1998; Lambooij, 2000). Transport of early weaned piglets has many factors in common with transport of older pigs including mixing, fasting, temperature extremes, vibration and noise. However, responses to these factors during transport have been largely unstudied in the early weaned piglet.

1.1. Slaughter hogs

Transport of slaughter hogs, typically 90–120 kg, have been studied extensively (Warriss, 1998) and work on smaller (40–60 kg) hogs has extended information in this area. Transport of hogs has been shown to increase cortisol levels (Nyberg et al., 1988; Bradshaw et al., 1996a; Cook et al., 1996, 1998; Parrott and Mission, 1989; Parrott et al., 1998; Geverink et al., 1999; Jong et al., 2000). Although cortisol levels are not always increased it seems clear that transport is stressful for slaughter pigs. Transport may vary with respect to the degree of stress imposed, based on a number of factors. Rough transport is more stressful than smooth travel (Bradshaw et al., 1996b). Duration of transport is also a primary factor contributing to transport stress. Long durations increase fatigue (Lambooy, 1988) and increase feed and water deprivation (Lambooy, 1988). Even relatively short journeys of 3 h can produce high creatine phosphokinase (CPK) levels indicative of muscle fatigue (Warriss et al., 1998). Transport durations as low as 1 h have been shown to increase cortisol levels although weighing and loading may have contributed to this response (Cook et al., 1996). Temperature is also a crucial factor governing the amount of stress an animal experiences during transport (Lambooy, 1988; Randall, 1993; Warriss and Brown, 1994). Temperature can fluctuate rapidly in vehicles during transport (Tarrant and Grandin, 2000) and is dependent on many factors including density, ventilation and floor type (Randall, 1993). Humidity is also a stress imposing factor at temperatures above 30 °C (Randall, 1993).

Density may affect many aspects of transport (Randall, 1993; Lambooij, 2000). Due to the cost of transport there is a tendency to over rather than under stock trailers. At high stocking densities temperature may be unacceptably high in hot weather and ventilation will be important (Randall, 1993). Higher densities, which do not allow all pigs to lie down simultaneously may cause constant shifting of positions allowing little rest (Lambooy et al., 1985) and producing higher CPK levels (Warriss et al., 1998). With too much space, pigs may
have difficulty maintaining balance while standing (Gade and Christensen, 1998). Fighting may also increase at lower densities (Gade and Christensen, 1998). Some studies have found no effect of stocking density for short durations (Guise et al., 1998). However, comparison of studies is sometimes difficult due to the variation in methodology, pig age/weight and densities studied.

Transport, although often studied as a single stressor due to the similarity of current commercial practices, is undoubtedly a multifactorial stressor including the effects of loading, mixing and fasting. Loading, an integral component of transport, has been shown to increase serum cortisol even before transport has been initiated (Bradshaw et al., 1996a,b). Mixing is also known to increase cortisol levels (Parrott and Mission, 1989; Ekkel et al., 1995; Bradshaw et al., 1996a; Jong et al., 2000).

Although fasting is not necessarily a requirement during transport of pigs, feed and water are often not provided to livestock transported in groups and consequently fasting may contribute to stress. As duration increases, fasting is likely to have greater physiological effects. Fasting for 24 h has been shown to increase serum cortisol (Parrott and Mission, 1989). Fasting for 25–48 h produces a weight loss of 4–12% in slaughter weight hogs (Lambooy et al., 1985; Jones et al., 1985; Brumm et al., 1987; Lambooy, 1988). Based on carcass composition at slaughter, weight losses were judged to be 20–50% non-carcass weight loss (gut contents) and 50–75% carcass losses (largely water) (Jones et al., 1985; Lambooy et al., 1985). However, providing water during transport may not be an effective solution. Pigs provided with access to water on a 2-day journey did not consume adequate quantities of water and lost as much weight as pigs without water (Lambooy et al., 1985).

1.2. Grower hogs

Grower pigs are typically transported at 20 kg. These pigs are also stressed during transport (Hicks et al., 1998) but unlike slaughter hogs have the potential to be affected for longer periods of time post transport. Transport duration may therefore be a greater concern in these younger pigs. Nyberg et al. (1988) showed that a 5 h transport at 12 weeks of age could affect cortisol, corticosteroid binding globulin and glucocorticoid receptor concentrations, 3 months later, at slaughter. Brumm et al. (1987) found that grower pigs were able to cope, measured by performance, with journeys of 15 h if provision of feed and water occurred immediately after unloading. However, other studies (McGlone et al., 1993; Hicks et al., 1998) have shown that a journey of only 4 h significantly increased weight loss (5% and 2.9%, respectively). Fasting is stressful for grower pigs as well as market hogs and results in increased cortisol (Becker et al., 1992). The higher the weight loss (McGlone et al., 1993) and the longer the fast (Meunier-Salaun et al., 1991), the higher the stress level based on serum cortisol measurements. Mixing, which results in more fighting (Arey and Franklin, 1995), vibration which has been shown to be aversive (Perremans et al., 2001) and noise (Otten et al., 2004) which has been shown to increase cortisol levels may also contribute to stress during transport.

