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Influence of Housing System and Number of Transported Animals on Transport-induced Mortality in Slaughter Pigs

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Abstract

The study monitored the effect of the housing system and the number of animals transported together on transport-induced mortality of slaughter pigs in the Czech Republic in the period from 2004 to 2008. Concerning the type of housing during the fattening, the lowest mortality rate during the subsequent transport to slaughter houses was detected among pigs fattened on solid floor (0.047%) and on deep bedding (0.084%). The highest mortality during transport was detected among pigs fattened on fully or partially slatted floor (0.139%), a significant difference ($p < 0.01$) was found compared to other housing types. Assessment of the influence of individual pig load size on mortality showed the lowest mortality among pigs transported in loads of up to 40 animals (0.053%). Mortality during the transport in loads of the size of 41 to 120 animals was 0.130%, and for loads of the size over 120 pigs the mortality rate was 0.156%. These mortality rates are significantly higher ($p < 0.01$) compared to the load sizes of up to 40 animals.

Fattening pig, transportation, slatted floor, solid floor, deep bedding, welfare

The number of transport-induced deaths of animals on the way to the slaughter house indicates how animal welfare is secured during transport, but may be also influenced by pre-transport treatment (Malena et al. 2006, 2007; Večerek et al. 2006abcd; Voslářová et al. 2006, 2007ab). Warriss (1998b) reported that the transport-induced mortality of pigs ranged from 0.1% to 1.0% among different European countries. Von Altrock and von Holleben (1999) focused on the sudden deaths of pigs during transport, and they reported that due to the stress load of the pigs, sudden deaths caused by lactacidosis and cardiac shock occurred in 0.4% of the pigs during transport to the slaughter house. In the Czech Republic Večerek et al. (2006c) and Malena et al. (2007) explored transport-induced pig mortality on the way to the slaughter house, and they discovered a mortality rate of 0.107% and 0.108%, respectively.

An important factor affecting the welfare of pigs during transport is the concentration of the transported animals. Warriss (1998a) discovered that higher stocking densities during pig transport are associated with higher mortality rates. Ritter et al. (2007) reported that the transport floor space had a major effect on transport losses and suggested that these losses be minimised to a floor space of 0.462 m^2/pig or larger. Lambooy and Engel (1991) proposed limiting the loading density to ca 232 kg/m^2 (ca 0.47 m^2/pig) for animal welfare and meat quality reasons. On the basis of measurements of the space needed for sternal recumbence and direct observations of pigs at different stocking densities, Warriss (1998a) reported that the minimum space required was equivalent to about 250 kg/m^2 for normal slaughter pigs of 90 to 100 kg live weight. Guise et al. (1998) found no evidence that the transport stocking density affected the carcass quality or welfare of 95-kg pigs on short journeys (3 h). Kim et al. (2004) detected a lower concentration of stress hormones in the low-density group than in the medium- or high-density group. Also detected was a significant interaction between the stocking density and transportation time in these blood

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variables. Pale, soft and exudative (PSE) carcass appeared most frequently in the high-stock density group. Also the number of pigs transported in one delivery affects the loading density and animal welfare. Gade and Christensen (1998) discovered that giving pigs more space during short transport did not make them lie down. On the contrary, there was continuous disturbance from the other pigs and with a space of 0.42 and 0.50 m^2/pig they had difficulty in maintaining balance when the vehicle swerved at bends or on poor road surfaces.

The relationship between the rearing system and welfare of pigs is well documented, but the effect of the rearing system on transport mortality in pigs has not been studied yet. Some authors describe differences in behaviour during transport as a consequence of different rearing conditions (Geverink et al. 1999). Pigs reared in barren environment are likely to experience more stress during common pre-slaughter procedures including transportation, than pigs reared in enriched environment (de Jong et al. 2000; Gade 2008). Lebret et al. (2006) found non-significant effects of the rearing system on stress reaction at slaughter, but some meat quality indicators were influenced significantly. Effects of different housing conditions of slaughter pigs on pork quality characteristics are described also by e.g. Klont et al. (2001), Lambooij et al. (2004), Lebret et al. (2006), Gade (2008).

Materials and Methods

We evaluated the influence of the housing system and number of transported animals on the mortality of fattening pigs in connection with their transport for slaughter (i.e. death of pigs during transport or during lairage after transport) in one selected slaughter house in the Czech Republic in the period of 2004–2008. Data on the numbers of transported animals, origin of animals and the mortality rate were obtained from data of the state veterinary supervision and verified using data of the slaughter house operator.

