Mortality Rates in Poultry Species and Categories during Transport for Slaughter

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Abstract

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Transport-related mortality rates were compared for various poultry species and categories where
published data are limited. The numbers of broilers, hens and cockerels, turkeys, ducks, and geese
transported for slaughter, and the numbers that died during such transport, were recorded from
1997 to 2006 in cooperation with the State Veterinary Administration of the Czech Republic.
The mortality rate for individual poultry species and categories was calculated overall, and was
also recorded for the following transport distances: up to 50 km, from 51 km to 100 km, from
101 km to 200 km, from 201 km to 300 km, and over 300 km. Transport of poultry for slaughter
was accompanied by varying mortality rates depending on poultry species and categories. The
highest mortality rates occurred in hens and cockerels (1.013%), followed by turkeys (0.272%),
broilers (0.253%), ducks (0.103%), and geese (0.056%). Differences among the mortality rates
estimated were highly significant ($p < 0.001$). Mortality rates highly correlated with transport
distance. The lowest mortality rates were for the shortest transport distances: In broilers (0.154%),
turkeys (0.164%), and hens and cockerels (0.595%) for a transport distance up to 50 km; and in
ducks (0.069-0.111%) and geese (0.021 - 0.053%) for transport distances up to 300 km. Highest
mortality rates in hens and cockerels (1.892%), turkeys (0.341%), and broilers (0.536%) were
observed for transport distances over 200 km, while in ducks (0.147%) and geese (0.253%),
highest mortality rates were with transport distances exceeding 300 km. The highest mortality
rates for all transport distances were in hens and cockerels, followed by turkeys and broilers. The
mortality rate in turkeys for a transport distance up to 50 km was significantly higher than that
in broilers. No significant differences were found between mortality rates in turkeys and broilers
for transport distances of 51-100 km and 101-200 km whereas, for a distance of 201-300 km and
in distances exceeding 300 km, the mortality rates in broilers were significantly higher compared
to turkeys. The lowest mortality rates were observed in ducks and geese, with a significant
difference between them only for transport distances of 51 to 100 km, where the mortality rate in
ducks was higher, and over 300 km, where the mortality rate in geese was higher. When planning
the transport of poultry for slaughter, susceptibility to stress induced by transport and transport
distance (i.e. the duration of transport) of poultry species and categories should be considered.

*Broiler chicken, hen, cockerel, turkey, goose, duck, mortality, poultry processing plant, transport
distance*

During loading and transport to a slaughterhouse, poultry are exposed to situations
resulting in mortality: injuries, damage to health, and changes resulting from increased
stress. Factors that affect mortality include the method of catching (Knierim and Gocke
2003; Nijdam et al. 2005), handling (Knowles and Broom 1990; Kettlewell and
Mitchell 1994), thermal stress (MacCaluim et al. 2003), density, live weight, breed, time
spent in transport, and lairage time at the processing plant (Warriss et al. 1992; Mitchell
and Kettlewell 1998; Nijdam et al. 2004; Bedáňová et al. 2006, 2007; Voslářová et al.
2006a,b; Suchý et al. 2007).

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Mitchell and Kettlewell (1994) emphasise that the potentially harmful effects of adverse conditions during the transport are not only of political and public concern due to their consequences for animal welfare, but are also of economic importance with respect to increased losses and diminished quality of meat. A correlation between meat quality and exposure to preslaughter stress conditions has been demonstrated by Gregory (1996), Kannan et al. (1997), Owens and Sams (2000), Taubert et al. (2002), Debut et al. (2003) and others. In addition, the stress associated with transporting poultry prior to slaughter has been shown to increase endogenic contamination and consequently aggravate the microbial risk for the consumer of poultry meat (Mengert and Fehlhaber 1996; Mengert et al. 1998).