2. Early weaned piglets

SEW piglets because of the young age at which they are weaned are recognized as having special needs (CARC, 2001, 2003). However, only a few studies on transport of early weaned piglets are available. Although it can be assumed that early weaned piglets will be affected by many of the same factors which have been shown to contribute to transport stress in older pigs,
the effect this has on the early weaned piglet may be quite different from that on older hogs (Bergeron and Lewis, 1997).

2.1. Transport versus control

Experimental transport of SEW piglets (17 ± 1 days), by van, showed lying and standing to be the most prevalent behaviours during transport (Lewis and Berry, 2006). Lying occupied 75.6% and standing 21.6% of the time in transit. High levels of resting (79.6%) following weaning are common (Metz and Gonyou, 1990) and this may have affected the level of lying during transport. However, market hogs (Lambooy et al., 1985) and grower pigs (Hicks et al., 1998) were also observed to spend most of the time during transport lying down. Consequently, the high levels of lying may also be a result of fatigue related to transport. This interpretation was corroborated by the increased percentage of time spent resting on the day following 6 h (80.2%), 12 h (82.2%) or 24 h (81.9%) of transport when compared to control (77.5%) piglets (Lewis and Berry, 2006).

The assumption was made that piglets which recovered well from transport would begin feeding and drinking early, which would be reflected in normal feeding and drinking patterns and weight gain. Feeding was infrequently observed (0.5%) on the first day in the weanling pens whether piglets were transported or not (Lewis and Berry, 2006). Since limited feeding occurred in both control and transported piglets and is a common finding following early weaning (Metz and Gonyou, 1990; Gonyou et al., 1998; Worobec et al., 1999), the low levels of feeding were attributed to weaning. Piglets transported for 12 and 24 h consumed more feed on the second day in the weanling pens than the non-transported control piglets (Lewis and Berry, 2006). Fasting would be expected to increase the motivation to feed and is the likely explanation for the increase in feed consumption following transport. However, piglets transported for 24 h were 1 day older when placed on feed than control piglets. When the feeding behaviour of piglets the same age (19 ± 1 days) was compared, control piglets were observed to feed more frequently (1.3%) than piglets transported for 24 h (0.57%). The same comparison can be made at 20 ± 1 days of age (24 h: 4.3%, control: 6.6%) (Lewis and Berry, 2006). It is unclear, to what extent age and motivation were causal components in feeding frequency. Typically piglets lose weight (6.9 ± 2.4%) following weaning, reach a minimum weight at 2.4 ± 1.2 days and regain their weaning weight at 3.7 ± 0.98 days. These values were not different for transported and non-transported piglets (Lewis et al., 2005).

2.2. Duration of transport

Activity showed a temporal pattern during transport. After 12 h of transport, standing frequency dropped and lying frequency increased. Standing averaged 36% and resting 60% in the first 12 h of transport (Lewis and Berry, 2006). In the second 12 h of transport lying frequency rose to 91.5% while standing dropped to 7.4%. A similar pattern was described by Lambooy et al. (1985), which the authors associated with fatigue. However, the temporal pattern in early weaned piglets was less defined in summer than in winter (Lewis and Berry, 2006) indicating that some of the increase in lying after 12 h of transport was related, not only to fatigue, but also to thermoregulation (huddling).

Mixing is an integral component of transport of early weaned piglets. It is both stressful (Blecha et al., 1985; Ekkel et al., 1995; Merlot et al., 2004) and has been shown to increase fighting (Friend et al., 1983) in early weaned piglets. However, in spite of mixing, fighting was
infrequently observed in the first 6 h of transport (Lewis and Berry, 2006). Only two piglets were observed fighting indicating that transport delayed establishment of the dominance hierarchy, possibly due to increased stress or the novelty of the environment. Sitting, one of the behaviours identified as an indicator of ‘stress’ (Dybkjær, 1992), was more common in the first 12 h of transport (2.8%) than in the second 12 h (0.3%) (Lewis and Berry, 2006). Sitting was also most frequently observed during the first day in the weanling pens (0.49%), then diminished in frequency (0.29%) on day 2 and 3 (Lewis and Berry, 2006).

