Welfare assessment: indices from clinical observation

AJF Webster*, DCJ Main and HR Whay

Department of Clinical Veterinary Science, University of Bristol, Langford, Bristol BS40 5DU, UK
*Contact for correspondence and requests for reprints: John.Webster@bristol.ac.uk

Abstract

It is not enough to study animal welfare; our responsibility is to promote it. To this end, we need to step out of our laboratories and develop robust protocols for assessing welfare in groups of animals on farms or in the laboratory. While these protocols must incorporate principles derived from detailed scientific study they will, in practice, need to be based on clinical observations and records that an assessor can acquire at a single visit. Such assessments must also be comprehensive: approaches based only on behaviour, or motivational state, or physical appearance, or performance records, can never tell the full story. The 'Five Freedoms' provide a comprehensive template that incorporates the different elements that define welfare state. However they only describe welfare at the time of observation. Protocols, for example, for on-farm assessment need to include measurements and records that provide evidence of long-term consequences of the quality of husbandry practices (eg body condition, chronic injuries). This paper reviews approaches developed at Bristol for the on-farm evaluation of welfare in dairy cows and free-range hens. The criteria used to assess welfare from clinical evidence were developed through expert consultation using the 'Delphi' review process. Experts were also asked to make value judgements as to the seriousness of different elements of poor welfare by indicating the point at which intervention would be necessary to resolve specific problems. This study identified a serious limitation of Quality Assurance schemes that seek to encompass many different elements of welfare into a single index that ranks overall welfare as acceptable or unacceptable. Specific farms had specific welfare problems and these required specific solutions.

Keywords: animal welfare, dairy cattle, freedom food, hens, on-farm assessment, quality assurance

Introduction

If science is to be of service to animal welfare, scientists must do more than just study it. If our past and current research is to have meaning for the vast populations of animals used by humans for our own ends, then we must take it out of the confines of our own laboratories and into the world where these animals actually live. We need practical, robust protocols for assessing the welfare of animals kept in groups for commercial purposes, whether on farms, in zoos and other places of popular entertainment, or in scientific establishments. What is more, we need effective, enforceable strategies for implementing these welfare assessments and addressing welfare problems as they occur. Although such assessments may appear superficial to those engaged in pursuit of subtler questions of motivation and behaviour, we should always remember that the best can become the enemy of the good if it becomes a recipe for inactivity.

This paper describes the development and implementation of protocols for the assessment of the welfare of animals on farms. Many of the points raised were discussed in greater depth at the Second International Workshop on the Assessment of Animal Welfare at Farm and Group Level, held in Bristol in 2002, the proceedings of which were published in *Animal Welfare* in 2003. The specific protocols described for the evaluation of welfare in dairy cattle and

laying hens are those used by the authors for an independent audit of the welfare of animals on farms operating to the standards of the Royal Society for the Prevention of Cruelty to Animals (RSPCA) Freedom Food system (Main *et al* 2003; Whay *et al* 2003a,b).

Husbandry and welfare

Our operational definition of animal welfare is encapsulated by the following minimalist statement:

'Fit and Feeling Good'

Fitness (for a 'production' animal) implies the capacity to sustain health and vigour throughout an effective working life. In essence, if not in practice, this corresponds to the Darwinian definition of fitness to transmit one's genes to subsequent generations. By this definition, a broiler chicken exhibiting symptoms of lameness at six weeks of age, or a dairy heifer exhibiting symptoms of lameness within 10 weeks of calving for the first time, are not fit. The expression 'Feeling Good' acknowledges sentience, where sentience can be defined, with similar brevity, as 'feelings that matter'. At the very least, it matters to an animal that it should not suffer. However our responsibility for animal welfare should imply more than simply the desire to minimise suffering; it should also incorporate a concern for elements of positive welfare such as comfort, companionship

Table 1   The Five Freedoms and Provisions as defined by the Farm Animal Welfare Council (FAWC 1993).

