Effects of Travel Distance and the Season of the Year on Death Rates of Broilers Transported to Poultry Processing Plants

V. Vecerek,*[1] S. Grbalova,* E. Voslarova,* B. Janackova,† and M. Malena‡

*University of Veterinary and Pharmaceutical Sciences Brno, 612 42 Brno, Czech Republic; †Ministry of Agriculture, 117 05 Prague, Czech Republic; and ‡State Veterinary Administration, 120 00 Prague, Czech Republic

ABSTRACT Death losses among broilers transported to processing plants are caused by poor welfare. The number of birds dying during transport and in processing plants shortly after arrival there may serve as an indicator of the quality of welfare during loading and transport. In the Czech Republic, shipments of broilers to processing plants were monitored from 1997 to 2004. It was found that the mortality of broilers during transport was 0.247%, but it varied according to the transport distance to the processing plant from 0.146% (50 km maximum) to 0.862% (>300 km). The broiler mortality in transit was also influenced by the season of the year. The highest mortality was found in summer months, especially in June, July, and August, and in winter months, especially in December, January, and February. A comparison between period 1 (1997 to 2000) and period 2 (2001 to 2004) showed a long-term adverse trend in the number of broilers dying during transport to processing plants for all of the distances monitored (except transport distances <50 km), because the overall number of dead birds on arrival to processing plants increased from 0.224 to 0.265% (index of 1.18). This difference is statistically significant (P = 0.000). The stress caused to broilers by transport to processing plants is reflected in higher transport-related mortality of the birds. Long-term trends point to an increase in death losses of broilers. Longer transport distances and transportation in summer and winter months have led to an increase in death losses among broilers transported to processing plants.

Key words: broiler, mortality, transport, stress, welfare

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INTRODUCTION

During loading and transport to a slaughterhouse, broilers are exposed to factors that are responsible for mortality, injuries, damage to health, and changes indicating increased stress. Gregory (1996) studied welfare and hygiene during preslaughter handling. He noted that broilers were subject to procedures that caused them suffering during preslaughter handling. Bedanova et al. (2006) reported that stress connected with crating, accompanied with mixed social and heat stress due to high bird density, induced strong changes in the inner environment of broilers.

Knowles and Broom (1990) stated that handling and transportation influenced the number of birds that were dead or bruised and resulted in a high incidence of bone breakage. Nijdam et al. (2004) looked into the factors influencing bruises and mortality of broilers during catching, transport, and lairage. They reported the mean percentage of dead on arrival (**DOA**) birds was 0.46. Alshawabkeh and Tabbaa (1997) studied factors affecting mortality and losses during transportation of broiler chickens from farms to processing plants in Jordan. They found that 0.40% of broilers died during transportation to processing plants. Tabbaa and Alshawabkeh (2000) studied some factors affecting preslaughter mortality and damage to broilers and interaction during transportation to processing plants. They found a significant relationship between season and mortality rate. Similarly, Mitchell and Kettlewell (1994) studied the potentially harmful effects of adverse environmental conditions during the transport of poultry and their welfare consequences. Investigating mortality during transport to the slaughterhouse, Fries and Kobe (1992) reported mortality averages of 0.41, 0.35, 0.65, 0.14, 0.67, and 0.29% from individual flocks. Causes of trauma in broilers arriving dead at poultry processing plants were investigated by Gregory and Austin (1992). Of the birds sent to the plants, 0.19% were DOA. Warriss et al. (1990) looked into the time spent by broiler chickens in transit to processing plants. Warriss et al. (1992) investigated higher mortality in broiler chickens in relation to longer journeys to processing plants. For journeys lasting less than 4 h, the incidence of dead birds was 0.156%; for longer journeys, the incidence was 0.283%.

Carlyle et al. (1997) studied the effect of time between farm loading and processing on carcass quality of broiler

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[1]Corresponding author: vecerekv@vfu.cz

chickens. Evaluating the incidence of fresh breast and wing bruising on carcasses in relation to the period from loading to entry into the shackling area of the processing plant, they found that the levels of breast and wing bruising were significantly affected by the period. Gregory (1996) pointed to effects of preslaughter stress on muscle glycogen metabolism and dark, firm, and dry meat. Kannan et al. (1997) concluded that higher preslaughter stress levels in broilers influenced the color of thigh meat. Mengert and Fehlhaber (1996) reported increased endogenous microbial contamination in broiler carcasses due to premortal stress. Stern et al. (1995) studied the prevalence of *Campylobacter* spp. in broilers on the farm and after transport. They reported a significant increase in levels of *C.* spp. on chicken carcasses after transport. Investigating the effect of transportation on the prevalence of *Salmonella* populations, Line et al. (1997) found that transport stress caused *Salmonella* colonization frequency to increase more than 5-fold.