The mortality rate in poultry (particularly in broiler chickens) associated with transport to the slaughterhouse and preslaughter handling has been investigated by numerous authors. Nijdam et al. (2004) studied conditions influencing bruising and mortality of broilers during catching, transport and lairage. They reported the mean percentage of birds dead on arrival (DOA) as 0.46. Alshawabkeh and Tabbaa (1997), in a study of mortality and losses during transportation of broiler chickens from farms to processing plants in Jordan, found a mortality rate of 0.40%. Tabbaa and Alshawabkeh (2000), in an examination of conditions, and the interaction of conditions, affecting preslaughter damage and mortality to broilers during transport, found a significant relationship between the time of year and mortality rate. Fries and Kobe (1992) reported transport-related mortality averages in broilers of 0.41%, 0.35%, 0.65%, 0.14%, 0.67% and 0.29% in individual flocks. Causes of trauma in broilers arriving dead at poultry processing plants were investigated by Gregory and Austin (1992). Their study found 0.19% dead on arrival. In the Czech Republic, Večerek et al. (2006a) found DOA rates of 0.247% for broilers. Voslářová et al. (2006c) reported a death rate of 0.279% in turkeys during transport, and Voslářová et al. (2007) reported a death rate of 0.925% in hens and cockerels transported to slaughter plants.

Death rates in poultry have been shown to be influenced by the distance transported. Warriss et al. (1990) looked at the time spent by broiler chickens in transit to processing plants. Warriss et al. (1992) investigated mortality in broiler chickens in relation to the length of journey to processing plants. In journeys lasting less than 4 h, the incidence of dead birds was 0.156%, for longer journeys the incidence was 0.283%. Similarly, Warriss and Brown (1996) monitored the period of time needed to transport turkeys to processing plants, and found that birds were more likely to suffer from transport-induced stress during a long transit periods. Newberry et al. (1999) outlined welfare concerns associated with the transport of hens kept for commercial egg production that are slaughtered after the end of their economically viable life span.

The aim of this study was to examine differences in mortality rates during transport of broilers, mature chickens (hens and cockerels), turkeys, ducks, and geese for slaughter and to determine which of the poultry categories investigated was the most susceptible to stress due to transport. Further, efforts were made to discover if the differences in mortality rates within individual poultry species were related to transport distance.

Materials and Methods

The numbers of poultry (broilers, hens and cockerels, turkeys, ducks, and geese) dying as a result of transport (i.e. the numbers of poultry that died in vehicles or in slaughterhouses shortly after transport) were recorded during the period 1997-2006 in cooperation with the State Veterinary Administration of the Czech Republic.

The transport of all monitored poultry species and categories from rearing farms to slaughterhouses was accomplished using road vehicles. Transport distances were categorised as: up to 50 km, 51-100 km, 101-200 km, 201-300 km, and over 300 km.

The average number of animals transported annually, and the average number dying as a result of transport, was recorded for individual poultry species and categories. On the basis of the results, the relationship between poultry species/categories and average transport-related mortality rates per year was calculated.

The average number of dead poultry per year for distances up to 50 km, 51-100 km, 101-200 km, 201-300 km, and for distances over 300 km was determined. On the basis of the results, the variation in transport-related mortality rates as a function of transport distance was calculated. These data were also recorded for individual poultry species and categories.

The results were processed with MS Excel using the statistical calculation module. Statistical processing was performed using the χ^2 test, implemented in the Unistat 5.1 computer programme.

Results

The transport of 1,184.9 million broilers, 51.8 million hens and cockerels, 17.2 million turkeys, 0.768 million geese and 20.5 million ducks for slaughter was monitored from 1997 to 2006. Variation in transport-related mortality rates among poultry species and categories was recorded. The average numbers of transported and dead poultry per year are listed in Table 1.

Table 1. Overall transport-related mortality rates versus poultry species and categories in the period 1997-2006

	Average number per year		
	Transported birds	Dead birds	Mortality (%)
Broilers	118 493 245	302 684	0.253[a]
Hens and cockerels	5 182 069	49 430	1.013[b]
Turkeys	1 722 725	4 719	0.272[c]
Geese	76 811	45	0.056[d]
Ducks	2 052 758	2 096	0.103[e]

Explanatory notes: [a,b,c,d,e] = statistical comparison – if the letters attached to particular values do not match, it indicates a significant difference at $p < 0.05$; if the letters attached to particular values match, it means a non-significant difference, i.e. $p > 0.05$, between poultry species and categories

Table 1 shows that individual poultry species and categories differed in transport-related mortality rates. The highest transport-related mortality rate was found in hens and cockerels (1.013 %), followed by turkeys (0.272%), broilers (0.253%), ducks (0.103%), and geese (0.056%). The differences between the mortality rates were significant.

