AN ANIMAL-BASED WELFARE ASSESSMENT OF GROUP-HOUSED CALVES ON UK DAIRY FARMS

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A series of measures of calf welfare was developed through a process of expert consultation. A welfare assessment of group-housed calves was carried out on 53 UK dairy farms during the winter of 2000/01. The assessment used animal-based measures including direct observation of the calves and examination of their health history through a review of farm records. The findings from this were compiled into a profile of calf welfare which outlined the range of results for each measure used. The results fell into the three categories of respiratory health, nutrition and general appearance. A broad range of results was found across the farms visited for the measures in each of these categories. Some farms performed well for all measures taken, and no farms performed consistently badly across all aspects of calf welfare. The majority of farms combined aspects of both good and poor welfare performance.

Keywords: *animal-based, animal welfare, calves, dairy, group housing, welfare assessment*

Introduction

The need for measurement of animal welfare on-farm has gained impetus with the advent of farm assurance schemes. The Farm Animal Welfare Council (FAWC 2001) has highlighted the need for further development of on-farm welfare assessment techniques.

In general, the type of welfare assessment used in the evaluation of farm assurance schemes is based on the provision of resources and management (Wood *et al* 1998). The Animal Needs Index (Bartussek 1999) uses measures of provision such as a farm's potential to provide mobility, social contact, good quality flooring and correct climate to assess the welfare suitability of a farm. These types of assessment are considered to be of value because of their objective and repeatable nature. An animal-based approach is inherently more difficult as it involves observation of animals. However, the merit of this approach is that it aims to give a more direct view of how the animals are coping with the resources provided for them.

Calves produced by dairy cattle have very variable economic value to UK producers. Pure-bred dairy heifers to be reared as herd replacements are a reasonably high-value commodity in comparison with pure-bred dairy bull calves. A number of UK farmers have adopted a policy of slaughtering dairy bull calves shortly after birth; those that decide to rear these animals do not expect a good financial return, which may affect the welfare provision

for those animals. Calves which are beef/dairy crosses also have a variable value to the producer depending on the cross and its sex and fluctuations in its market value.

In this study, group-housed calves were assessed. Legislation in Great Britain (*The Welfare of Farmed Animals (England) Regulations 2000*) requires that all calves are group housed by eight weeks of age. This means that calves spend the majority of their lives in a group situation which is often dynamic and which does not enable observation as easily as would individual-pen housing. This study describes the development of a protocol to determine the range and level of welfare indicators in group-housed calves on UK dairy farms through observation of health and behaviour and farm records. This welfare assessment protocol was then tested on 53 dairy farms in the Midlands and the South West of England.

Method

A welfare assessment protocol was developed based around the outcome of a consultation exercise during which respondents were asked to identify and rank suitable animal-based measures of welfare for dairy cattle, pigs and laying hens (Whay *et al* 2003a). Within those measures listed for the assessment of dairy cattle, some measures specific to calf welfare such as observation of calf disease and examination of calf health records were identified by respondents. Further, a number of measures such as observation of skin lesions, cleanliness, body condition, behaviour, demeanour and social interaction were equally applicable to the welfare assessment of both calves and adult animals. These indicators were used in the assessment protocol and were based around the Five Freedoms (FAWC 1993), incorporating both animal observation and examination of farm records.

In total, 53 commercial dairy farms situated in the Midlands and the South West of England were visited between November 2000 and February 2001. The visits combined an assessment of both calves and adult dairy cattle; the results of the latter group are reported elsewhere (Whay *et al* 2003b). The youngest group of calves, irrespective of breed or the range of ages in the group, was assessed wherever they were present. All visits were arranged to take place during the afternoon, prior to afternoon milking. The three stages of the welfare assessment involved a questionnaire to be completed by the farmer requesting an estimate of disease incidence, observations made by a single observer (HRW) during a single visit, and an analysis of medicine use and treatment records. Farms were recruited either through membership of the Freedom Food farm assurance scheme (28), or through nomination by neighbours or local veterinary surgeons or from the telephone directory (25).