To evaluate the effect of the number of pigs transported in the van, the deliveries were divided into 3 groups: up to 40 pigs in the delivery van, 41–120 pigs and more than 120 pigs in the van. Data on the number of animals in the van were obtained from records of the slaughter house operator who entered detailed data about the deliveries of animals, including mortalities, from the area where the animals were received (platform and stables). The numbers of transported pigs and numbers of dead pigs were monitored and the ratio between the dead pigs and the total number of transported pigs was calculated and expressed as percentage. The effect of the number of transported pigs in the van on transport-induced pig mortality on the way to the slaughter house was derived from the monitored results.

To evaluate the effect of the rearing system, the floor types in the stables of supplier companies were monitored (fully or partially slatted floor, solid (concrete) floor with or without bedding). Data were obtained from the breeders. The numbers of pigs transported from each rearing system and numbers of pigs that died during transport were monitored and the ratio between the dead pigs and the total number of transported pigs was calculated and expressed in per cent. The effect of the rearing system on transport-induced pig mortality on the way to the slaughter house was derived from the monitored results.

The results were processed statistically using the χ^2 test and statistical programme UNISTAT; the frequency was compared by means of contingency tables.

Results

The level of transport-induced mortality of pigs depending on the number of pigs transported in one load is displayed in Table 1.

Analysis of the effect of individual delivery size on mortality showed the lowest mortality in pigs transported in deliveries of up to 40 pigs (0.053%). Transport-induced mortality was higher in pigs transported in deliveries of 41 to 120 animals, or over 120 pigs (0.130% and 0.156%, respectively). The difference was significant ($p < 0.01$).

Table 1. Dependence of the transport-induced mortality rate in slaughter pigs on the number of pigs in delivery

Number of pigs in one load	Number of pigs transported	Number of loads	Number of dead pigs	
			Number	%
≤ 40	65 681	3003	35	0.053 [b]
41 - 120	186 390	1903	242	0.130 [a]
> 120	100 983	580	158	0.156 [a]

Values within a column with different superscripts differ significantly ($p < 0.01$)

Table 2 shows the effect of rearing system (floor type), used for housing during the fattening, on mortality during subsequent transport from breeding place to the slaughter house.

The lowest mortality rate was found in pigs transported from the solid (concrete) floor housing systems (0.047%). Higher, but not significantly, was the mortality rate of pigs transported from the deep-bedding housing systems (0.084%). Significantly

Table 2. Dependence of the transport-induced mortality rate in slaughter pigs on the housing system

Housing system	Number of pigs transported	Number of loads	Number of dead pigs	
			Number	%
Solid floor	21 117	865	10	0.047 [b]
Deep bedding	65 194	1969	55	0.084 [b]
Slatted floor	266 743	2652	370	0.139 [a]

Values within a column with different superscripts differ significantly ($p < 0.01$)

higher ($p < 0.01$), compared to those two types of rearing systems, was mortality rate of the pigs fattened on fully or partially slatted floors (0.139%).

Discussion

Apart from being a considerable economic loss, mortality rate of pigs may serve as an indicator of pig welfare. Baumann and Bilkei (2002) reported that gastrointestinal tract disorders were the most frequently recorded cause of emergency-culling or mortality in fattening pigs followed by lesions which involved the respiratory system, diseases involving the urinary system, cardiovascular disorders, lesions involved the locomotor system, systemic infections, social stress and cannibalism. Pig losses are common also during their transport to the slaughterhouses. The data on transport-induced mortality in pigs were published by e.g. Warriss (1998b), von Altrock and von Holleben (1999), Večerek et al. (2006c) and Malena et al. (2007).

