Comparison of Mortality Rates in Different Categories of Pigs and Cattle during Transport for Slaughter

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Abstract

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The death of animals during transport for slaughter is a major factor indicating the level of welfare in transported animals. However, research data that report the level of animal welfare as reflected in transport-related mortality rates of individual animal species and categories are missing. The present study focused on losses of pigs and cattle in the period from 1997 to 2006. Transport-related mortality rates were recorded by species and categories of animals and also for the following travel distances: up to 50 km, 51-100 km, 101-200 km, 201-300 km, and over 300 km. Rates differed according to species and category. The highest mortality rates were found in young sows, sows, and boars (0.2562%) followed by fattened pigs (0.1075%), excluded dairy cows (0.0396%), calves (0.0269%), and fattened cattle (0.0069%). Significant differences were found among mortality rates ($p < 0.05$). The lowest mortality rates occurred with shorter travel distances (< 50 km and 51-100 km) when compared to long travel distances (101-200 km, 201-300 km and > 300 km), with a significant difference ($p < 0.05$) between short and long travel distances being found in fattened pigs, fattened cattle and dairy cows. Mortality rates in animals during transport for slaughter show young sows, sows, and boars to be the most susceptible to transport-related stress, followed by fattened pigs, dairy cows, and calves, whereas the highest resistance was observed in fattened cattle.

Fattened pigs, sows, fattened cattle, dairy cows, calves, mortality, slaughter, transport distance

Transport to a slaughterhouse is a stress-inducing situation in pigs and cattle that may lead to subclinical changes, clinical manifestations of poor health, and to death. The level of transport-related stress in animals is affected by several factors.

Perremans and Geers (1996) report that loading and unloading affect the level of stress in transported animals, and that mixing with unfamiliar conspecifics has an impact on the level of stress in pigs during transport. Geverink et al. (1998) investigated the effect of regular moving and handling on the behaviour and physiological response of pigs. They found that pigs that had experience with leaving their home pen and with some other aspects of transport conditions were much more easily handled when loading. In his studies of stocking densities for slaughter pigs transported by road, Warriss (1998a,b) found that a higher mortality rate is associated with higher stocking densities. The impact of loading density on the level of stress in pigs intended for slaughter is also reported by Lambooy and Engel (1991), and Perremans and Geers (1996). Stress in pigs increases with greater transport distance or duration (Perremans and Geers 1996). Warriss (1998a) reported a higher mortality rate after longer journeys. According to the finding made by Werner et al. (2005), transport increases mortality rate in pigs for both long and short

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transport distances. The welfare of transported pigs is also affected by the style of driving. Bradshaw et al. (1996) found that the style of driving (rough vs. smooth) influenced biochemical indicators related to the level of stress in pigs, particularly plasma cortisol, beta–endorphin, and lysine vasopressin. Warriss (1998a) and Werner et al. (2005) found that ambient temperature during the transport had a major effect on the welfare of pigs, and also that genetic predisposition is an important factor in their stress response. Murray and Johnson (1998) studied the impact of the halothane gene on muscle quality and pre-slaughter deaths.

Warriss (1998a) found mortality rates in pigs during transport for slaughter in various European countries to range from 0.1 to 1.0%. Von Altrock and von Holleben (1999) report mortality in pigs resulting from stress during transport at about 0.4%. Večerek et al. (2006a) reported that the mortality rate in fattened pigs was 0.107% over an 8-year period. Fischer (1995) reported damage to the carcasses resulting from transport. Kozák et al. (2004) point out to the occurrence of immobile pigs caused by unsuitable handling during transport.

The level of welfare during the transport of pigs for slaughter is reflected in the quality of both the carcass and the meat. Troeger (1995) reported that product quality can be reduced by mechanical damage to animals being transported and by the development of stress-induced physiological processes in pigs that may reduce the quality of meat. This damage to the animals is reflected in veterinary decision-making about meat edibility and increases the incidence of meat being declared unfit for consumption due to its sensory characteristics, as reported by Kozák et al. (2003). The effect of loading density of pigs on the quality of meat was revealed by Lambooy and Engel (1991). Schutte et al. (1994) reported that damage to the carcass is often connected with transport. Kim et al. (2004) found that the incidence of pale, soft, and exudative (PSE) carcasses was greatest in a high density stocking group. Their results suggest that medium density may be preferable to low density stocking in long distance transportation. Guardia et al. (2005) studied variations in the risk of PSE carcasses and dark, firm, and dry meat (DFD), with the duration of transportation and stocking density during transport. Warriss (1998a) reported that the occurrence of DFD in pigs increases with long journeys.

