



Review

Livestock transport from the perspective of the pre-slaughter logistic chain: a review

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ABSTRACT

New developments in livestock transport within the pre-slaughter chain are discussed in terms of three logistic nodes: origin, stopovers and slaughterhouse. Factors as transport cost, haulier, truck specifications, micro-environment conditions, loading density, route planning, vehicle accidents and journey length are discussed as well as causes of morbidity, mortality, live weight and carcass damage. Taking into account current trends towards increased transport times, logistics stopovers and mixed transport, there is a need to develop systems of evaluation and decision-making that provide tools and protocols that can minimize the biological cost to animals, which may have been underestimated in the past.

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1. Introduction

Over the past few decades, food safety has become more of an issue in animal production systems, forcing governments and industry to react to maintain consumer confidence. The concept of quality in the food sector has become more important for all involved in the agri-food chain (Sepúlveda, Maza & Mantecón, 2008). For consumers, quality goes beyond safety, or organoleptic and nutritional qualities, to include aspects related with production conditions and environmental impact (Becker, 2000). Animal welfare has become a social concern, an attribute within a wide concept of meat quality (María, 2006; Schnettler, Vidal, Silva, Vallejos, & Sepúlveda, 2007).

Farmers, hauliers, retailers and other meat chain participants increasingly recognize that consumer concerns for good animal welfare represent a business opportunity that could be profitably incorporated into their commercial strategies (Velarde & Dalmau, 2012). In this context, the meat industry and retailers are exploring the application of welfare friendly farm husbandry systems, management practices and breeding strategies, the implementation of monitoring, quality assurance during transport and pre-slaughter operations, certification schemes, and the dissemination of associated information to the consumer (e.g. Certified Humane from HFAC-USA; Freedom Food from RSPCA-UK; Animal Welfare Certification System from AMIC-Australia) (Miranda-de la Lama, Sepúlveda, Villarroel, & María, 2013).

Livestock transport is an essential component of the meat industry (Ljungberg, Gebresenbet, & Aradom, 2007). Conventionally, animals are sent to the slaughter plant by the farmer through some intermediaries (with the participation of hauliers, wholesalers and sale-yards). The main links of the chain are thus the farm, transport and slaughter plant. Recently, production systems have become more stratified including more intermediate steps between the main links, making national meat markets and associated pre-slaughter operations more dynamic and complex (i.e. auction markets, storage centres, classification of logistics centres, health checkpoints, key stopovers and resting points; Miranda-de la Lama, Rivero, et al., 2010). These developments can improve efficiency but also increase the incidence of pre-slaughter stress, leading to poor animal welfare (Ferguson & Warner, 2008). The efficient administration of a pre-slaughter logistic chain based on animal welfare will have a positive impact on the income of producers, distributors and retailers, because pre-slaughter processes may affect animal cost, product quality and consumer satisfaction (Ferguson & Warner, 2008; Miranda-de la Lama, Rivero, et al., 2010). Here we review current knowledge about livestock transport from the perspective of the pre-slaughter logistic chain using examples and requirements, to give the reader an overall view, with emphasis on animal welfare.

2. Logistics applied to pre-slaughter logistic chain

Logistic is the process of planning, implementing and controlling the efficient, effective flow and storage of raw materials, in-process inventory, finished goods, services, and related information from point of origin to point of consumption (including inbound, outbound, internal, and external movements) for the purpose of conforming to customer requirements (Christopher, 1998; Ginters, Cirulis, & Blums, 2013). The food supply chain is composed of companies that manufacture and process/transform raw materials and semi-finished products coming from primary activities such as agriculture, forestry, fishing and livestock

(Manzini & Accorsi, 2012). The livestock move from feedlots/farms to processors who transform them into meat products and organise delivery into the hands of end customers. This supply chain includes: breeders, farmers, stockers/backgrounders, feedlot operators, packers, processors, food-service providers and retailers. The pre-slaughter logistic chain is part of the meat supply chain that schedules, implements and controls the flow of a given animal from the point of origin to slaughter, to obtain homogenous, quality products in a competitive market that satisfy the requirements of the final consumer (Bosona & Gebresenbet, 2013).

The key element in a pre-slaughter logistics chain is the transportation system, which joins the independent activities. Transportation is required throughout production, from the farm to delivery to consumers. Maximizing the coordination between each component will help to maximize benefits. Modelling livestock transport logistics, particularly between farm/feedlot, intermediate stopovers and the slaughterhouse presents several challenges (Edge & Barnett, 2009). These include the substantial within- and between-year differences in the number of animals movements, loss in live weight and body condition during transit, the unpredictable impact of inherently variable climates on livestock supply and the ability of the transport system to move them correctly (Higgins et al., 2013). According to Bosona and Gebresenbet (2011) and Miranda-de la Lama (2013), the integration of logistic activities in livestock transport systems has the following palpable advantages: (1) to coordinate the transport of animals and reduce transport distance and time using optimised routes; (2) to promote animal welfare; (3) to expand the market area for producers; (4) to reduce operational costs and increase competitiveness; (5) to reduce carbon dioxide (CO₂) emissions; (6) to improve traceability of meat origin for authorities and consumers; (7) to strengthen the partnership between producers, distributors, retailers and consumers and (8) to encourage exchange of knowledge, experience and information.

3. Logistic nodes

Logistic management implies controlling several critical stages that include hauliers and intermediate points. The coordination of all of those operations is a complex undertaking that requires communication, synchrony and the efficient use of available sources by all concerned, in terms of time and frequency of delivery with the minimum cost and guaranteeing product quality (Ljungberg et al., 2007). In the generic meat logistics chain, farms, feedlots and logistics centres in specific production regions are responsible for moving livestock to slaughterhouses. Slaughterhouses can be supplied by more than one production region (Soysal, Bloemhof-Ruwaard, & van del Vorst, 2014). In this context, the nodes of a distribution network of the pre-slaughter chain can now be described as origin, intermediate and destination.

3.1. Origin node: farm or feedlot

The origin node is the beginning of the pre-slaughter logistic chain, normally the farm or feedlot, although there is an increasing verticalization in supply chain management in almost all species (Buil, María, Villarroel, Liste, & Lopez, 2004). The feedlot is normally responsible for weighing the animals or classifying them by commercial type, choosing those suitable for transport, organising the fasting of the animals and to coordinating the journey with the haulier and possible intermediate

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