The impact of distance on transport-related mortality for individual poultry species and categories was also investigated. The average number of transported animals per year for individual poultry species and categories for the transport distances monitored, is shown in Table 2. The average number of animals dying per year as a result of transport at the monitored distances is provided in Table 3 for individual poultry species and categories.

Table 2. The average numbers of birds transported annually to slaughterhouses for individual poultry species and categories for monitored transport distances

Transport distance (km)	Broilers	Hens and cockerels	Turkeys	Geese	Ducks
	transported	transported	transported	transported	transported
< 50	50 245 622	1 596 023	548 975	37 368	601 679
51-100	41 251 061	1 304 734	493 017	19 432	405 657
101-200	23 301 249	1 394 239	307 914	4 028	918 211
201-300	3 234 938	595 928	214 245	13 318	116 767
> 300	460 376	291 146	158 574	2 664	10 444

The lowest mortality rates occurred at the shortest transport distances. The highest mortality rates in turkeys and hens and cockerels were found during transport distances of 201-300 km, while broilers, ducks, and geese showed the highest mortality rate at distances over 300 km.

Table 3. The average annual transport-related mortality rates for individual poultry species and categories for the transport distances monitored

Transport distance (km)	Broilers	Hens and cockerels	Turkeys	Geese	Ducks
	Mortality %	Mortality %	Mortality %	Mortality %	Mortality %
< 50	0.154[a]	0.595[a]	0.164[a]	0.053[a,b,c,d]	0.084[a,d]
51-100	0.280[b]	0.766[b]	0.297[b]	0.021[a,b,c,d]	0.110[b]
101-200	0.373[c]	1.131[c]	0.340[c]	0.036[a,b,c,d]	0.111[c]
201-300	0.535[d]	1.892[d]	0.341[d]	0.045[a,b,c,d]	0.069[a,d]
> 300	0.681[e]	0.963[e]	0.279[e]	0.253[e]	0.147[e]

Explanatory notes: [a,b,c,d,e] = statistical comparison – if the letters attached to particular values do not match, it indicates a significant difference at $p < 0.05$; if the letters attached to particular values match, it means a non-significant difference, i.e. $p > 0.05$, between transport distances for individual poultry species and categories

Table 4. Poultry species and categories versus the average transport-related mortality rate per year for transport distances up to 50 km, 51-100 km, 101-200 km, 201-300 km, and over 300 km

	Transport distance (km)				
	< 50	51-100	101-200	201-300	> 300
	Mortality (%)	Mortality (%)	Mortality (%)	Mortality (%)	Mortality (%)
Broilers	0.154[a]	0.280[a,c]	0.373[a,c]	0.535[a]	0.681[a]
Hens and cockerels	0.595[b]	0.766[b]	1.131[b]	1.892[b]	0.963[b]
Turkeys	0.164[c]	0.297[a,c]	0.340[a,c]	0.341[c]	0.279[c,d,e]
Geese	0.053[d,e]	0.021[d]	0.036[d,e]	0.045[d,e]	0.253[c,d]
Ducks	0.084[d,e]	0.110[e]	0.111[d,e]	0.069[d,e]	0.147[c,e]

Explanatory notes: [a,b,c,d,e] = statistical comparison – if the letters attached to particular values do not match, it indicates a significant difference at $p < 0.05$; if the letters attached to particular values match, it means a non-significant difference, i.e. $p > 0.05$, in the column between poultry species and categories

Variation in average annual transport-related mortalities in poultry species and categories for transport distances up to 50 km, 51-100 km, 101-200 km, 201-300 km, and over 300 km were calculated. The results are provided in Table 4.

At all transport distances, the highest mortality rates were shown to occur in hens and cockerels, followed by turkeys and broilers. Mortality rates in turkeys at distances up to 50 km were significantly higher than those of broilers. No significant differences between mortality rates in turkeys and broilers were found at transport distances of 51-100 km and 101-200 km. However, at distances of 201-300 km and over 300 km, mortality rates in broilers were significantly higher than those in turkeys. The lowest mortality rates were in ducks and geese, with a difference between them found at the transport distance of 51-100 km, where the mortality rate in ducks was higher than that in geese, and at distances over 300 km, where the mortality rate in geese was significantly higher than that in ducks.

