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EFFECTS OF DAIRY CATTLE BREEDING AND PRODUCTION METHODS ON ANIMAL WELFARE

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Abstract

The continuing success of the dairy industry depends upon public perception of the products. If products and production methods were perceived to be bad in respect of human health, the welfare of the animals or the impact of the environment, sales could be severely affected. Animal welfare is of major concern now in many countries and concern is growing in most countries. The welfare of an animal is its state as regards its attempts to cope with its environment. Hence welfare varies from good to poor and includes the health and feelings of an animal as well as aspects of its behaviour and physiology.

Welfare is poor in dairy cows when, for example, they are lame, have mastitis, are unable to reproduce, are unable to show normal behaviour, show emergency physiological responses, or are injured. Poor welfare can be caused by cruelty or poor management but it is also commoner as production efficiency increases. Mastitis, lameness and reproductive failure tend to increase as milk yield increases. Hence it may well be necessary to stop using genetic selection and some feeding methods to increase milk yield. Cows are well adapted to high fibre, low density foods and moderate milk yields so there are more problems when their normal biological functioning controls are overtaxed, i.e. when they are stressed. Bovine somatotrophin increases the risk of poor welfare, especially when given to cows which are already relatively high yielding.

The design of accommodation for cows, and management procedures, also have considerable effects on cow welfare. Cubicle houses, particularly when cubicles are too short or otherwise poorly designed, tend to result in too much lameness and other problems. Straw yards are generally better for welfare if well managed. Lameness is much rarer in cows at pasture although special paths are needed in areas with sharp stones. Housed cows can vary individually in their susceptibility to lameness according to their social position.

Farm operations and increasing automation on farms also require careful monitoring if poor welfare is to be minimised. Indeed efforts should be made to provide conditions in which welfare is good; individual production will then be better.

Public perception of the dairy industry

Most members of the public who are asked about the dairy industry think of cows grazing in fields and living for some time whilst a series of calves are born and milk is produced. Milk products are considered by the public in relation to their effects on human nutrition and health, their effects on the environment and their effects on animal welfare. If production is perceived to be bad in relation to any of these aspects, sales of the products could be severely affected. Some people may limit their intakes of milk products because of a desire to reduce cholesterol intake and certain aspects of the dairy industry, such as methane production, may be criticised in relation to pollution but it is animal welfare rather than these topics which is the subject of this paper. Until recently, the welfare of the cow was not often perceived to be poor and it has been only in calf rearing that dairy production systems have been regularly criticised. However, the industry has been changing and evidence of poor welfare in cows is accumulating and has had influence on public opinion in several countries. It is important to the dairy industry that welfare problems should be addressed before there is any widespread public condemnation of breeding and management practices. A few critical newspaper articles or television programmes which appear well founded can be very damaging to producers, processors and retailers.

Public concern about animal welfare manifests itself in actual product purchasing and in pressure applied to retailers and to legislators. Major supermarket and cooked food chains can be influenced rapidly by customer pressure and can cause changes to be brought about in the methods used by suppliers. Retailers may impose codes of practice on suppliers and the execution of these codes is checked because the retailers cannot afford public criticism of what they sell (1). In several European countries, certain housing systems and farm practices have been changed by many farmers because of the standards required by the purchasing companies. For

example the use of crates for calves, stalls and tethers for sows and castration of pigs slaughtered at 100 kg or less has ceased on many farms.

Effects of public pressure on legislation is usually slower but legislation makes for more equal constraints on producers. Legislation is becoming more and more international although it is clearly important that where there is legislation on wholly moral grounds, for example in order to prevent poor welfare in animals, there should be restrictions on imports from countries whose moral standards are lower and that such restrictions should be authorised by the World Trade Organisation.

The concept of animal welfare

Animal welfare has to be defined in such a way that it can be scientifically assessed and the term can be used in legislation and in discussion amongst animal users and the public. Welfare is clearly a characteristic of an individual animal and is concerned with the effects of all aspects of its environment on the individual. The welfare of an animal is its state as regards its attempts to cope with its environment (2). This state includes the feelings of the individual, various physiological and behavioural responses and its health. The extent of the difficulty which the individual has in trying to cope with its environment, the extent of any failure to cope and the degree of happiness are all components of welfare. Hence welfare varies from very poor to very good and can be scientifically assessed (3,4,5,6).

Indicators of animal welfare are listed in Table 1. These include disease prevalence and reduced ability to grow and breed. As explained by Broom and Johnson (3), the welfare of a diseased individual is poorer than that of an individual which is not diseased and reduced ability to produce offspring given appropriate opportunities also indicates poor welfare. Individuals which are finding it difficult to cope with their environment, or which are failing to cope may be more likely to become diseased, less likely to produce embryos, less likely to carry young to term and more likely to die early.