Increased resting, reduction in sitting and establishment of the dominance hierarchy later in transport may indicate that piglets became habituated to some elements of the transport environment. However, this habituation will not extend to hunger or thirst which is likely to increase with time in transit based on weight loss and increased hematocrit values (Berry and Lewis, 2001).

Drinking frequency was highest on the first day post-transport and increased as duration of transport increased (control: 2.4%, 6 h: 2.7%, 12 h: 3.0%, 24 h: 3.7%) (Lewis and Berry, 2006). In a simulated transport model, piglets transported for 24 h, regardless of temperature (20, 30, 35 °C) had higher hematocrits (41.1%) than controls (39%) (Berry and Lewis, 2001). These results indicated that piglets were thirsty and increased drinking post-transport to replace water losses incurred during transport.

2.3. Temperature during transport

Both summer heat and the cold in winter may influence behaviour, stress level and welfare of early weaned piglets. In summer, temperatures in North America can exceed 40 °C. In winter, night time lows can reach below −40 °C. The combination of low outside temperatures and the move by industry to utilize trailers without supplemental heating results in cold truck temperatures, a critical factor governing stress during transport.

Summer temperatures (hourly averages) measured on commercial transport ranged from 17.3 to 28 °C, and largely stayed within the comfort zone of young piglets (24–34 °C; CARC, 2003). Fall temperatures (1.4–31.2 °C) often fell below the comfort level at night but day time temperatures stayed within the comfort zone. Winter temperatures were always below the comfort level (−5 to 16.2 °C) (Lewis et al., 2005). The high temperatures recorded during fall journeys were thought to result from restricting air flow into the trailer in the early morning and failure to open the coroplast (side) panels early enough as day time temperatures rose.

Behaviour was affected by temperature during experimental transport. More fighting was observed on the truck during the summer (39 piglets) than during the winter (3 piglets) indicative that, in the colder truck environment in winter, social behaviours, such as establishing the dominance hierarchy, had a lower priority than thermoregulation (Lewis and Berry, 2006). Winter transport appeared to be more fatiguing for piglets as higher levels of lying extended to 3 days post-transport in this season, extended to only 2 days in summer, and was not observed in fall transport (Lewis and Berry, 2006). The observation of additional lying in the weanling pens following winter transport further indicates that the lying observed in transit in the winter was associated with thermoregulation rather than resting.

Skin temperatures measured at the surface of the ear in summer (36.2 °C) were significantly higher than ear temperatures measured in fall (27.0 °C) and winter (23.1 °C) (Lewis et al., 2005). Rectal temperatures were also higher in summer (39.2 °C) than in fall (38.7 °C) and winter (38.6 °C) (Lewis et al., 2005). These differences in ear and rectal temperatures were indicative
that physiological mechanisms were required to maintain core temperature. However, since the rectal temperatures were all within the normal range, it is not clear that these differences were an indicator of compromised welfare.

Simulated transport, in temperature controlled rooms, showed a combination of long transport (24 h) at high temperatures (35 °C) reduced the rate at which piglets regained weaning weight (Berry and Lewis, 2001). Following simulated transport, differences between treatments (temperature and duration) were apparent for up to 7 days post-transport but were no longer apparent by 14 days post-transport (Berry and Lewis, 2001).

Seventeen piglets (5.9%) were classified as ‘poor doers’, piglets which had not regained their weaning weight by 7 days post-weaning (Lewis et al., 2005). Preliminary observation of these piglets indicated that they were apparently healthy piglets which had not learned to eat enough feed to meet physiological requirements. These piglets represent an important welfare concern due to prolonged low feed consumption. ‘Poor doers’ were more commonly observed, 13 of 17 piglets, following winter transport.

3. Conclusions

Increasing transport duration from 6 to 12 and 24 h increased fatigue, but was also associated with some indicators of habituation including decreases in sitting and establishment of the dominance hierarchy. Increasing transport duration was also associated with increased drinking post-transport and higher hematocrits, indicative of rising levels of dehydration and thirst. Both summer transport and winter transport increased fatigue, while winter transport also resulted in lower ear skin temperatures, delayed dominance hierarchy development, thermoregulatory behaviour and an increase in ‘poor doers’. Temperature and duration of transport must be considered carefully prior to initiation of transport and piglets not recovering well from weaning and transport must be provided with additional care. More studies are needed in this area, especially studies correlating behaviour to physiological indicators of stress.

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