1.	Freedom from thirst, hunger and malnutrition — by ready access to fresh water and a diet to maintain full health and vigour.
2.	Freedom from discomfort — by providing a suitable environment including shelter and a comfortable resting area.
3.	Freedom from pain, injury and disease — by prevention or rapid diagnosis and treatment.
4.	Freedom from fear and distress — by ensuring conditions that avoid mental suffering.
5.	Freedom to express normal behaviour — by providing sufficient space, proper facilities and company of the animal's own kind.

and security. It follows from this that good husbandry involves the provision of the resources and care necessary to promote (if not guarantee) lifetime welfare (sustained fitness and feeling good).

There is a school of thought amongst welfare scientists that argues that if the welfare of an animal is defined by how it feels then, by definition, feeling good is all that matters. This presents practical problems since there is frequently a conflict between actions directed towards fitness and feeling good. Permitting broiler breeders, or young human children, to eat energy-rich food to appetite may help them to feel good at the time, but it is not good husbandry because it compromises their fitness. Thus, while you may not accept the proposed definition of welfare, you must accept that both elements of the definition (fitness and feeling good) are necessary to our contract to provide good husbandry.

The Five Freedoms and Provisions, as defined by the Farm Animal Welfare Council (FAWC 1993), offer a concise yet comprehensive approach to identifying and evaluating the elements that determine animal welfare and the provisions necessary to promote it. Each of the Freedoms listed in Table 1 defines an element of welfare state and is accompanied by an expression of the provisions necessary to achieve that element. The logic of the Five Freedoms can be used to identify, in general terms, possible contributors to poor welfare through loss of physical fitness or mental suffering that may be linked directly to feeding, breeding, housing and management. The following examples illustrate the application of the Five Freedoms as a diagnostic tool to the assessment of the welfare of the dairy cow.

• The cow may both suffer and fail to sustain fitness from hunger, malnutrition or metabolic disease attributable to a failure to provide a diet appropriate to its phenotype (its genetic and physiological potential to produce milk).

• The cow may suffer chronic discomfort through poor cubicle design and inadequate bedding, and this may become worse if she loses condition through malnutrition.

• The cow may suffer chronic pain through lameness or mastitis attributable to a failure to ensure adequate prevention and early treatment.

• The cow may show an increased susceptibility to infectious disease attributable to a failure to sustain metabolic fitness.

• The cow may be bullied or denied proper rest by other cows because of inadequate housing provision.

• The cow may experience metabolic or physical exhaustion caused by the stress of prolonged high production.

Exhaustion, the last element of this analysis, is a long-term consequence of poor welfare and one that does not emerge clearly from the logic of the Five Freedoms.

Quantifying welfare state on farms

Public concern for high standards of food production has encouraged producers, and especially retailers, to develop Quality Assurance (QA) schemes that set production standards relating to food hygiene, production system (eg organic), country (or farm) of origin, and animal welfare. The only true assurance of conformity with standards of quality assurance is an effective system of quality control. Thus any QA scheme that claims to operate to high standards of animal welfare must incorporate an effective audit to ensure that these standards are being met and to remedy specific problems as they occur. The welfare of animals confined, fed and bred to serve the needs of man, whether on intensive farms or in laboratories, will be profoundly influenced by the quality of resource provision and animal care. If a quality control scheme is to provide a measure of welfare assurance for farm animals, it must therefore give attention to elements of both provision and outcome: ie husbandry and welfare (Figure 1). European agriculture is currently awash with welfare-based QA schemes (for a review see FAWC 2001). At present these are based almost entirely on measures of husbandry (resources and records). This is understandable and valid up to a point, partly because such information can be collected in objective fashion and partly because the purpose of QA schemes is to regulate what the farmer does to promote welfare in his/her animals. Nevertheless the ultimate objective of a welfare-based QA scheme must be to ensure a satisfactory *outcome*; namely animals that are fit and feeling good. Thus the ultimate guarantee of quality in such a scheme must be based on direct, animal-based measures of welfare state. These measurements need to be robust, quantifiable and sufficiently objective to minimise between-observer variation. Moreover, for practical purposes each set of measurements will need to be accomplished within a day or less. This raises the concern that they may be no more than snap shots, which fail to reflect the long-term picture. This is a valid concern but one that can be offset to a large extent by selecting animal-based measures that integrate long-term consequences of past husbandry. Body condition scores in cattle and the prevalence of healing fractures in laying hens are two good examples of such integrative measures.