Table 1 Indicators of animal welfare

Physiological indicators of pleasure
Behavioural indicators of pleasure
Extent to which strongly preferred behaviours can be shown
Variety of normal behaviours shown or suppressed
Extent to which normal physiological processes and anatomical development are possible
Extent of behavioural aversion shown
Physiological attempts to cope
Immunosuppression
Disease prevalence
Behavioural attempts to cope
Behaviour pathology
Self narcotization
Body damage prevalence
Reduced ability to grow or breed
Reduced life expectancy

Welfare can be poor in any animal if it is ill-treated or neglected. This can be a problem occasionally but most dairy farmers value their animals too much to allow either of these causes of poor welfare to occur. However, there can be ill treatment of cattle going to slaughter. The general areas of cattle welfare problems have been reviewed (7) and many of these will not be reported here.

The welfare of veal calves

Scientific studies of the welfare of veal calves have been reported in detail by Broom (8) and in the Report on the Welfare of Calves by the E.U. Scientific Veterinary Committee (Directorate-general for Agriculture VI/5891/95). Amongst the needs of calves which are not met during veal production in crates are: resting in

normal postures, turning around and exercising adequately, exploration, normal grooming, social contact, normal gut development and avoidance of anaemia with associated immunosuppression and disease.

Well managed group-housing systems in appropriately ventilated buildings had no more disease than individual-housing systems (9). Anaemic calves with a blood haemaglobin level of 5.5 m mol l^{-1} are adversely affected by exercise (10) and immune system function was adversely affected at 4.5 m mol l^{-1} (11). Confined calves show prolonged inactivity, excessive licking and sucking behaviour with consequent hair-ball formation in the gut, oral stereotypies and locomotor difficulties (12,13,14,15). All of these abnormalities of behaviour indicate poor welfare caused by confinement and lack of normal stimulation. Confined calves also show greater cortisol response to ACTH challenge than group-housed calves (16,17) and lack of fibre and iron in the diet causes abnormalities of gut anatomy and physiology (11,18,19).

As a consequence of the evidence of poor welfare in veal calves, the European Union passed a Directive in 1997 which required group-housing of calves after 8 weeks of age, individual pens at least as wide as the height of the calf at the withers, no tethering of calves except for <1 h at feeding time, sufficient iron to ensure an average blood haemoglobin of 4.5 m mol l^{-1} and fibre in the diet increasing from 50 g per day at 8 weeks to 250 g pr day at 20 weeks. Many E.U. calf producers have found group-housing of calves to be more successful economically than the old crate system and white veal can still be produced from systems which comply with the new law.

The welfare of cows

The major welfare problems of dairy cows are lameness, mastitis, and any conditions which lead to impaired reproduction, inability to show normal behaviour, emergency physiological responses or injury.

Leg and foot problems

For a recent review of lameness, including the extent to which it is a welfare problem, see Greenough and Weaver (20). Almost all animals which walk with a limp, or reduce walking to a low level, or avoid walking whenever possible suffer from some leg or foot pain. Their ability to carry out various preferred behaviours is generally impaired and there may be adverse consequences for various other aspects of their normal biological functioning. Lameness always means some degree of poor welfare and sometimes means that welfare is very poor indeed.

Measurements of the extent to which some degree of lameness occurs in dairy cows include 35 - 56 cases per 100 cows per annum in the USA, 59.5 cases per 100 cows per annum in the UK, and more than 83% of examined cows in the Netherlands. The actual figures depend upon the method of assessment and most of these cases were not treated by veterinary surgeons but there is no doubt that lameness is often a severe welfare problem.

Mastitis

Mastitis in mammals is a very painful condition. The sensitivity to touch of affected tissues is clearly evident and there is obvious damaging of normal function. Mastitis prevalence should have declined greatly with improved methods of prevention and treatment but it has not declined as much as it should have done. Webster (21) reports 40 cases of mastitis per 100 cows per year as an average for the UK.

Reproductive problems

Reproductive problems in dairy cows have become very common in recent years with large numbers of cows being culled because of failure to get in calf. In a study of 50 dairy herds in England, Esslemont and Kossaibati (22) found that farmers reported failure to conceive as the predominant reason for culling with 44% of first lactation, 42% of second lactation and 36.5% of cows in total being culled for this reason. However, mastitis, feet and leg problems, ketosis and other disease conditions can lead to reproductive problems and it is difficult to discover their initial cause from farmers' records. A report by Plaizier *et al* (23) concerning Canadian herds indicated that reproductive culling risk varied between 0 and 30% with a mean of 7.5%.

