The relationship between clinical signs of respiratory system disorders and lung lesions at slaughter in veal calves

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ARTICLE INFO

ABSTRACT

The presence and severity of lung lesions recorded post-mortem is commonly used as an indicator to assess the prevalence of respiratory problems in batches of bovines. In the context of a welfare monitoring based on on-farm measures, the recording of clinical signs on calves at the farm would be more convenient than the recording of lung lesions at slaughter. The aim of the present study was to investigate the relationship between clinical respiratory signs at farm and post-mortem analyses of lung lesions observed at slaughter in veal calves. If clinical signs were a good predictor of lung lesions it could be possible to integrate only those measures in a welfare monitoring system. One-hundred-and-seventy-four batches of calves were observed 3 times: at 3 and 13 weeks after arrival of the calves at the unit and at 2 weeks before slaughter. For each batch a maximum of 300 calves was observed and the proportions of calves showing abnormal breathing, nasal discharge and coughing were recorded. Post-mortem inspection was carried out on a sample of lungs belonging to calves from the observed batches. Each examined lung was classified according to a 4-point scale for pneumonia from healthy lung (score 0) to severe lesions (score 3). The clinical signs recorded *infra vitam* were significantly correlated with moderate and severe lung lesions for observations at 13 weeks and 2 weeks before slaughter and the level of the correlation was highly variable (r_{sp} from 0.16 to 0.40). Receiver operating characteristic (ROC) curves were created and the area under the curves showed that batches with a high proportion of lungs with moderate or severe lesions could not be accurately detected by the three clinical signs of respiratory disorders. These results suggest that both clinical signs and post-mortem inspection of lung lesions must be included in a welfare monitoring schemes for veal calves.

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1. Introduction

In Europe, approximately 5.6 million dairy and cross-bred calves are kept for veal production every year (Institut de l'Elevage, 2010). Calves generally arrive at specialized fattening units at the age of approximately 15 days, where they are kept until 4–6 months of age before being slaughtered. During the fattening period, calves are mainly fed

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milk replacer with some solid feed supplementation. The predominant housing system in Europe is the following: calves are kept individually for the first 6–8 weeks; thereafter they are housed in group pens of 5–15 calves with $1.8\,m^2$ space allowance per animal. These pens have wooden slatted floors (or less frequently concrete slatted floors) and a bucket or a trough feeding system. In some farms calves are kept in large groups of 15–80 animals per pen. These calves are fed through automatic milk delivery devices (AMD) and kept mainly on wooden slatted floors (or less frequently on straw) with a space allowance of $1.8\,m^2$ per animal. These systems of intensive rearing of veal calves have been long time criticized for their potential detrimental effects on the welfare of calves (EFSA, 2006).

On-farm animal welfare monitoring schemes have been developed for different farm animal species including calves kept for veal production (Botreau et al., 2007a; Bokkers et al., 2009; Welfare Quality®, 2009). These schemes are mainly based on animal based measures including health and behavioral measures such as lameness or abnormal oral behaviors. Ideally only one visit per production cycle (*e.g.* lactation or fattening period) should be performed after which the results will be used to define an action plan for welfare improvements on farms where the situation does not fulfill the minimal requirements (Welfare Quality®, 2009).

Respiratory disorders are one of the major contributors to reduce welfare in veal production (EFSA, 2006). Around 25% of veal calves are treated for respiratory disorders (Martineau et al., 2007) and 17% of the calves show extensive lung lesions post-mortem (Van der Mei and Van den Ingh, 1987). The most frequent symptoms observed in veal calves treated for respiratory disorders are fever, abnormal breathing and coughing (Martineau et al., 2007). The inclusion of animal-based respiratory disorders in a health protocol as part of an on-farm welfare monitoring scheme is only possible if the measures are non-invasive, valid, reliable and easy to be recorded in practice. This condition excludes, for example, individual body temperature measurements (fever), because they are time-consuming and require animal handling. In contrast, clinical symptoms of respiratory disorders such as abnormal breathing, nasal discharge and coughing can be easily recorded on farm on a large number of animals without a need for handling. The inspection of lungs at the slaughterhouse represents also a feasible retrospective tool for collecting information on respiratory disorders in veal calves. However, a farm visit is needed in any case because of all other measures needed to monitor welfare. When additionally to that visit, a visit to the slaughter house is needed to collect post-mortem data, that will result in extra time and costs. Furthermore, it is not clear if for example lung lesions give information on respiratory disorders that occurred at a certain moment in time or over the complete fattening period.

The objective of the present study was to determine which respiratory clinical sign would be the best estimate for lung lesions. Therefore, the relationship was studied between three respiratory disorders (abnormal breathing, coughing and nasal discharge) recorded on farm at three moments (early, mid, late stage) during the fattening period and pathological findings on lungs

obtained for the same batches of calves at slaughter. The hypothesis was that the level of respiratory clinical signs recorded in a given batch of calves would be a good measure to detect batches with high levels of lung lesions.

2. Materials and methods

2.1. Farm sample

Data were collected between the summer of 2007 and spring of 2009 on 174 veal farms located in the Netherlands ($n = 100$), France ($n = 50$) and Italy ($n = 24$). The sample within each country consisted of farms located in the main regions where veal calves are reared and it was selected among farmers willing to participate in the study. The sample is considered as a judgment sample as described by Dohoo et al. (2003). A single batch of calves (group of calves that arrived at the farm at the same time to be fattened and slaughtered together) was considered for each farm, and the selected batches were distributed across all four seasons. One hundred and forty nine batches were housed for the whole fattening period in groups of 5–15 calves (small groups) and fed milk replacer with a collective trough or an individual bucket. Twenty-five batches were housed in groups of 25–80 calves (large groups) and fed milk replacer by AMD. Calves (mostly males of Holstein breed) arrived at the fattening units around 15 days of age. All batches received one collective prophylactic treatment for respiratory disorders at the start of the fattening. The calves were slaughtered after a fattening period of on average 26 weeks (range 15–31 weeks). The study farms showed a large variability in size (number of calves), feeding plan (amount of milk replacer and amount and type of solid feed), microclimate control and management.

2.2. Clinical observations

On all farms, the selected batch was observed 3 times during the fattening period for clinical inspection: the first observation was performed at about 3 weeks (range 2–6 weeks) after arrival of the calves at the fattening unit, the second at 13 weeks (range 11–17 weeks) after arrival and the third at the final stage of fattening period which was about 2 weeks (range 1–4 weeks) before slaughter. At the onset of fattening period, calves that were later on housed in small groups were individually housed by temporary separators placed inside the group-pen. These separators were removed after a maximum of 6 weeks and thereafter animals were group housed until the end of fattening period. Consequently, calves were individually housed at the time of the first visit, while they were group housed at the second and the third visit. The protocol for detecting respiratory disorders (including conditions of the observation and a description of the symptoms) was developed in collaboration with field veterinarians specialized in veal production. Three symptoms were taken into account to evaluate the prevalence of respiratory disorders: abnormal breathing, nasal discharge and coughing. A calf exhibited abnormal breathing when at least one of the