The level of welfare in cattle during transport for slaughter, with regard to stress in animals, has been studied by several authors. Broom (2003) dealt with transport-induced stress in cattle particularly focusing on physiological, ethological, and other indicators. Fazio and Ferlazzo (2003) report that the response of animals to stressors depends on the duration and intensity of the stressors. Maria et al. (2004) studied the scoring system for evaluating the stress to cattle of commercial loading and unloading. Von Holleben et al. (2003) monitored the handling of slaughter cattle on journeys in Germany. Marahrens et al. (2003) addressed the problem of long distance road transport of cattle. Damage to the locomotor apparatus in cattle, due to improper handling during transport for slaughter, was observed by Pištěková et al. (2004).

Malena et al. (2006) found a transport-related mortality rate of 0.007% in fattened cattle during an 8-year period. Večerek et al. (2006b) found that the mortality rate in dairy cows was 0.038%. Chandra and Das (2001) focused on bruising in buffaloes in connection with handling and short-haul road transportation. Mechanical damage to cattle during transport may increase the probability that the meat will be unacceptable, as reported by Večerek et al. (2003). When studying the transport of steers, Gallo et al. (2000) focused on the effects of transport duration prior to slaughter on animal behaviour and carcass characteristics. The impact of transport-induced stress on meat quality in cattle was studied by Honkavaara et al. (2003). Villarroel et al. (2003a) examined the effect of commercial transport in Spain on cattle welfare and meat quality. The impact of stressful transport on meat quality was also reported by Hartung et al. (2003). Villarroel et al. (2003b) and Maria et al. (2003)

also studied the effect of transport time on sensory properties of beef. Gallo et al. (2001) studied the effects of a 36-hour road journey on some aspects of beef quality.

Wikner et al. (2003a,b) attempted to characterize factors affecting the level of stress in cattle during transport as assessed by animal behaviour. They found driving performance, handling during loading and unloading, and air quality in the vehicle to have an effect. Wikner et al. (2003a) dealt with the impact of various climatic conditions, stocking density, and transport duration on stress in cattle during transport. According to Costa et al. (2003), environmental conditions represent a major stressor affecting bulls' behaviour during road transport. Von Holleben et al. (2003) found stress factors to also include regrouping, loading, transport time, loading density, mounting prevention, unloading, and lairage time.

Inducers of stress in calves during transport were investigated by Grigor et al. (2001), who examined the effect of space allowance on physiological and behavioural responses. Van de Water et al. (2003) also report the effect of the location of calves on the truck. Steinhardt (2003) studied transport-induced stress in cattle and intensified human-animal contact on the reactions of animals exposed to transport. Lensink et al. (2000) dealt with influence of gentle contacts by stockpersons on the welfare of calves. Lensink et al. (2001a) studied previous experience with humans on calves' behaviour during transport. The influence of farmers' behaviour on calves' reaction to transport was investigated by Lensink et al. (2001b). Steinhardt and Thielscher (2000, 2002, 2003, 2005a) dealt with the reaction of dairy calves exposed to transport stress, particularly with regard to the effect of rearing conditions, husbandry systems, and different breeds. Mortality rates in calves during transport for slaughter was studied by Večerek et al. (2006c), who found a rate over an 8-year period of 0.026%. According to Lensink et al. (2000, 2001b) and Van de Water et al. (2003), improved conditions of transport will decrease the level of stress in calves during transport for slaughter, thus improving the quality of veal.

The aim of the present study was to investigate the differences in mortality rates in fattened pigs, young sows, sows and boars, fattened cattle, dairy cows and calves during transport for slaughter, in order to determine which categories of pigs and cattle appear to be the most susceptible to transport-induced stress. The present study also attempted to determine if the mortality rate within categories of pigs and cattle was affected by distance transported.

Materials and Methods

The numbers of animals such as fattened pigs, young sows, sows and boars, fattened cattle, dairy cows, and calves that were transported for slaughter and that died as a result of such transport (either in a vehicle or shortly after arrival to a slaughterhouse) were recorded in cooperation with the State Veterinary Administration of the Czech Republic over the period 1997-2006.

Transport of pigs and cattle was carried out from farms to slaughterhouses by means of road transport using trucks specifically designed for pigs or cattle. Travel distances were categorized into the following ranges: up to 50 km, 51-100 km, 101-200 km, 201-300 km, over 300 km.

Mortality in individual categories of pigs and cattle associated with transport for slaughter was recorded. The results obtained were used to evaluate the correlation between species and category and the transport-induced mortality.

The mortality rates in categories of pigs and cattle for particular travel distances were also calculated. On the basis of the results obtained, the impact of a travel distance on transport-induced mortality rate was evaluated.

The results were processed with the MS Excel. Statistical processing was performed with the χ^2 test using the programme Unistat 5.1.

Results

During a ten-year period from 1997 to 2006, transport for slaughter was monitored for the following numbers of animals: 41.1 million fattened pigs; 1.1 million young sows, sows, and boars excluded from rearing; 2.1 million fattened cattle; 1.3 million dairy cows; and

0.1 million calves. The differences in mortality rates during transport for slaughter among individual categories of cattle and pigs were investigated. The numbers of all transported and dead cattle and pigs are given in Table 1.