The aim of our study was to investigate the mortality of broilers transported to processing plants in the Czech Republic from 1997 to 2004, to assess the effect of transport distance, to investigate the effect of seasons of the year, and to outline trends in mortality of broilers transported to processing plants.

MATERIALS AND METHODS

From 1997 to 2004, inspectors of the State Veterinary Administration of the Czech Republic recorded death losses among broilers related to their transport to processing plants, specifically, the number of broilers that died in transport vehicles or shortly after they arrived to the processing plant.

Transport distances were divided into 5 categories: <50 km, 51 to 100 km, 101 to 200 km, 201 to 300 km, and >300 km. For each of these distance categories, the number of broilers transported and the number of broilers that died during transport were ascertained, and the percentage of transport deaths of the total number of broilers transported was calculated. The results were used as an indicator of the effect the transport distance has on the mortality of broilers shipped to processing plants.

The number of broilers transported and the number of broilers that died during transport in individual months over the entire period of monitoring were ascertained, and the percentage of transport deaths of the total number of broilers transported was calculated. The results were used as an indicator of the effect of the season of the year on the mortality of broilers shipped to processing plants.

To assess trends in death rates of broilers transported to processing plants, the number of broilers transported and the number of broilers that died during transport from 1997 to 2000 (period 1) and from 2001 to 2004 (period 2) were ascertained, and the percentage ratio between the total number of broilers shipped and the total number of broilers that died during transport was calculated. The index ratio of period 2 to period 1 was calculated as a ratio between the relative number of broilers that died in period 2 and the relative number of broilers that died in period 1. Values >1.00 indicated a trend toward an increase in broiler mortality in the given period; the value of 1.00 indicated that the death rate neither increased nor decreased in the given period; and values <1.00 indicated a decreasing trend in the number of broilers that died during transport in the period investigated. The indices were used to outline the trends in broiler mortality concerning their transport to processing plants.

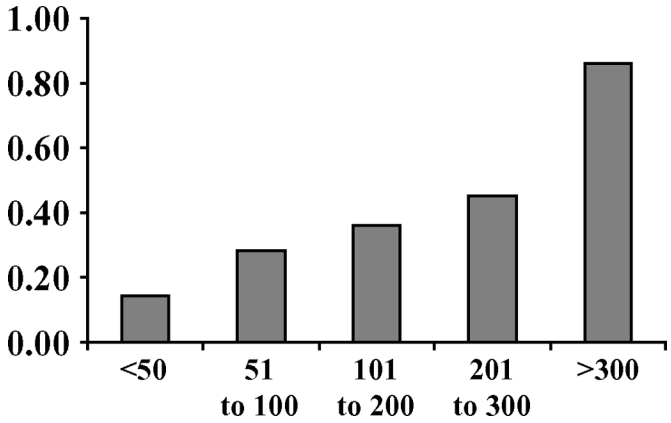

Figure 1. Numbers of broilers (%) that died during transport to processing plants in relation to travel distances (km).

The results of absolute and relative frequencies were processed using the statistical calculation module of Excel software (Micrsoft Corp., Redmond, WA), and the χ^2 test of the Unistat software program was used for the statistical processing of results (Zar, 1999).

RESULTS

Death rates of broilers and the effects of travel distances on the mortality of broilers transported for slaughter are given in Figure 1. It follows from Figure 1 that the overall death rate of broilers in relation to travel distances for the entire period was 0.247%. Although only a 0.146% death rate was found when broilers for slaughter were transported over distances up to 50 km, considerably higher death rates of up to 0.862% were found when travel distances exceeded 300 km. Mortality rates among broilers grow with longer distances.

Effects of the season of the year in individual months on death rates of broilers transported for slaughter in individual distance categories are given in Figure 2. It follows from Figure 2 that seasons of the year shown here by the month influence the number of broilers dying during transport. The highest mortality was found in the summer months of June, July, and August and in winter months of December, January, and February. Increased mortality in summer and winter months can be linked to ambient temperatures in those months, when too high or too low temperatures negatively influence welfare of transported broilers.

Trends in death rates of broilers transported to slaughter in relation to transport distances are given in Figure

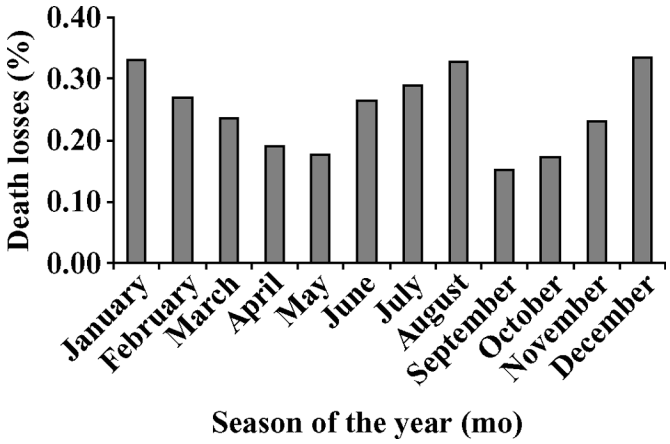

Figure 2. Numbers of broilers that died during transport to processing plants in relation to the season of the year.