The first target of any QA Scheme is to ensure compliance with existing legislation and welfare codes of practice (FAWC 2001). However this alone provides negligible

incentives either to the consumer or to the farmer to buy and sell food produced to high welfare standards. No QA scheme will prove effective in practice unless it is seen to add real value by all concerned parties: consumers, retailers, farmers and their animals (Webster 2001). Some improvements to animal welfare, implemented at the farm level, can be economically advantageous to the farmer. For example, sustaining the fitness of the dairy cow to prolong her working life from two to six lactations can improve her lifetime productive efficiency by 15–20% (Webster 2000). However many of the husbandry provisions necessary to improve welfare (better housing, improved veterinary care) can only be achieved at a cost. It follows therefore that many farmers, currently doing the best they can within the current economic climate, will only improve standards of husbandry if they are paid a premium to do so. For this to happen, it is necessary to promote the demand for higher value animal products within a free market. Here the measure of value incorporates an assessment of the 'Non-product-related Processing and Production Methods' (Webster 2001). This is the basis for QA schemes directed towards niche markets (eg 'organic', 'Freedom Food'). Producers see these as a way to combat international competition for trade in commodities by producing higher value products. QA is therefore an instrument of competition. It follows that only the most successful QA schemes will survive. A successful (and good) welfare-based QA scheme requires:

• Consumer awareness of the principles of animal welfare and good husbandry that underpin the scheme (eg the 'Five Freedoms and Provisions').

• Consumer trust based on a demonstrable guarantee of high welfare through proper quality control (audit and intervention).

• Farmer compliance based on an acceptable reward for increased expenditure of time and money on good husbandry.

"Quis custodiat ipsos custodies": audit of the RSPCA 'Freedom Food' system

The RSPCA 'Freedom Food' scheme provides an independent audit of welfare-related standards on participating farms. This, in common with other QA schemes, has been accredited to the European standard EN45011, which, in essence, demonstrates that the scheme itself meets the criteria of competence and impartiality. What such accreditation does not demonstrate, however, is whether the scheme achieves its aim of ensuring good welfare on individual farms. At present this is not possible for the simple reason that the standards (eg RSPCA 2001) are based almost entirely on measures of husbandry provision rather than on welfare outcomes. The commitment of the RSPCA to the principles and practice of the Freedom Food scheme has undoubtedly been a powerful force for imbuing a sense of trust in the consumer. It is, however, always necessary to ask the question: "Who is policing the policeman?" In this context the question becomes: "Who is auditing the effectiveness of the Freedom Food scheme in promoting high (or improved) standards of animal welfare on farms?" The

