Assessing the relationship between dairy cow cleanliness and bulk milk hygiene on organic and conventional farms

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Abstract

Twenty eight UK dairy farms were visited during January 2004. A representative sample of cows was hygiene scored to determine the degree of contamination with dirt, faeces and bedding. Monthly milk quality data including Bulk Tank Somatic Cell Count (BTSCC) and Bactoscan (BS) count and the reported clinical mastitis case rate were recorded. Bulk-tank milk samples from each farm were submitted for bacteriological culture. The quartile of herds with the lowest BTSCC tended to a lower (cleaner) cow hygiene score. When ranked by cow hygiene score, the top quartile of herds (cleanest cows), were compared to the bottom quartile of herds (dirtiest cows), with respect to milk bacteriology results. No significant mastitis pathogens were cultured from milk from the top quartile of herds (with the cleanest cows), although samples from the bottom quartile of herds contained major mastitis pathogens. Regression analysis comparing BTSCC to median herd hygiene score found a significant positive association on organic farms. Logistic regression analysis found that increased whole-cow, flank score and udder hygiene score (more dirty) tended to be associated with a decreased risk of being in a low BTSCC herd. There was no significant association between hygiene score and BS or mastitis incidence. This study suggests that cleanliness of cows is associated with BTSCC, which most likely reflects subclinical mastitis and is especially important on organic farms.

Introduction

A number of hygiene scoring systems for dairy cows have been developed to record the degree of contamination of different anatomical areas with dirt and faecal matter, thus giving an overall assessment of the cleanliness of the whole animal (Hughes, 2001; De Rosa *et al.*, 2003). Hygiene scoring of cattle is routinely used in the beef industry in the UK to assess the cleanliness of cattle prior to slaughter as part of the Clean Livestock Policy to reduce the potential risk of contamination of carcases with dirt and faecal material (Meat Hygiene Service, 1987). In the dairy industry it has been used as a possible indicator of cow welfare and in studies of the influence of housing conditions on mastitis incidence (Ward *et al.*, 2002), the effects of tail docking (Schreiner and Ruegg, 2002), sub-clinical intra-mammary infection rates (Schreiner and Ruegg, 2003) and the risk of bacterial contamination of milk (Sanaa *et al.*, 1993). Animal-based health and welfare assessment is used as a tool to investigate the effects of different management systems on the cows themselves, as opposed to evaluating the provision of resources on a farm (Main *et al.*, 2003; Whay *et al.*, 2003). There is increasing interest in, and demand for, animal-based assessment of livestock from organic and conventionally managed farms, allowing benchmarking between farms and to compare the effects of different management systems (Pye-Smith, 2003; Huxley *et al.*, 2004). This study aimed to determine whether cow hygiene score affected the hygiene parameters of the milk produced and the clinical mastitis incidence on organic and conventional dairy farms. A cross sectional study assessed farms during the winter housing period.

Methods

Twenty eight UK dairy farms (14 organic and 14 conventional) were visited during January 2004. A representative sample of cows from each management group on the farm was assessed to determine the degree of contamination with dirt, faeces and bedding. A modified scoring method based on previous studies was used (Hughes, 2001). Four anatomical areas were observed on each cow: the flanks, the legs, the tail and the udder, with an overall whole-cow score ascribed based on summation of scores from these sites. Scores were assigned on a 1 to 5 scale (score 1 = very clean, no dirt; score 5 = heavily soiled with dirt and/or faeces) with all area scores summated for each cow; thus giving the whole-cow score from 4 to 20. One observer determined and recorded scores throughout the study. Monthly milk quality data including Bulk Tank Somatic Cell Count (BTSCC) and Bactoscan (BS) count and the reported clinical mastitis case rate were recorded. The three-month (January-March) geometric mean BTSCC and two-month (Jan-Feb) mean BS counts were calculated. The mean monthly clinical mastitis case rate was determined for January and February. Bulk tank milk samples were obtained aseptically on each farm following stirring for a minimum of 2 minutes after milk had cooled to below 4ºC. All milk samples were stored frozen at -20ºC and submitted together for bacteriological culture to the Veterinary Microbiology Laboratory, University of Glasgow Veterinary School.