Discussion

The mean percent of poultry DOA is a value that demonstrates deficiencies in poultry welfare during transport to processing plants. It is important both from the ethical standpoint, as an indicator of poor welfare during loading and transport, and also from an economic point of view as a loss to producers.

Stress factors for poultry in transport mentioned by various authors include the method of catching, handling, loading onto a vehicle, density, microenvironment in the transport vehicle, duration of transport and transport distance, driving style, unloading, and lairage time in processing plants, as well as season (e.g. Knowles and Broom 1990; Warriss et

al. 1992; Kettlewell and Mitchell 1994; Mitchell and Kettlewell 1998; Knierim and Gocke 2003; MacCaluim et al. 2003; Nijdam et al. 2004, 2005; Bedáňová et al. 2006). The present investigation showed that differential susceptibility to stress in individual poultry species and categories was also a key factor contributing to transport-related mortality.

The data on the transport of poultry showed that the highest number of transported birds were domestic chickens, with broilers as the most numerous category within this species. In the monitored period, it was found that the average transport-related mortality rate per year in broilers was 0.253%. This is a lower rate than the results reported by Nijdam et al. (2004) - 0.46% DOA; Alshawabkeh and Tabbaa (1997) - 0.40% DOA; and Fries and Kobe (1992) - 0.41, 0.35, 0.65, 0.67, and 0.29% DOA. It is, however, a higher value than the rates reported by Gregory and Austin (1992) and Warriss et al. (1992) - 0.19 and 0.194% DOA, respectively. Significant differences in mortality rates were found among transport distance categories, with rates ranging from 0.154% to 0.681%, the lowest mortality rates occurred over the shortest transport distance (up to 50 km), and the highest mortality rates were seen for the longest transport distances (over 300 km). These results corroborate the findings of Warriss et al. (1992), who noted that longer journeys to processing plants were associated with higher mortality in broiler chickens, and who reported mortality rates ranging from 0.156% to 0.283%, depending on transport distance. The results of the present study indicate a substantially higher increase of DOA in broilers in relation to longer transport distances than that reported by Warriss et al. (1992). The results of investigations published by Večerek et al. (2006a) demonstrated that conditions under which broilers are shipped worsen with increasing transport distances. The fact that the mortality of broilers transported to processing plants showed an increasing trend during the monitored period is particularly alarming.

Of the categories monitored, hens and cockerels showed the highest transport-related mortality rate. An average of 1.013% of transported hens and cockerels died annually during transport to a slaughterhouse. The percentage of dead animals, for various transport distances, ranged from 0.595% to 1.892%, with the lowest mortality rate occurring at the shortest transport distance (up to 50 km) and the highest found at distances of 201-300 km. High transport-associated mortality rates in hens and cockerels were also reported by Voslářová et al. (2007). Not only is the DOA percentage in hens and cockerels several times higher than that of other monitored poultry species and categories, but it is also higher than mortality rates reported for other species of farm animals transported for slaughter in the Czech Republic. For example, the average transport-related mortality rate per year in pigs is 0.107% (Večerek et al. 2006c); in dairy cows, 0.038% (Večerek et al. 2006b); in fattened cattle, 0.007% (Malena et al. 2006); and in calves, 0.026% (Večerek et al. 2006d). Newberry et al. (1999) monitored DOA rates of hens transported for slaughter in Canada and the United States and observed that mortality ranged from 0.7% to 2.3% depending on the duration of the journey. These authors explained high mortality rates by claiming that relatively few poultry-processing companies are willing to accept spent hens because of their low meat value compared with broiler chickens and turkeys. For this reason, spent hens in Canada and the United states tend to be transported longer distances to slaughter than other types of poultry.

