



RISK FACTORS FOR BRUISING AND MORTALITY OF BROILERS DURING MANUAL HANDLING, MODULE LOADING, TRANSPORT, AND LAIRAGE

Introduction: The average mortality [dead-on-arrival (DOA)] of the 659 million broilers transported from farm to federally inspected processing plants in 2017, as reported by Agriculture and Agri-Food Canada, was 0.2%. This mortality has financial and animal welfare implications. The three main factors considered to influence mortality in a load (DOA) are: (1) health status of the flock, (2) thermal stress, and (3) physical injury during catching and loading (Bayliss and Hinton 1990). Further study of these factors and their relative significance is useful for continuous improvement in industry practices and for the formulation of codes of practice and the regulation of broiler handling and transport in Canada.

Objective: This study used in-barn observations and multivariable analyses of processing plant data to identify risk factors for bruising and mortality, when flocks of broilers were loaded using a modular handling system and then transported to slaughter under a range of external environmental conditions and journey durations.

Trial: Two studies were conducted in Atlantic Canada— Study 1 evaluated loads from producers in a different province from the processing plant, thus longer journeys; Study 2 evaluated loads from producers located near the processing plant, thus shorter journeys. Study 1 was conducted between April 2014 and April 2015, observing a total of 212 loads of birds from 7 broiler producers. Each trailer load consisted of birds that were raised on the same site and transported on the same date to the processing plant. The birds had a median journey duration of 6 hours and external temperature ranged between -22 and 22 degrees Celsius. Study 2 was conducted for comparison purposes between February and April 2015, comprising a

total of 40 loads from 8 barns located near the processing plant (0.66 h).

Potential risk factors for bruising and mortality during handling, transport, and lairage were quantified for selected flocks from records provided by the processing plant and by undertaking direct observations during on-farm loading of these flocks. The processing plant provided data on the rearing mortality, age and weight of the birds at the time of loading. Samples of the litter on the barn floor were collected after loading (as an indicator of the quality of the management of the housing conditions). A catching team, provided by the processing plant, manually caught the birds in the barn and loaded them using a modular system. The handlers were observed during module loading, recording the manner in which the birds were placed in the module drawers and a limited number of behavioral responses of the birds during this procedure. For each load, the times that food and water were withdrawn before the start of loading, start and ending loading times, the number of birds placed per drawer, number of birds per load, and the ambient temperature in the barn at the start of loading were provided by the processing plant. The birds were transported to the processing plant in a trailer that consisted of a flatbed with a solid front, back and roof. Temperatures during loading, the journey and in lairage, were recorded, as well as the number & duration of stops during the journey, and condition of the birds. Once loads arrived at the processing plant, the modules were removed from the trailer and restacked. Mechanical fans and heaters were used in the lairage to adjust the temperature and ventilation. After slaughter, the processing plant provided condemnation data which was used to provide an assessment of the health status of the birds. When possible, 100

birds from each load were visually examined by the processing plant quality control team, and the number of birds with leg and (or) wing bruising was recorded.

Results: The median DOA % per load was 0.1 for broilers in Study 1. Most of the variability in DOA values was at the level of the load rather than at the event or producer levels. An important finding in this study was that no relationships were found between the type of handling during loading and the DOA % and the percentage wing bruising. As well, the loading arrangement and the manner in which the birds were loaded did not affect DOA %. When loading was undertaken efficiently, and the speed of loading was high, the risk of mortality was lower. Litter dry matter as an indicator of the quality of management did not affect the risk of DOA.

As with most other studies on broiler DOAs, the seasonal effect suggested that environmental conditions experienced by the birds affected the risk of mortality. The mortality risk was lower when the external temperature at the end of loading was $>10^{\circ}\text{C}$ and the RH was $\leq 90\%$. When the total duration from the start of loading to the end of lairage was less than 9 h, there was no effect of total duration on DOA%. In summer and fall, there was no effect of total durations from start of loading to the end of lairage of up to 12 h on DOA %. However, in winter and spring, when the total duration from the start of loading to the end of lairage was longer than 9 h, there was a significant increase in the risk of DOA with each increased hour. One possibility for the seasonal effect of duration on DOA % was that, as a result of the colder external temperature during the winter and spring, some of the birds needed to utilize body energy reserves to attempt to avoid hypothermia.

Of the many variables considered in the study, those that were found to be most significant included bird weight, rearing mortality, duration of feed withdrawal before loading >6 h, speed of loading, season, total duration of loading, journey, and lairage; and an interaction between season and total duration from loading to slaughter. The DOA % increased with increased bird weight and with increased rearing mortality; DOA decreased

with increased speed of loading. The DOA was greater when the duration of feed withdrawal was >6 h. During winter and spring, the DOA increased with the total duration from loading until slaughter. There were virtually no loads for which even modest levels of leg injuries were reported: as such this outcome variable was not considered further. There was no significant relationship between DOA% and the wing bruising percentage per load.

The DOA % in Study 2 was considerably lower (0.02) than that in loads from Study 1. Journey duration was likely the most important factor influencing this difference. However, other differences, such as health status, external temperature, and age and weight, may have contributed to this difference.

Conclusion: The main risk factors for increased mortality during transport were an increased duration between loading and the end of lairage (especially during winter) and a period of feed withdrawal before loading of greater than 6 h. The risk of mortality increased with the weight of the birds (over 1.7-2.7 kg) and increased with the percentage rearing mortality. No relationships were found between the manner in which the broilers were handled and % DOA or bruised birds.

References:

Agriculture and Agri-Food Canada. 2017. Economic and market information. Reports.
Bayliss, P.A., and Hinton, M.H. 1990. Transportation of broilers with special reference to mortality rates. *Appl. Anim. Behav. Sci.* 28: 93–118.

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