Herds were ranked by BTSCC, BS and mastitis incidence, with the median hygiene score of the top quartile of herds compared to the median hygiene score of the bottom using a Mann-Whitney test. Herds were also ranked by cow hygiene score, and the top quartile of herds (cleanest cows), were compared to the bottom quartile of herds (dirtiest cows), with respect to milk bacteriology results. Linear regression analysis compared BTSCC and BS to median herd hygiene score on organic and conventional farms. All herds were allocated into either high or low status groups for mean BTSCC and BS count (above or below 250,000 cells/ml and 50,000 counts/ml respectively). Logistic regression analysis to determine inclusion in a high (less desirable) status group was conducted including the hygiene score of cows as a factor.

Results

The quartile of herds with the lowest BTSCC (124,000 cells/ml) tended to have a lower (cleaner) median cow hygiene score (score of 9) than herds in highest BTSCC quartile (294,000 cells/ml; score of 11) (p=0.06). Linear regression showed a difference in relationship between hygiene score and BTSCC association between organic and conventional farms (Figure 1).

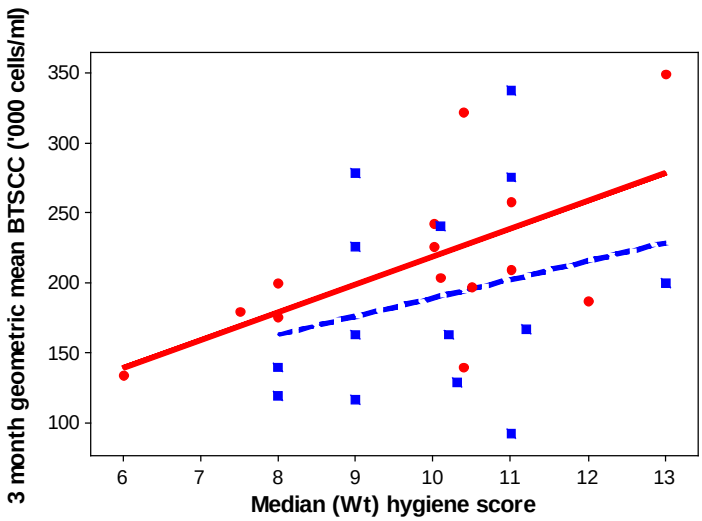

Figure 1 Association between cow hygiene score and BTSCC (▪ =conventional farms, • =organic farms)

There was a significant relationship between hygiene score and BTSCC on organic farms R^2=0.38 (p=0.02) but not on conventional farms R^2=0.06 (p=0.38). There was no significant association between hygiene score and BS count or mastitis incidence. No major mastitis pathogens were cultured from the cleanest quartile of herds, but major pathogens (*Streptococcus uberis* and *Staphylococcus aureus*) were cultured from 3 herds in the dirtiest quartile. Increased whole-cow, flank score and udder hygiene score (more dirty) tended to be associated with a decreased chance of being in a low BTSCC herd (P<0.07).

Discussion

This study identified a tendency for a positive relationship between cow hygiene score and herd BTSCC, possibly indicative of increased sub-clinical mastitis. This would suggest that hygiene score is not merely a cosmetic issue and is associated with BTSCC and therefore, sub-clinical mastitis. Importantly, major mastitis pathogens were isolated in milk from the dirtiest quartile of herds. Investigation of risk for high BTSCC is difficult, as the aetiologies of both sub-clinical and clinical mastitis are multi-factorial. Other factors to consider in future studies (which were outside the scope of this study) are, for example, the level of intra-mammary drug use, the culling policy of high cell count cows, the milking routine or mastitis prevalence. No multivariable logistic regression model could be constructed for the high and low BTSCC groups, which most likely reflects this multifactorial nature and the small sample size of herds considered here. The difference in the association between BTSCC and hygiene score between organic and conventional farms would suggest that organic farms, which use fewer antimicrobials and no blanket dry cow therapy, should emphasise clean cow management as part of sub-clinical mastitis prevention. The lack of association between hygiene score and BS count or clinical mastitis incidence again reflects the multifactorial aetiological nature of mastitis and also may reflect difficulties in case definition and reporting when using farm record data, when mastitis incidence may only reflect those cases receiving antibiotics. Additionally, the BS count is often dissociated from cow factors and influenced poor bulk tank hygiene or poor parlour and milking machine washing techniques.

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