Figure 1
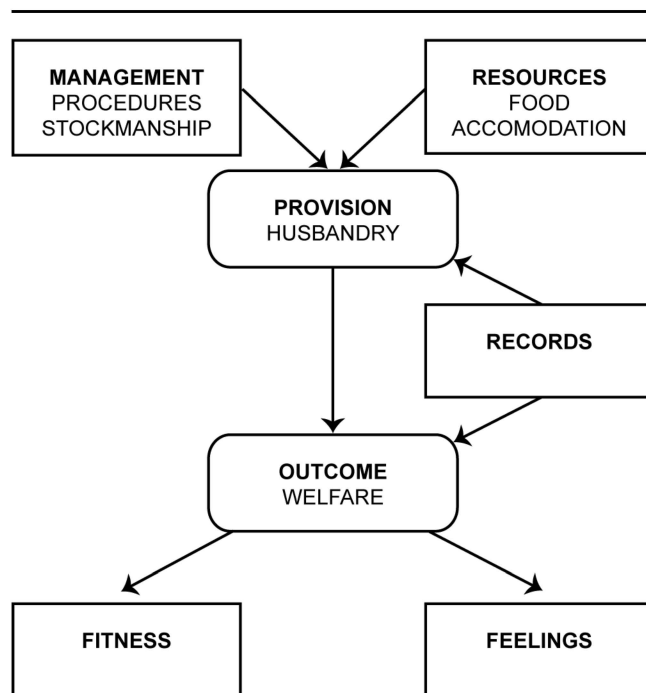
Elements necessary for the assessment of husbandry provision and its outcome, animal welfare.

RSPCA, to its credit, has commissioned such an independent audit from our team at the University of Bristol. The dairy cow welfare audit is complete (Main *et al* 2003; Whay *et al* 2003b). Audit of the welfare of growing pigs and laying hens is in progress.

The complete process for assessing welfare state and imposing quality control has involved the following steps:

1. 'Delphi' review of expert opinion as to the relative importance of different welfare concerns;

2. Development and testing of protocols for on-farm assessment of animal welfare;

3. Assessment of welfare on a statistically valid sample of farms;

4. Identification of strengths and weaknesses on individual farms;

5. Review of expert opinion as to the need for intervention to address specific welfare problems;

6. Actions necessary to address specific problems on individual farms.

Dairy cows

The 'Delphi' review process was designed to achieve a consensus of expert opinion (Whay *et al* 2003a). Experts on dairy cow health and husbandry were contacted as individuals by correspondence and invited to identify their main concerns regarding dairy cow welfare. The first round of comments was collated and returned to the experts who were invited to modify their original comments (or not) in the light of majority views. This procedure provided assurance that the welfare concerns that we sought to address in

Table 2 Results profile for indices of dairy cow welfare measured on 53 UK dairy farms and arranged in quintiles (from Whay et *al* 2003b).

Measure	Type	Score Categories (20% in each banding)				
		A	**B**	**C**	**D**	**E**
Nutrition						
Thin cows (CS < 2%)	Obs	0-6	6.3-11	13-21	22-31	33-61
Fat cows (CS > 3.5%)	Obs	0	0	0	1-5	5-28
Bloated rumen (%)	Obs	0	3-6	7-17	18-24	25-47
Hollow rumen (%)	Obs	0-6	7-14	14-20	21-31	32-82
Milk fever (%/y)	Est	0	0	0	1	1-31
Metabolic disease* (%/y)	Est	0-3	3-4	5-7	7-9	10-19
Reproduction						
Conception to 1st service (%)	Est	80-68	66-60	59-56	55-49	47-28
Assisted calving (%/y)	Est	0	0	1	1-5	5-40
Disease						
Mastitis (%/y)	Rec	0-9	11-21	21-34	41-46	47-120
Mastitis (%/y)	Est	3-13	15-19	20-33	33-47	47-89
Lameness prevalence (%)	Obs	0-14	14-18	19-23	24-30	30-50
Lameness incidence (%/y)	Rec	0	0	2-4	4-11	11-42
Lameness prevalence (%/y)	Est	3-9	9-14	15-21	21-34	35-54
Claw overgrowth (%)	Obs	0-12	12-25	27-34	35-46	46-76
External appearance						
Dirty hind limbs (%)	Obs	65-85	90-96	97-100	100	100
Dirty udder (%)	Obs	0-8	10-18	18-23	24-33	36-70
Dirty flanks (%)	Obs	0	2-7	8-11	14-23	26-78
Hair loss (%)	Obs	0	4-7	8-13	15-31	33-88
Environmental injury						
Hock hair loss (%)	Obs	0-8	10-22	22-45	47-71	74-92
Swollen hock (%)	Obs	0-11	11-28	29-36	37-68	70-97
Ulcerated hock (%)	Obs	0	3-4	5-12	12-25	29-50
Non-hock injuries (%)	Obs	6-43	46-59	59-66	67-79	80-100
Behaviour						
Average flight distance[†] (m)	Obs	0.6-1.1	1.2-1.5	1.5-1.7	1.7-1.9	2.1-3.4
'Idle' cows[‡] (%)	Obs	0-2.6	2.8-3.7	4.7-5.1	5.6-8.3	8.5-25
Rising restriction[§] (%)	Obs	0-10	12-20	30	33-40	50-78

