Improvement of animal welfare by strategic analysis and logistic optimisation of animal slaughter transportation

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Abstract

The transportation of animals to slaughterhouses is a major welfare concern. The number of slaughterhouses has decreased over time in Europe due to centralisation. This is expected to increase transport time for animals and as a consequence negatively affect animal welfare. We propose an optimisation model based on a facility location model to perform strategic analysis to improve transportation logistics. The model is tested on the Swedish slaughter transport system. We show that, by strategic planning and redirection of transports while keeping the slaughterhouse capacities as of the original data, the potential exists to reduce transport distance by 25% for pigs and 40% for cattle. Furthermore, we demonstrated that approximately 50% of Swedish slaughterhouses can be shut down with a minimal effect on total transport distances. This implies that in terms of the overall welfare picture, the decision of which animals to send where plays a far more significant role than the number of slaughterhouses. In addition, by changing relative weights on distances in the optimisation function the amount of individual transports with long journey times can be decreased. We also show results from altered slaughterhouse capacity and geographical location of slaughterhouses. This is the first time an entire country has been analysed in great detail with respect to the location, capacity and number of slaughterhouses. The focus is mainly on the analysis of unique and detailed information of actual animal transports in Sweden and a demonstration of the potential impact redirection of the transports and/or altering of slaughterhouses can have on animal welfare.

Keywords: animal welfare, cattle, pig, slaughterhouse capacity, slaughter transports, transportation logistics

Introduction

The transportation of animals from farms to slaughterhouses is a major welfare concern, both from the perspective of transport time and quality (Kristoffersson 2004; Gebresenbet et al. 2005; Malena et al. 2007). The welfare of animals in transport to slaughter systems depends on several elements. During loading and transport animals are exposed to a variety of potential stressors. Studies have shown that long journeys affect the mortality of pigs and cattle (Kristoffersson 2004; Malena et al. 2007) and that transport time significantly influences other stress parameters (Gebresenbet et al. 2005). Transport time may thus represent a major concern for animal welfare. Additional important questions include road quality, waiting time at the slaughterhouse, quality and design of equipment, and the behaviour and strategies of various key individuals. Hence, the overall animal welfare quality for animal journeys includes everything from loading conditions, vehicle design, driving strategies, to the structuring of the system. In this paper we focus on transport time.

Factors related to the transport to slaughter process resulting in stressed animals may, in addition to impinging on animal welfare, cause lowered meat quality through an increased risk of DFD (dark, firm and dry meat) and PSE (pale, soft and exudative meat) (Manteca & Vilanova 2007). Short animal transports, which could potentially affect animal welfare less, may therefore be another important goal of producers. Moreover, consumers are willing to pay extra for regionally produced and slaughtered meat, which implies short transport times (Anderson et al. 2004; Carlsson et al. 2007). However, in the meat industry the trend today is towards most animals being slaughtered at larger and fewer slaughterhouses. Between 1985 and 2004, the number of slaughterhouses in Sweden, representing more than 90% of the slaughtered animals, was reduced by 50% (Kaspersson & Gullstrand 2004). Figure 1 shows slaughter frequencies at the largest slaughterhouses in Sweden. Centralisation results in increased travel distances and travel time for animals unless animal production is also moved closer to the slaughterhouses (Kaspersson & Gullstrand 2004).