The Veterinary Journal 239 (2018) 48–53

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Original Article

Risk factors associated with beef cattle losses on intensive fattening farms in Austria, Germany and Italy

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ARTICLE INFO

Article history:
Accepted 9 August 2018

Keywords:
Beef cattle
Intensive fattening systems
Mortality
Risk factors

ABSTRACT

The aim of this study was to investigate management and feeding practices associated with on-farm loss rate (mortality) on 63 beef cattle farms in Austria, Germany and Italy with housing systems other than fully slatted pens. Information on mortality and 56 categorised factors relating to the cleanliness of animal facilities, health and feeding management, animal-human interaction, cattle transport and origin were gathered during on-farm visits. Samples of total mixed rations (TMRs) were collected and analysed for chemical composition and particle size distribution. Twenty-eight categorised factors were removed from the initial 56 due to exclusion criteria (missing data $\geq$ 20% and/or monolevel factors with $\geq$ 80% answers in one category). Mortality was the response variable in the risk factor analysis and the remaining 10 continuous covariates from TMR analyses and 28 categorised factors were independent predictors. Mean ($\pm$ standard deviation) mortality, representing the proportion of dead, euthanased and early culled animals over the total number of animals bought in or reared in the previous year, was 2.8 $\pm$ 3.5%. Fourteen factors were significantly associated with mortality in the bivariable analyses; seven factors were not considered further in the multivariable analysis due to collinearity. None of the factors related to TMR were associated with mortality. Four categorical factors, referring to biosecurity measures and management, were retained in the final multivariable model, with country effect. Buying cattle from only one farm, no mixing of animals during transport, presence of a dedicated sick pen and keeping production records were associated with lower percentage mortality.
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Introduction

Cattle mortality and culling are important welfare indicators that have a relevant impact on the efficiency of a farm.[1] High on-farm losses are associated with lower financial returns, since each dead or culled animal implies a loss in relation to investments in animals (in the case of purchased bulls), housing, feeding and labour (Mõtus et al., 2017). Additionally, costs arise for carcass pickup, transportation and all disposal-related operations. Moreover, feeding animals that are not used for consumption increases nitrogen excretion and enteric methane emission per kg of meat (Rumor et al., 2015).

Culling is defined by Compton et al. (2017) as removal of a live animal from the farm for immediate slaughter; when applied to intensive beef cattle systems, culling identifies animals with severe health problems from which recovery is unlikely. In this case, beef cattle farmers decide not to treat animals and to cull them at an early stage in order to comply with European legislation on the use

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[1] See: World Organization for Animal Health (Office International des Épizooties, OIE), 2017. Terrestrial Animal Health Code, 21st Ed. OIE, Paris, France. http://www.oie.int/fileadmin/Home/eng/Health_standards/tahc/current/chapitre_aw_beef_-catthe.pdf (accessed 2 July 2018).

https://doi.org/10.1016/j.tvjl.2018.08.002
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of pharmaceutical treatments, which imposes specific suspension times after drug use before slaughter,[2] and on transportation, which bans the movement of unfit animals.[3] As an example, according to this latter regulation, severely lame animals should be slaughtered on-farm if not treated; otherwise they should be euthanased; animals unfit to travel but judged as healthy at the ante-mortem inspection carried out by the veterinarian, and stunned and bled hygienically on-farm, may enter the food chain after being processed at an abbatoir, while other euthanased animals may not be used for human consumption and are likely to be disposed of as 'fallen stock' for animal by-product production or for rendering.

Several factors are known to affect beef cattle losses on farms. As in North America, the beef production chain in Europe often involves the mixing of young animals from different origins and their subsequent transportation. Crowding and stressful circumstances increase exposure to pathogens and decrease immunity, predisposing animals to disease (Callan and Garry, 2002). Amongst newly purchased beef cattle, losses increase when the management at the receiving fattening unit is poor (Gottardo et al., 2009; Mee et al., 2012). On fattening units in southern Europe, the hot season is a further critical factor for imported young stock (Rumor et al., 2015). Mortality decreases with increasing air volume and space allowance in housing facilities (Béranger, 1986),[4] while exposure to adverse microclimatic conditions has the opposite effect (Callan and Garry, 2002). The risk of early culling is lower for bulls housed on deep litter compared to fully slatted floors (Brscic et al., 2015).

Nutrition can have an effect on beef cattle losses. Earlier studies by Béranger (1986) have shown that metabolic disorders due to inappropriate or unbalanced feeding schemes may account for up to 42% of beef cattle mortality. Common diets for finishing beef cattle are rich in concentrates, particularly starch sources, to promote high daily gains (Cozzi et al., 2009). However, a minimum amount of coarse fibrous material must be included in order to ensure adequate rumination (Campbell et al., 1992). Digestive disorders due to ruminal acidosis and feeding of acidogenic diets are responsible for 30–42% of monthly mortality rates in North American feedlots where the total mortality is from 0.17% to 0.42% of animals reared (González et al., 2012). Furthermore, feeding high concentrate diets to beef and dairy cattle has been associated with liver abscessation (Nagaraja and Titgemeyer, 2007) and laminitis (Nocek, 1997).