* Metabolic disease includes ketosis, hypomagnesaemia (but not milk fever) mastitis and lameness.
[†] Distance at which cows retreat from the observer.
[‡] Standing cows performing no activity.
[§] Cows showing severe difficulty in rising, hitting fittings, and 'dog-sitting'.
CS = condition score.
Obs = observed by HRW; Rec = recorded by farmer; Est = Estimated by farmer.
Annual incidence is expressed as cases per 100 cows per year (%/y).

our assessment protocols reflected a majority of expert opinion rather than our own personal bias. For dairy cows, the welfare concerns most frequently identified by experts were lameness, comfort and body condition. These were identified approximately five times more often than behavioural disorders.

We then developed and tested an inspection protocol designed to address the major concerns identified by the experts. This protocol was based on direct indices of welfare derived from a combination of direct observations, recordings and farmers' estimates, and used for a planned evaluation of welfare on 80 dairy farms (a comparison of 40 Freedom Food [FF] farms and 40 non-FF farms, paired by farm type and location). All observations were made by HRW. The study was curtailed by the foot-and-mouth disease epidemic of 2001 after only 53 visits. However the numbers were sufficient to achieve nearly all of our principal objectives. The results for all farms are summarised in Table 2, grouped according to nutritional state, reproduction, disease, external appearance, environmental injury and behaviour, and arranged into five quintiles (A to E), so that each banding comprises 20% of the herds visited. Obviously, the allocation of a farm to a particular band is specific to each observation.

A complete analysis of the information provided in Table 2 appears in Whay *et al* (2003b). Only a selection of the results is discussed here to illustrate major welfare concerns. Nutritional state was obtained from observations of

body condition (thin or fat cows), state of the rumen, milk fever (periparturient hypocalcaemia) and other production-related diseases. Table 2 shows, for example, that for the specific observation 'thin cows' (condition score < 2), prevalence in the 'best' 20% of herds (Band A) was 0–5.6%, while in the 'worst' herds (Band E) it ranged from 33 to 61%.

The true prevalence of lameness (%) was assessed by observing the locomotion score of all cows as they left the milking parlour. The farmer's perception of lameness was obtained from records of incidence (% per year) and their estimates of prevalence at the time of the visit. The proportion of cows recorded as moderately or severely lame from direct observation of locomotion score was 0–14% in Band A, rising to 30–50% in Band E. The overall lameness prevalence was 23%, which compares closely with that recorded in the 1989 Liverpool Study (Clarkson *et al* 1996). However farmer estimates of lameness prevalence were, on average, only about 20% of that observed by HRW. Moreover these estimates did not correspond to those identified by HRW as severely lame. This identifies a major welfare concern. When at any time 20% of animals are lame and less than 50% can be said to be walking truly sound, such behaviour can appear 'normal'. This is a powerful illustration of a general conclusion that a major task for those seeking to improve farm animal welfare is to increase farmers' perceptions of the problem. There was also a significant correlation between the prevalence of true lameness and other environmental injuries, especially ulcerated hocks. Hock damage can serve as a simple and robust indicator of inadequate standards of comfort and injury for dairy cows. There was, however, a good association between farmer estimates of mastitis incidence and records of treatment. This reflects a policy to treat mastitis early and record each treatment.