Table 1. Mortalities among pigs and cattle transported for slaughter in the period 1997-2006

	Transported	Mortalities	Mortality (%)
Fattened pigs	41 148 937	44 247	0.1075[a]
Young sows, sows, boars	1 061 719	2 720	0.2562[b]
Fattened cattle	2 136 503	148	0.0069[c]
Dairy cows	1 319 960	523	0.0396[d]
Calves	126 534	34	0.0269[e]

[a,b,c,d,e] = statistical comparison - if the letters attached to particular values do not match, it indicates a significant difference ($p < 0.05$); if the letters attached to particular values match, it means a non-significant difference ($p > 0.05$), between the categories of pigs and cattle

The highest mortality rate (0.2562%) occurred in animals excluded from breeding (young sows, sows, and boars), followed by fattened pigs (0.1075%), dairy cows (0.0396%), calves (0.0269%), and fattened cattle (0.0069%). Significant differences were found between mortality rates in the monitored animals.

Also mortality rates at different travel distances for particular categories of pigs and cattle were calculated. The numbers of animals in the categories transported for slaughter are given in Table 2. The percent loss in categories of pigs and cattle for the transport distances investigated are given in Table 3.

Table 2. Numbers of pigs and cattle, by category, transported for slaughter versus transport distances in the period 1997-2006

Transport distance (km)	Fattened pigs	Young sows, sows, boars	Fattened cattle	Dairy cows	Calves
< 50	24 852 257	550 780	1 360 772	827 115	95 622
51-100	10 151 613	264 818	426 347	285 598	20 564
101-200	3 948 830	177 747	239 626	156 683	6 043
201-300	1 368 063	54 585	82 629	39 893	4 141
> 300	828 174	13 789	27 129	10 671	164

Table 3. Percent of pigs and cattle, by category, that died during transport for slaughter in the period 1997-2006

Transport distance (km)	Fattened pigs	Young sows, sows, boars	Fattened cattle	Dairy cows	Calves
	Mortality (%)	Mortality (%)	Mortality (%)	Mortality (%)	Mortality (%)
< 50	0.0674[a]	0.0458[a]	0.0036[a]	0.0137[a]	0.0188[a,b,e]
51-100	0.1317[b]	0.2757[b,d]	0.0070[b]	0.0385[b]	0.0340[a,b,d]
101-200	0.2045[c]	0.8535[c]	0.0209[c,d]	0.1423[c,d]	0.0993[c,d,e]
201-300	0.2479[d]	0.3114[b,d,e]	0.0157[c,d,e]	0.1429[c,d,e]	0.0724[b,c,d,e]
> 300	0.3225[e]	0.3699[d,e]	0.0221[d,e]	0.1874[d,e]	0.0000[a,c,d,e]

[a,b,c,d,e] = statistical comparison - if the letters attached to particular values do not match, it indicates a significant difference ($p < 0.05$); if the letters attached to particular values match, it means a non-significant difference ($p > 0.05$), between the transport distance and categories of pigs and cattle

The lowest mortality rates occurred at short transport distances (< 50 km and 51-100 km), as compared to long transport distances (101-200 km, 201-300 km, and > 300 km), with a significant difference between short and long distances being revealed for fattened pigs, fattened cattle and dairy cows.

Discussion

Transport-related mortality in pigs represents a substantial loss of the total number of transported pigs. Mortality rates found in the present investigation for fattened pigs and young sows, sows and boars are the lower end of the range, 0.1 to 1.0%, reported for European countries by Warriss (1998a). Von Altrock and von Holleben (1999) report a higher rate of 0.4%. Our investigation showed mortality in pigs transported longer distances similar to the results reported by these authors. The higher mortality rates in animals transported longer distances is probably due to a higher level of transport-induced stress. These results corroborate findings concerning transport-induced stress in pigs reported by Warriss (1998a), Bradshaw et al. (1996), Perremans and Geers (1996), Večerek et al. (2006a).

Higher mortality rates in young sows, sows, and boars, as compared to fattened pigs, may be related to the fact that these animals have been excluded from breeding due to decreased performance, possibly the result of poor physical condition. This may lead to impaired health and combined with transport-induced stress, to a higher mortality rate.

Transport by road can induce significant stress in cattle, as reported by Wikner et al. (2003a), and Maria et al. (2004). Changes are also manifested through carcass bruising, as reported by Chandra and Das (2001), Gallo et al. (2000), Honkavaara et al. (2003). Major stress load may manifest itself in transport-induced mortality of cattle during transport for slaughter (Malena 2006; Večerek 2006b,c). This study found transport-induced mortality rates in cattle as follows: 0.0069% in fattened cattle, 0.0396% in dairy cows, and 0.0269% in calves. The values mentioned are relatively low compared to the findings in pigs, documenting that cattle may be more resistant to transport-induced stress.