A questionnaire was sent to the farmer prior to the farm visit and included a request for an estimate of the incidence of calf pneumonia cases and diarrhoea cases which had occurred during the past year. The animal-based observations included undisturbed behaviours such as grooming, signs of skin irritation, oral activity, and playing. These behaviours were scored as either absent or present at the level of some, medium or a large amount. This was followed by a sequence of detailed observations made on every individual within the group; these observations were classified as none, mild, medium or severe. The observations included increased respiratory rate and abnormal respiratory character, as well as the presence of coughing. Nutrition was assessed through body condition less than score 2 using a body condition scoring system adapted from use in dairy cattle (Edmonson *et al* 1989), bloated or hollow rumen shape, signs of an impacted rumen (hay belly) and dirt in the area of the perineum and tail or observable diarrhoea. Finally the calves were checked for body lesions (usually injuries caused by the environment), coat condition (dull, thick or showing areas of hair loss), dirt on the hind limbs or flanks, and general demeanour (dull or apathetic). A set of guidance notes was produced giving detailed descriptions of how each measure was to be

observed and distinguishing between the severity categories. Wherever possible, details were recorded from the medicine and treatment records spanning the previous 12 months.

The observations and records collected from all farms were collated and the results from each set of observations and records were grouped into thirds (A, top; B, middle; C, bottom) such that the range of results from one third of farms was displayed within each band. Consequently, a farm whose results for increased respiratory rate was in the top third (band A) would not necessarily also be in band A for all other measures. Where measures were ranked according to severity (eg injuries to body, cleanliness), all degrees of severity from mild to severe were pooled for this analysis and compared with animals showing no signs. The interaction of different elements of the welfare assessment protocol was examined using Pearson's correlation to relate measures, and only those significant at the level of $P < 0.01$ are reported.

The observations of welfare parameters made on an individual-animal basis were ranked across 45 of the farms from 1 (best) to 45 (worst) for each measure. These farms were included in this analysis as they had complete data sets. The overall rank score for each farm was obtained by calculating the mean of the ranks for all measures for that farm. Thus, a farm that performed consistently well across all calf welfare measures would have a very low mean rank score and *vice versa*.

Results

The independent observations were completed for all 47 farms with group-housed calves. Fourteen farms did not produce medicine and health records and four farms did not complete the questionnaire asking for their own estimate of disease incidence. However, all 53 farms provided some of the information required for the assessment. Of the groups of calves observed, 34 were housed with animals all of a similar size while 13 were housed with animals of dissimilar ages and sizes. The median number of calves kept on each farm was 28 (lower quartile 15, upper quartile 42) and the youngest group of calves on which the animal-based observations were made had a median group size of eight animals (lower quartile 5, upper quartile 13). However, overall the median age of the calves observed was 3 months (lower quartile 2, upper quartile 5).

The presence and level at which group behaviours were observed in the calves, before they were disturbed by the observer, is shown in Table 1. The numbers of groups displaying fearfulness, avoidance, disinterest, cautious interest and interest were 2, 0, 8, 7 and 30, respectively.

Table 1   **The proportion of farms with each severity category for four behaviours observed at the group level.**

| | | Level at which each behaviour was observed | | | |
		None	Some	Medium	Large amount
Observation of group behaviour	Grooming	4	35	7	1
	Signs of skin irritation	33	7	7	0
	Oral behaviours	8	31	8	0
	Play	29	11	6	1

The results of the sequence of observations of all individuals within each group of calves and the disease incidence information gathered from the medicine records and farmer estimates of disease levels were compiled into a profile of calf welfare (Table 2). The measures have been organised into categories of observations, records and farmer estimates of disease relating to respiratory health, nutrition and observations of general health.

Table 2 **Welfare profile of group-housed calves based on observations, records and farmer opinion. Est, estimated by farmer; Obs, observed during visit; Rec, farm records.**

Measure (including unit and source)	Score categories (Results from one third of farms in each band)		
	A	B	C
Respiratory health			
Increased respiration rate (% Obs)	0–0	0–0	3.6–56.3
Abnormal respiratory character (% Obs)	0–0	0–6.7	9.1–43.8
Coughing (% Obs)	0–7.1	10–28.6	33.3–100
Cases of pneumonia (per 100 calves per year, Est)	0–0	0–2.4	3.3–32.4
Cases of pneumonia (per 100 calves per year, Rec)	0–0	0–0	0–19.6
Nutrition			
Thin calves (BCS<2) (% Obs)	0–0	0–0	6.3–88.9
Bloated rumen (% Obs)	0–0	0–0	0–63.6
Hollow rumen (% Obs)	0–0	0–11.1	16.7–100
Impacted rumen 'hay belly' (% Obs)	0–0	0–12.5	18.2–100
Dirty perineum and tail (% Obs)	0–0	0–25	28.6–100
Diarrhoea[1] (% Obs)	0–0	0–0	12.5–83.3
Cases of scour (per 100 calves per year, Est)	0–0	0–9.1	9.8–47.9
General appearance			
Injuries, body lesions (% Obs)	0–0	0–0	0–100
Dull coat (% Obs)	0–0	0–0	0–14.3
Thick/hairy coat (% Obs)	0–0	0–45.5	53.3–100
Hair loss[2] (% Obs)	0–0	0–14.3	18.2–100
Dirty hind limbs (% Obs)	0–0	0–6.3	9.1–100
Dirty flanks (% Obs)	0–0	0–0	0–77.8
Dull/apathetic demeanour (% Obs)	0–0	0–4.5	6.7–40