The information summarised in Table 2 was circulated to 50 experts (veterinarians, ethologists and animal welfare scientists) who were asked to indicate the Score Category at which intervention was necessary to remedy a welfare problem apparent at herd level. We identified a clear herd problem as one where the prevalence or incidence was such that 75% of experts recommended intervention. In the case of thin cows, 75% considered that intervention was necessary for farms in Bands D and E (ie when prevalence was > 21%). For mastitis, intervention was recommended at an annual incidence above 20% (Bands C–E). For lameness, intervention was recommended when prevalence was greater than 13% (Bands B–E). In other words, 75% of competent judges considered that lameness was a welfare problem that required attention in 80% of the recorded herds.

The final step necessary to ensure the effectiveness of any welfare-based quality control system is to ensure that action is taken to address welfare problems as they occur. Figure 2 presents a distribution curve for the welfare ranking of the farms according to their mean rank score for the measures reported in Table 2. This figure shows that farms did not perform consistently well or badly. Most were good at some aspects, but poor at others. It follows from this that remedies for welfare problems need to be tailored according to the

Figure 2
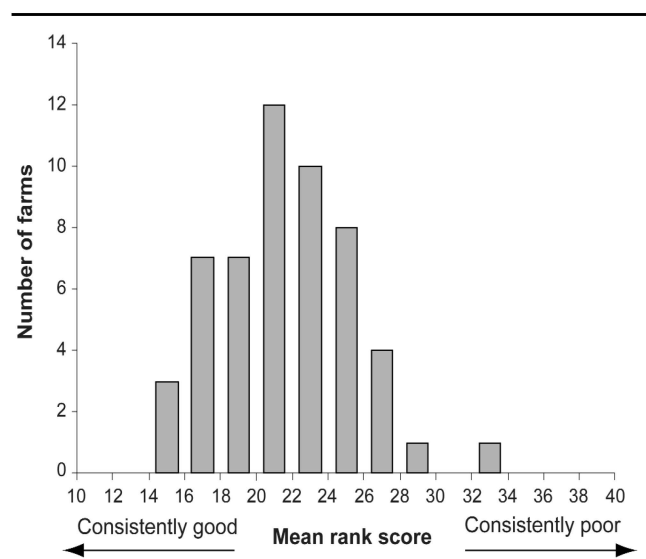
Distribution of the mean rank scores for all welfare measures. (For example, if a farm had ranked first for all measures it would have had a mean rank score of 1.)

Table 3   Protocol for the assessment of welfare in laying hens in free-range units.

Flock assessment
- Calmness, flight distance
- Response to novel object
- Signs of ill health
- Aggression, feather pecking, feather loss
- Comb colour

Individual assessment (20 birds)
- Weight and body condition
- Beak trimming (score 1–3)
- Plumage (soiling and feather loss)
- Injuries: limbs, skin, skeletal fractures
- 'Overall state'

specific needs of specific farms. Overall, there were no consistent statistically significant differences between FF and non-FF farms. Where lameness was identified as a specific problem on FF farms, herd health programmes directed towards the control of lameness had been set up with the active collaboration of the farmers and their veterinarians.

Laying hens

An audit of the welfare of free-range hens is currently in progress. All farms are members of the FF scheme. The aim is to determine whether the FF standards of provision can assure welfare in (almost) all circumstances. It is possible, for example, that welfare problems may develop in individual flocks for reasons that may be attributable to the behavioural development of the population of birds, rather than to any inherent feature of the system. Table 3 outlines the protocol for assessing the welfare of laying hens in the order in which the tasks are undertaken. It begins with an assessment

of the flock as a whole, designed to minimise disturbance, then proceeds to an assessment of 20 individual birds selected, as far as possible, at random and handled by the producer. Once again, clinical and behavioural observations have been selected to address all five freedoms. Conclusions from this study must await completion and analysis of all observations.