Influence of the transport loading density on animal welfare is not clear, published data on optimal animal density in the vehicle or on the effect of its exceeding vary (e.g. Lambooy and Engel 1991; Guise et al. 1998; Warriss 1998a; Kim et al. 2004; Ritter et al. 2007). Current legislation valid in EU countries since the 5th of January 2007 requires all transported pig to have enough space to be able to lie down and stand up in their natural position. In order to comply with these minimum requirements, the loading density for pigs of around 100 kg should not exceed 235 kg/m^2 (Council Regulation (EC) No 1/2005). In our study, we monitored the effect of the number of pigs transported in a vehicle (loading density was kept within the limits required by regulations). Even when complying with regulation requirements, the density of pigs in a vehicle can vary according to the number of transported pigs, it can however be optimised by choosing a vehicle of appropriate size, or by using transportable dividers, keeping in mind that both too low or too high density of animals has a negative influence on the welfare of transported pigs (Gade and Christensen 1998; Warriss 1998a; Kim et al. 2004). Various numbers of pigs in one load are connected with different time requirements for loading, unloading and manipulation with pigs, i. e. with the time period when animals are exposed to an increased stress level connected with the transport. The transport-induced stress can be decreased when animals are handled by trained personnel, by choosing appropriate vehicle and devices for loading and unloading (e.g. Fischer 1996; Broom 2003, 2005; von Borell and Schaffer 2005), but the differences in handling groups of animals of different size cannot be disregarded. In our study, the effect of individual pig load size on the mortality level was found as follows: the lowest mortality was detected among the pigs transported in loads of up to 40 pigs (0.053%), whereas loads transporting more than 120 pigs have shown the highest level of transport-induced mortality (0.156%). Even though the transport was carried out by qualified personnel and vehicles complied with all regulation requirements, there was an effect of a higher stress level and its longer exposition during the loading and unloading of pigs that can not be completely avoided during transport by multi-level semi-trailer.

Because the rearing system has a significant influence on both welfare and health condition of pigs (Scott et al. 2006), it is reasonable to expect that the condition of pigs influenced by their housing during fattening will also show at the time of increased stress level connected with their transport to slaughter houses. Among the set of monitored pigs, the majority was fattened on fully or partially slatted floors. A negative effect of slatted floors on the welfare

of pigs, particularly concerning the effect on locomotive apparatus, has been described by e.g. Jorgensen (2003) and KilBride et al. (2008). In our study, this effect has also been demonstrated by higher mortality of pigs transported after fattening to the slaughter house from slatted floor housing compared to pigs transported from solid floor housing. The reason can be possible health problems as well as more sensitive reaction to stress during pre-slaughter procedures connected to pig transportation for slaughter, as has been described by e.g. de Jong et al. (2000), Lebret et al. (2006) and Gade (2008) concerning pigs fattened in conditions with lower animal welfare. No significant difference has been found between mortality of pigs transported to the slaughter house after fattening on solid floor without bedding and in deep-bedding, although slightly lower mortality has been detected among pigs housed without bedding. This floor type is the most similar to the floor to which animals are exposed during the transport, which might be of some importance, however, not enough animals have been transported from this kind of housing to allow coming to a solid conclusion. As for the animals' welfare, breeding on deep-bedding has been found more effective (e.g. de Jong et al. 2000; Klont et al. 2001; Lambooij et al. 2004). Our study shows that better welfare of animals bred on solid floor without slats results in a better physical and psychical condition, leading to better coping with stress and therefore lower mortality during the transport to slaughter houses.

In conclusion, our study shows that together with previously described factors influencing transport-induced mortality of pigs, e.g. transport distance, season, stocking density, humane handling (Warriss 1998ab; Kim et al. 2004; Večerek et al. 2006c; Malena et al. 2007; Ritter et al. 2007), the number of pigs transported in one load and the housing systems during fattening can also be considered as important factors. Our study has shown a significant increase of mortality in loads over 120 animals and higher mortality was also connected with transport of pigs fattened on fully or partially slatted floors, compared to solid floor systems.

Vliv typu ustájení a počtu přepravovaných zvířat na úhyny prasat při přepravě na jatky

V práci byl sledován vliv ustájení a počtu přepravovaných zvířat na úhyny jatečních prasat v souvislosti s jejich přepravou na vybrané jatky v České republice v období let 2004 - 2008. Z hlediska typu ustájení prasat při výkrmu nejmenší podíl uhynulých prasat při následné přepravě na jatky byl zaznamenán u výkrmu na bezroštových podlahách (0,047 %) a na hluboké podestýlce (0,084 %). Nejvyšší úhyny při přepravě byly zjištěny u prasat vykrmovaných na plně nebo částečně roštových podlahách (0,139 %), byl zjištěn významný ($p < 0,01$) rozdíl ve srovnání s předchozími typy ustájení. Při hodnocení vlivu velikosti jednotlivých zásilek prasat na úroveň úhynů byl zjištěn nejnižší počet úhynů u prasat přepravovaných při počtu do 40 prasat v jedné zásilce (0,053 %). Při přepravě prasat s počtem přepravovaných prasat v dodávce 41 až 120 byly úhyny 0,130 % a nad 120 prasat v dodávce 0,156 %. Tyto počty uhynulých prasat byly významně vyšší ($p < 0,01$) ve srovnání s přepravou prasat do 40 jedinců.

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