[1] Diarrhoea observed as either signs in the calf or on the bedding
[2] Hair loss primarily due to ringworm

Table 3 presents a series of correlations between the observational measures made on individual farms. Some of these were predictable and indicated good reliability between observations. There were significant correlations between abnormal respiratory character and rapid respiration, coughing and dull demeanour. Many correlations between coat condition and cleanliness were found to be significant, and included within this were signs of skin irritation and dull demeanour.

Forty-two farms reported the number of calf deaths they had had during the previous 12 months. The median number of calf deaths per 100 calves per year was 1.6 (lower quartile 0, upper quartile 6.5) based on the farmer's estimate. Of the 43 farms that provided information about the number of cases of scours, the median incidence was 2.5 cases per 100 calves per year (lower quartile 0, upper quartile 12.3). A significant correlation was found between the reported number of calf deaths and the reported incidence of calf diarrhoea ($r = 0.555$, $P < 0.001$). The average incidence of calf pneumonia reported by the farmers was 3.6 cases per 100 calves per year (median 0, lower quartile 0, upper quartile 4.6), and the incidence as recorded in the medicine records was 1.5 cases of pneumonia per 100 calves per year (median 0, lower quartile 0, upper quartile 0). The correlation between the incidence of

pneumonia reported by the farmer and the level recorded in the medicine book was significant ($r = 0.589$, $P = 0.00$).

Table 3   Significant correlates of calf welfare measures.

Welfare measures		Correlation coefficient	P value *
Body injuries and lesions	Dull coat	0.388	0.007
	Hair loss	0.454	0.001
Abnormal respiratory character	Rapid respiration rate	0.572	<0.001
	Apathetic/dull demeanour	0.470	0.001
	Coughing	0.541	<0.001
Rumen appearance			
Bloated rumen	'Hay belly' impacted rumen	0.396	0.008
Hollow rumen	Thin (< BCS 2)	0.736	<0.001
Coat condition and cleanliness			
Dull coat	Thin (< BCS 2)	0.445	0.002
	Hair loss	0.39	0.007
Dirty perineum and tail	Apathetic/dull demeanour	0.428	0.003
Dirty hind limbs	Thick hairy coat	0.480	0.001
	Dirty flanks	0.643	<0.001
Dirty flanks	Thick hairy coat	0.400	0.005
Hair loss	Skin irritation	0.527	<0.001

*   Inclusion level $P < 0.01$

The overall assessment of calf welfare for 45 farms is shown in Figure 1. One farm achieved a mean rank score of 1 and no farm received a mean rank score of greater than 30 out of a possible maximum rank score of 45. The results followed a normal distribution and showed that some farms scored consistently well across the measures taken and no farm was consistently bad for all of the measures taken.
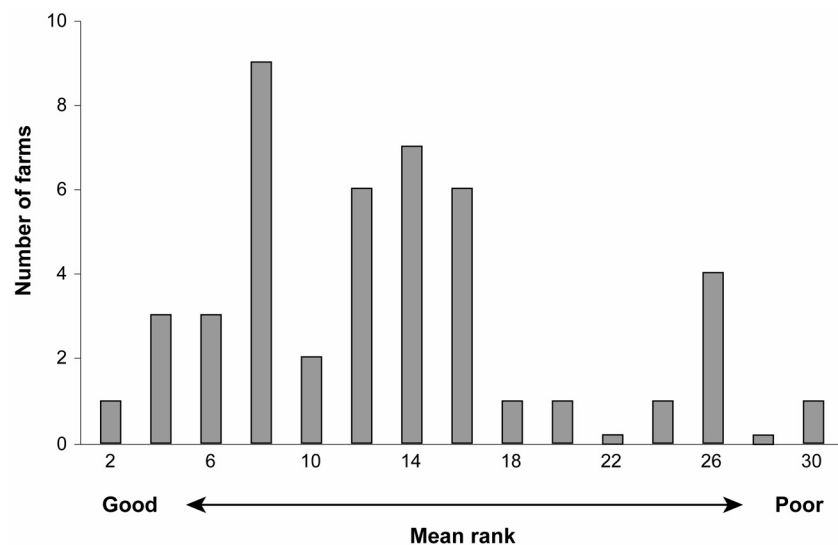
Figure 1   Distribution of the mean rank scores for the observed welfare measures of individual calves.