Conclusions and animal welfare implications

To recapitulate, the principles essential to the success of any welfare-based QA scheme are as follows:

• Consumer awareness of the principles of animal welfare and good husbandry that underpin the scheme (eg the 'Five Freedoms and Provisions').

• Consumer trust based on a demonstrable guarantee of high welfare through proper quality control (audit and intervention).

• Farmer compliance based on an acceptable reward for increased expenditure of time and money on good husbandry.

A comprehensive audit of animal welfare, whether on farms, in the laboratory, or in zoos or other commercial animal enterprises, must incorporate a review of both provisions and outcome, ie husbandry and welfare. The protocols described in this paper for assessing the welfare of dairy cows and laying hens were designed only to measure welfare outcomes. This was quite deliberate since our specific aim was to carry out an independent audit of the consequences for animal welfare of participation in the Freedom Food scheme. Our review was not only independent of the FF organisation (the RSPCA); it was also independent of the methods used by the RSPCA to determine compliance with the FF welfare standards. There was general agreement among the experts who reviewed our results from the dairy cow audit as to the point at which intervention was necessary to reduce welfare problems associated with, for example, thin cows or lameness. This provokes three general conclusions, two good, one bad:

• Our protocol, based on welfare outcomes, can identify specific welfare problems as they occur.

• There is good agreement among experts as to the importance of specific problems and the need for intervention to address these problems.

• Compliance with existing welfare-based QA schemes (including FF) based on husbandry provisions does not, at present, provide a satisfactory assurance of good welfare.

So where do we go from here?

At present there are too many allegedly welfare-based QA schemes offered to or imposed upon farmers. None is satisfactory. Although they may involve more than 400 questions (almost entirely related to provisions) they can still fail to identify an important welfare problem such as lameness.

This implies that they are both failing to measure the things they ought to have measured, and measuring the things that they ought not to have measured. The protocols described here were not intended to replace existing QA schemes but to evaluate them. Further development of this approach should make it possible to develop new simpler, but subtler, schemes that incorporate measurements of both welfare outcomes (eg lameness) and relevant elements of provision (eg cubicle dimensions and bedding). Current measures of provision that are shown not to correlate with welfare problems can be struck off the list.

In a free market society the ultimate success of any QA scheme will require recognition both by farmers and by consumers that it gives added value, where this concept includes a proper recognition of the intrinsic value of sentient animals (for a fuller review of this argument see Webster 2001). In this way, all parties can benefit from the scheme. For the consumer, there will be more trust; for the farmer there will be more pride. As for the animals, they are more likely to be fit and feel good.

Acknowledgements

References

Clarkson M J, Downham D Y, Faull W B, Hughes J W, Manson F J, Merritt J B, Murray R D, Russell W B, Sutherst J E and Ward W R 1996 Incidence and prevalence of lameness in dairy cattle. *Veterinary Record 138*: 563-567

FAWC 1993 *Second Report on Priorities for Research and Development in Farm Animal Welfare*. Ministry of Agriculture, Fisheries and Food: Tolworth, UK

FAWC 2001 *Interim Report on the Animal Welfare Implications of Farm Assurance Schemes*. Ministry of Agriculture, Fisheries and Food: Tolworth, UK

Main D C J, Whay H R, Green L E and Webster A J F 2003 Effect of the RSPCA Freedom Food scheme on dairy cattle welfare. *Veterinary Record 153*: 227-231

RSPCA 2001 *RSPCA Welfare Standards for Dairy Cattle*. Royal Society for the Prevention of Cruelty to Animals: Horsham, UK

Webster A J F 2000 Sustaining fitness and welfare in the dairy cow. *Proceedings of the New Zealand Society of Animal Production 60*: 207-213

Webster A J F 2001 Farm animal welfare: the five freedoms and the free market. *The Veterinary Journal 161*: 229-237

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 dairy cattle welfare using animal-based measurements. *Veterinary Record 153*: 197-202