3. From Figure 3, it follows that indices of both the overall trend and trends for individual distance categories were all above 1.00 (except the <50 km transport distance); there was an increase in transport losses in the period from 2001 to 2004 compared with the period from 1997 to 2000 in all distance categories. The differences were statistically highly significant. This is an adverse trend, and it becomes more pronounced in the case of longer transport distances.

DISCUSSION

Transport to processing plants causes stress to broilers that carries the risk of death of the birds, injury, health impairment, and stress manifestations that may also influence carcass and meat quality (Knowles and Broom, 1990; Mitchell and Kettlewell, 1994; Bedanova et al., 2006).

We found that the mean percentage of DOA birds was 0.247%. This is less than DOA results reported by Nijdam et al. (2004; 0.46%), Alshawabkeh and Tabbaa (1997; 0.40%), and Fries and Kobe (1992; 0.41, 0.35, 0.65, 0.67, and 0.29%). It is, however, a higher value than those reported by Gregory and Austin (1992) and Warriss et al. (1992; 0.19 and 0.194%, respectively). Dead on arrival figures are very important from the ethical point of view as an indicator of poor welfare during loading and transport of broilers to processing plants and also from the economic point of view as a loss to producers.

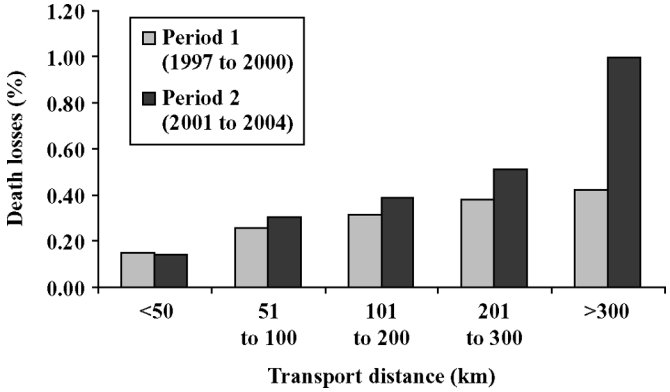

Figure 3. Trends in the numbers of broilers dying during transport to processing plants in relation to transport distances.

The increase in broiler mortality with increases in the travel distance shows that longer transport distances cause higher bird mortality. We found that the DOA of 0.146% for transport distances <50 km increased to 0.862% for transport distances >300 km. These results corroborate the findings published by Warriss et al. (1992), who noted that longer journeys to processing plants were associated with higher mortality in broiler chickens. For journeys lasting less than 4 h, the incidence of dead birds was 0.156%, and for longer journeys, the incidence was 0.283%. Our results, however, indicate a much more substantial increase in DOA in broilers in relation to transport distances than those reported by Warriss et al. (1992). The DOA level reflects the factors operating before the transport of broilers (for example, injuries to broilers resulting from loading) and during transport (e.g., microclimate conditions, loading density, etc.), which either alone or combined lead to increasing mortality in broilers.

We found increased mortality of broilers during transport in both summer and winter months. These results are in agreement with conclusions reported by Mitchell and Kettlewell (1994), who found large thermal gradients and the existence of a thermal core within moving vehicles in summer and in winter. The results also corroborate the findings of Alshawabkeh and Tabbaa (1997) that the percentages of dead chickens fluctuated around the year and that the numbers of damaged chickens and of total disposed chickens were highest in August. Tabbaa and Alshawabkeh (2000) reported the highest mortality and numbers of injured broilers in winter.

The fact that the mortality of broilers transported to processing plants shows long-term increasing trends is particularly alarming. The results of our investigations demonstrate that conditions under which broilers are shipped get worse with increasing transport distances. Not only may poor welfare during transport cause an increase in broiler mortality and the number of damaged birds (Alshawabkeh and Tabbaa, 1997; Carlyle et al., 1997; Tabbaa and Alshawabkeh, 2000), but it also affects the color of thigh meat (Kannan et al., 1997), incidence of dark, firm, and dry meat (Gregory, 1996), the frequency of endogenous microbial contamination in broiler carcasses (Mengert and Fehlhaber, 1996), and higher levels of *C.* spp. (Stern et al., 1995) and *Salmonella* population (Line et al., 1997) on chicken carcasses.

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