Discussion

The 53 farms involved in this study were situated in the Midlands and the West of England so do not necessarily represent the situation across all areas of the UK. However, they probably constitute the largest independently observed animal-based welfare assessment to have been carried out to date in the UK. The expert consultation process from which the animal-based measures of calf welfare were derived (Whay *et al* 2003a) was aimed at determining measures of dairy cattle welfare. The fact that respondents included measures relating to calves indicates the importance of calf welfare within any assessment of animal welfare carried out on dairy farms.

The calf welfare profile (Table 2) presents the range of results for each welfare measure and their distribution among the 53 farms. The spread of results shows that although for each measure some farms performed well, in most cases at least one third of farms was found to be performing poorly. Indeed, for each of the observations of coughing, hollow and impacted rumens, dirty perineum/tails and hind limbs, injuries and body lesions, and poor coat condition, at least one of the farms displayed a 100% prevalence. Figure 1 illustrates that a few farms were able to perform well for all measures. In most cases some problems were identified and these were not the same for each farm. Most importantly no farm performed consistently badly for all measures. The fact that different farms performed poorly in different aspects of calf welfare is encouraging as this indicates that it is ultimately possible to achieve good welfare in group-housed calves. This assessment protocol provided a single 'snap-shot' of welfare state at the time of the visit. It should, however, be noted that nearly all of the measurements used in this assessment reflect the welfare state of the animals over the previous period of weeks or months.

There must inevitably be some uncertainty attached to the reliability of farm records and estimates of disease rate. However, in the case of calf pneumonia a good correlation was found between the incidence reported by the farmer and the level recorded in the medicine book. This gives a level of validity to using records to assess this particular condition. The range of correlations found between observational measures of calf welfare also serves to validate the use of these measures. Exploration of the relationships between some of the measures may allow future refinement of the assessment process and a better understanding of how some animal-based measures are related to resource and production indices.

The observation of group behaviours shows that some grooming, although generally not excessive amounts, was observed among the majority of calves. A considerable number of animals was observed to be performing some oral behaviours, predominantly sucking and licking. Although there is concern about the presence of stereotypies developing in group-housed calves, it has also been found that postprandial sucking behaviour is important for the digestive process in calves (De Passillé *et al* 1993). The observations made during this study were not able to differentiate between oral behaviours attributable to stereotypies and normal digestive requirements. However, excessive oral behaviours were not observed among any groups.

The welfare assessment protocol was designed for use in group-housed calves. The aim of the protocol was to assess how the animals were coping within the environment available to them. This protocol does achieve the objective of assessing outcome and, where possible, has included positive welfare indicators such as play behaviour in calves. Because the assessment is based on measures of outcome (welfare state) it has general application to all breeds and ages of calves and all systems of housing and management. It is, therefore, well suited to explore the welfare impact of different husbandry systems.

References

Bartussek H 1999 A review of the animal needs index (ANI) for the assessment of animals' well-being in housing systems for Austrian proprietary products and legislation. *Livestock Production Science 61*: 179-192

De Passillé A M B, Christopherson R J and Rushen J 1993 Nonnutritive sucking and postprandial secretion of insulin, CCK and gastrin by the calf. *Physiology & Behavior 54*: 1069-1073

Edmonson A J, Lean I J, Weaver L D, Farver T and Webster G 1989 A body condition scoring chart for Holstein dairy cows. *Journal of Dairy Science 72*: 68-78

Farm Animal Welfare Council 1993 Report on priorities for animal welfare, research and development. FAWC: London,UK

Farm Animal Welfare Council 2001 Interim report on the animal welfare implications of farm assurance. FAWC: London, UK

The Welfare of Farmed Animals (England) Regulations 2000 Statutory Instrument No 1870. Her Majesty's Stationery Office: London, UK

Whay H R, Main D C J, Green L E and Webster A J F 2003a Animal-based measures for the assessment of welfare state of dairy cattle, pigs and laying hens: consensus of expert opinion. *Animal Welfare 12*: 205-217

Whay H R, Main D C J, Green L E and Webster A J F 2003b Assessment of the welfare of dairy cattle using animal-based measurements: direct observations and investigation of farm records. *Veterinary Record 153*: 197-202

Wood J D, Holder J S and Main D C J 1998 Quality assurance schemes. *Meat Science 49*: 191-203 (Suppl 1)