High mortality rates were also found in turkeys (0.272%). One encouraging finding made by Voslářová et al. (2006c) is that the total mortality rate of turkeys during transport to slaughterhouses in the Czech Republic has been decreasing. The mortality rates in turkeys during the monitored period varied from 0.164% to 0.341%, where the lowest and the highest mortality rates were found for transport distances up to 50 km and 201-300 km, respectively. As with hens and cockerels, the average mortality rate decreased for travel distance above 300 km. This might be due to the factors that ensure a higher level

of welfare for animals when transport is longer, as compared with that for the animals transported shorter distances. On the other hand, broilers, geese, and ducks showed the highest mortality rates when transported for the longest distance.

The lowest mortality rates were found in geese and ducks at all transport distances investigated. Mortality rates in geese and ducks varied from 0.021% to 0.253%, and 0.069% to 0.147%, respectively.

In conclusion, the currently used method of transport of poultry to a slaughterhouse was associated with mortality; with the highest mortality rates in hens and cockerels, followed by turkeys and broilers, and the lowest mortality rates found in ducks and geese. The number of poultry dying during transport to processing plants could be significantly reduced by a reduction in the transport distance. All monitored poultry species and categories showed significantly lower mortality rates at shorter transport distances. When planning the transport of poultry, transport distance and susceptibility to stress induced by transport in individual poultry species and categories should be considered.

Vliv různých druhů a kategorií drůbeže na úhyny při přepravě na jatky

Práce se zabývá porovnáním úhynů při přepravě na jatky mezi různými druhy a kategoriemi drůbeže, kde literární údaje jsou omezené. V období let 1997 až 2006 byly ve spolupráci se Státní veterinární správou České republiky zaznamenávány počty přepravených a počty uhynulých brojlerů, slepic a kohoutů, krůt, kachen a hus v souvislosti s přepravou na jatky. Byl sledován vliv druhu a kategorie drůbeže na úhyny při přepravě na jatky souhrnně a dále pro přepravní vzdálenosti do 50 km, 51 km až 100 km, 101 km až 200 km, 201 km až 300 km a nad 300 km. Přeprava na jatky je provázena úhyny u drůbeže a to rozdílně podle jednotlivých druhů a kategorií drůbeže. K největším úhynům dochází u slepic a kohoutů (1,013 %), dále u krůt (0,272 %), u brojlerů (0,253 %), u kachen (0,103 %) a hus (0,056 %). Mezi těmito úhyny byly zjištěny statisticky vysoce významné rozdíly ($p < 0,001$). Úhyny závisely na přepravní vzdálenosti. Ke statisticky nejnižším úhynům docházelo při nejkratších přepravních vzdálenostech: u brojlerů (0,154 %), u krůt (0,164 %), u slepic a kohoutů (0,595%) při přepravní vzdálenosti do 50 km, a u kachen (0,069 % až 0,111 %) a hus (0,021 % až 0,053 %) při přepravních vzdálenostech do 300 km. Ke statisticky nejvyšším úhynům u slepic a kohoutů (1,892 %), krůt (0,341 %) a brojlerů (0,536 %) docházelo při přepravních vzdálenostech nad 200 km, u kachen (0,147 %) a hus (0,253 %) při přepravních vzdálenostech nad 300 km. Ve všech přepravních vzdálenostech k nejvyšším úhynům docházelo u slepic a kohoutů. Dále následovaly úhyny u krůt a brojlerů, kdy při přepravní vzdálenosti do 50 km byly statisticky významně vyšší úhyny u krůt, při přepravní vzdálenosti 51 až 100 km a dále 101 až 200 km nebyl mezi úhyny krůt a brojlerů statisticky významný rozdíl, a při vzdálenosti 201 až 300 km a nad 300 km jsou statisticky významně vyšší úhyny u brojlerů. Nejnižší úhyny byly u hus a kachen, mezi nimiž nebyl zjištěn u všech přepravních vzdáleností statisticky významný rozdíl, s výjimkou přepravní vzdálenosti 51 až 100 km, kdy byl zjištěn vyšší úhyn u kachen, a dále s výjimkou přepravní vzdálenosti nad 300 km, kdy byl zjištěn statisticky významně vyšší úhyn u hus. Při přepravě drůbeže na jatky je tak třeba zohlednit rozdílnou citlivost jednotlivých druhů drůbeže na stres spojený s přepravou a také vzdálenost – dobu přepravy.

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