Higher mortality rates were seen in fattened cattle, dairy cows, and calves transported long distances. Reaction of animals to stressors have been shown to depend on the duration and intensity of the stressors (Fazio and Ferlazzo 2003). Gallo et al. (2000, 2001), Honkavaara et al. (2003), Marahrens et al. (2003), and Villarroel et al. (2003a,b) have documented alterations in stress load indicators during long-duration transport of cattle, while Steinhardt and Thielscher (2000, 2002, 2003, 2005a,b), and Odore et al. (2004) have demonstrated changes in stress load indicators during transport in calves.

Higher mortality rates in dairy cows and calves, as compared to fattened cattle, may be related to the fact that dairy cows and calves are excluded from breeding generally for decreased performance, which may stem from the animal's poor condition. In combination with transport-induced stress, this may become a critical factor leading to impaired health and finally to death.

The level of stress in pigs and cattle and, therefore, transport-induced mortality rates can be minimized by complying with the requirements concerning transport conditions. This particularly concerns the conditions described for pigs by Troeger (1995), Perremans and Geers (1996), Fischer (1995), Schutte et al. (1994), Lambooy and Engel (1991), Geverink et al. (1998), Warriss (1998b), Kozák et al. (2004), and for cattle by Grandin (1999), von Holleben et al. (2003), Wikner et al. (2003b), Costa et al. (2003), Lensink et al. (2000, 2001a). This generally means careful and humane treatment with respect to regular moving and handling, loading and unloading, not mixing unfamiliar conspecifics in the loading space; as well as attention to loading density, ambient temperature, air quality in the vehicle, temperature-humidity index, transportation time, and careful driving. Genetic predisposition has a major influence on pre-slaughter mortality rates particularly in pigs, as reported by Murray and Johnson (1998), Warriss (1998a), and Werner et al. (2005).

Compliance with transport conditions from an animal welfare point of view will reduce the level of stress in animals and will have a positive effect on the quality of pork, as concluded by Troeger (1995), Fischer (1995), Lambooy and Engel (1991), Schutte

et al. (1994), Kozák et al. (2003), Kim et al. (2004), Guardia et al. (2005), Warriss (1998a), as well as on the quality of beef as reported by Gallo et al. (2001), Hartung et al. (2003), Maria et al. (2003), Broom (2003), Pištěková et al. (2004), Večerek et al. (2003), Villarroel (2003a,b), and on the quality of veal, as pointed out by Lensink et al. (2000, 2001b) and Van de Water et al. (2003).

Porovnání úhynů různých kategorií prasat a skotu při přepravě na jatky

Úhyny zvířat při přepravě na jatky jsou jedním z faktorů, který vypovídá o úrovni welfare přepravovaných zvířat. Literární údaje porovnávající úroveň welfare z pohledu úhynů u jednotlivých druhů a kategorií zvířat při jejich přepravě na jatky jsou však nedostatečné. Zaměřili jsme se proto na úhyny skotu a prasat v souvislosti s přepravou na jatky. V období let 1997 až 2006 byly ve spolupráci se Státní veterinární správou České republiky sledovány rozdíly v úhynech skotu a prasat při přepravě na jatky celkově a zvlášť pro přepravní vzdálenosti do 50 km, 51 km až 100 km, 101 km až 200 km, 201 km až 300 km, nad 300 km. Mezi jednotlivými druhy a kategoriemi prasat a skotu se projevily rozdíly v úhynech při přepravě na jatky. K největším úhynům docházelo u prasniček, prasnic a kanců (0,2562 %), dále u vykrmovaných prasat (0,1075 %), u vyřazených dojnic (0,0396 %) a u telat (0,0269 %) a vykrmovaného skotu (0,0069 %). Mezi těmito úhyny byly zjištěny statisticky významné rozdíly ($p < 0,05$). U všech sledovaných druhů a kategorií skotu a prasat k nejnižším úhynům docházelo při kratších přepravních vzdálenostech (< 50 km a 51 až 100 km) ve srovnání s delšími přepravními vzdálenostmi (101 až 200 km, 201 až 300 km a > 300 km), přičemž statisticky významný rozdíl ($p < 0,05$) mezi těmito kratšími a delšími přepravními vzdálenostmi byl prokázán u vykrmovaných prasat, vykrmovaného skotu a dojnic. Z pohledu úhynů zvířat při přepravě na jatky vykazují největší citlivost na nedostatky ve welfare prasničky, prasnice a kanci, dále vykrmovaná prasata, po té dojnice, dále telata a nejvyšší odolnost vykazuje vykrmovaný skot.

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