Although relevant to animal welfare, the environment and farm economics, comprehensive epidemiological analyses of mortality in finishing beef cattle systems under current European farming conditions have not been carried out to date. The aim of the current study was to investigate management and feeding practices associated with mortality rates on 63 beef cattle farms in Austria, Germany and Italy.

Materials and methods

Study design

This study was part of a wider research project investigating the application of the Welfare Quality protocol for beef cattle[5] on commercial beef cattle farms and farmers' attitudes to the implementation of changes intended to improve cattle welfare. Only farms with housing systems other than fully slatted floor pens were included in this study; the rationale behind this choice was to select farmers who were already using flooring considered to provide higher welfare standards. As detailed by Kirchner et al. (2014), a sample of 63 farms (29–31 farms/country) was selected from a pool of 90 commercial farms located in Austria, Germany and Italy that had been recruited according to the following criteria: (1) housing system other than fully slatted floor pens; (2) fattening of intact bulls; (3) at least three pens with finishing bulls > 350 kg live weight.

All farms were visited by three trained assessors (one per country) in spring 2008. During this assessment, each assessor interviewed the farmer, owner or stockperson responsible for the animals using a standardised questionnaire. The farmers were also asked to report, as a single value, the number of dead, euthanased and early culled animals recorded over the last 12 months. This value was used to calculate the percentage of on-farm losses (mortality) by dividing it by the total number of animals bought-in or reared during the previous 12 months. The information gathered from the questionnaire related to: (1) cleanliness of the animal facilities and cattle health management; (2) feeding management; (3) group management and animal-human interaction; and (4) cattle transport and origin (see Appendix: Supplementary material).

Cleanliness of the animal facilities and cattle health management — Questions were related to the frequency of cleaning of the floor and lying area, litter management (frequency of adding bedding material; type and amount of litter used), frequency of cleaning of drinkers and troughs, presence and cleaning of a pen for sick animals, disinfection and maintenance, storage of disinfecting agents, presence of dedicated quarantine areas for newly bought-in animals, veterinary health checks of purchased cattle, number of suckler and dairy herds used as suppliers of the purchased calves, whether calves were purchased or reared on-farm, self-evaluation of the farm health strategy and herd health plan, farm record keeping and subjective evaluation of the mortality in the current year compared to previous years.

Feeding management — Questions were related to the number of different rations, farmer's know-how for ration formulation, routine analysis of feed components, availability of a copy of the last analysis, calculations of exact rations, frequency of analysis of the TMR or other component of the diet, type of feed provision, if feeds were delivered in one place or if special feeds were delivered in special places, the practice and frequency of 'feed push-up' (the action of pushing the feed closer to the animals at the manger between feeding intervals, either mechanically or manually), and expected feed residuals and their management.

Group management and animal-human interaction — Questions were related to access to an outdoor 'loafing area' (an outdoor area where animals are able to rest) and the duration of access (number of days/year and number of h/day), frequency of animal regrouping, ratio between number of animals and stock people (animal keepers) working on a daily basis on the farm, presence of non-regular helpers (not the main animal keepers), presence of malfunctioning equipment assessed in the barn on the day of the farm visit.

Cattle transport and origin — Questions were related to mixing of animals during transport to the farm, calves reared on the farm or transported and the country of origin.

Dietary analysis

During the same on-farm visit, a sample of the diet provided to the animals (~ 1 kg as fed material) was collected by the assessors from different points of the manger at the time of feed distribution, refrigerated until arrival at the respective research institutions and then frozen at −18 °C. After completion of the farm visits, the samples from Germany and Austria were shipped by carrier to the laboratory of the University of Padova, Italy, for analysis. Samples during shipping were stored in insulated expanded polystyrene boxes provided with dry ice to keep them frozen. Samples from 14 farms were lost due to errors made by the shipping company. After arrival at the laboratory, the samples were thawed and 10 diet samples were discarded since they belonged to farms that did not use a TMR feeding system but provided roughage and concentrates separately.

TMR samples were analysed for dry matter (DM) and crude protein (CP) according to the methods of the Association of Official Analytical Chemists (AOAC, 1990). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) was analysed according to Van Soest et al. (1991). Starch content was determined by liquid chromatography (AOAC, 1990).

[2] See: European Commission Directive 2009/9/EC of 10 February 2009 amending Directive 2001/82/EC of the European Parliament and of the Council on the Community code relating to medicinal products for veterinary use L 44/10 EN Official Journal of the European Union 14.2.2009. https://ec.europa.eu/health/sites/health/files/files/eudralex/vol-5/dir_2009_9/dir_2009_9_en.pdf (accessed 2 July 2018).

[3] See: European Council Regulation No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97 5.1.2005 EN Official Journal of the European Union L 3/1. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32005R0001 (accessed 2 July 2018).

[4] See: Scientific Committee on Animal Health and Animal Welfare (SCAHAW), 2001. The Welfare of Cattle kept for Beef Production. SANCO.C.2/AH/R22/2000. https://ec.europa.eu/food/sites/food/files/safety/docs/sci-com_scah_out54_en.pdf (accessed 23 April 2018).

[5] See: Welfare Quality, 2009. Welfare Quality assessment protocol for cattle. Welfare Quality Consortium, Lelystad, Netherlands. http://edepot.wur.nl/233467 (accessed 2 July 2018).

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