Housing systems and welfare

The incidence of lameness is much worse in housed cows than in cows at pasture. Cows at pasture may have stone damage to hooves if they do not have a suitable place to walk but wet cubicle houses or poorly maintained straw yards can result in very high levels of lameness. Even the best cubicle housing systems seem to have some lameness problems which are exacerbated by social factors (24). Since the best straw yards, with an abrasive area on which normal hoof wear occurs, have little lameness, these may be the best solution for housed cows. Mastitis incidence is affected by hygiene at milking and various other conditions of management. Poorly designed housing systems can result in a variety of welfare problems and these can be exacerbated by high stocking density. Most of these problems, such as those resulting from cubicles being too short for the length of

the cows now occupying them or of poor design of cubicles which do not allow adequate movements in the cow, are well known so are mentioned briefly here. In general it seems that many dairy cow housing systems, and cubicles in particular, do not provide an environment to which cows can adapt easily, The best straw yards seem to be the most successful as they give the cows more opportunity to control their interactions with their environment.

Milk yield and welfare in dairy cows.

The dairy cow of 1998 may produce 18000l. or more of milk per annum with a peak milk yield of 75l. per day. This compares with UK figures of 6000l. and 30l. per day 10 years ago (21) and a beef cattle average of 1 - 2000l. and 10l. per day. The dairy animal is producing considerably more than its ancestor would have. This raises questions of whether it is at or beyond its maximum production level and the extent of any welfare problems.

The peak daily energy output of the dairy cow per unit body weight is not very high in comparison with some other species such as seals or dogs but the product of daily energy output and duration of lactation is very high indeed. Hence long term problems are the most likely to occur (25). This is what we see because, although some cows seem to be able to produce at high levels without welfare problems, the risk of poor welfare indicated by lameness, mastitis or fertility problems is greater as milk yield increases.

The steady increase in reproductive problems as milk yields have increased is well known. As Studer (26) states, "despite programmes developed by veterinarians to improve reproductive herd health, conception rates have in general declined from 55-66% 20 years ago to 45-50% recently (27,28,29,30). During the same periods, milk production has greatly increased."

Studies showing that milk yield is positively correlated with the extent of fertility problems have come from a range of different countries (31,32,33,34,35,36,37). Studer (26) explains that high producing cows which are thin and whose body condition score declines by 0.5 1.0 during lactation often experience anoestrus. A loss of condition score of about 1.0 during lactation was normal in the review presented by Broster and Broster (38). Data on the relationships between milk yield and reproduction measures from two large scale studies are presented in Tables 2 and 3.

In some studies, effects of health problems on reproduction are evident, for example Peeler *et al* (39) showed how cows which were lame in the period before service were less likely to be observed as being in oestrus. The lameness could be more likely in high producing cows. Direct links between level of milk production and extent of disease conditions are also evident from a range of studies, positive correlations being reported by Lyons *et al* (40), Uribe *et al* (41) and Pryce *et al* (36,37 see Tables 2, 3). In addition to mastitis and leg and foot problems, which are often measured in such studies, the occurrence of other clinical conditions can also be affected by production level. Modern, high producing cows with good body condition have a high incidence of milk fever, retained placenta, metritis, fatty liver and ketosis (26).

Table 2 Positive correlations between milk production level and indicators of poor welfare (from Pryce *et al*, 36).

Milk yield from 33,732 lactation records:

calving interval	0.50	±	0.06
days to first service	0.43	±	0.08
mastitis	0.21	±	0.06
foot problems	0.29	±	0.11
milk fever	0.19	±	0.06

Table 3 Positive correlations between milk production level and indicators of poor welfare (from Pryce *et al*, 37).

Milk yield from 10,569 lactation records:

calving interval	0.28	±	0.06

days to first service	0.41	±	0.06
mastitis	0.29	±	0.05
somatic cell count	0.16	±	0.04
foot problems	0.13	±	0.06

The high yields of modern dairy cows are a consequence of genetic selection and feeding. Cows are adapted to high fibre, low density diets. The ways in which they have been modified genetically do not change these basic characteristics much. Cows do not adapt easily to high grain diets or to manufactured diets with high protein and low fibre. Genetic selection has not taken adequate account of the adaptability and welfare of cows. Current trends towards ever greater milk production and feed conversion efficiency should not be continued unless it can be insured that welfare is good (42,43). Bovine somatotrophin (BST) results in high milk yields and higher levels of mastitis, lameness, reproductive disorders and other problems such as those at the injection site (44,45,46,47,48). Whether or not much of the effect of the genetically engineered hormone is a consequence of the milk yield, the poorer welfare caused by the BST is unacceptable.

The Report of the E.U. Scientific Committee on Animal Health and Animal Welfare on *Animal Welfare Aspects of the Use of Bovine Somatotrophin* concluded that the use of BST as follows.

BST is used to increase milk yield, often in already high-producing cows. BST administration causes substantially and very significantly poorer welfare because of increased foot disorders, mastitis, reproductive disorders and other production related diseases. These are problems which would not occur if BST were not used and often results in unnecessary pain, suffering and distress. If milk yields were achieved by other means which resulted in the health disorders and other welfare problems described above, these mans would not be acceptable. The injection of BST and its repetition every 14 days also causes localised swellings which are likely to result in discomfort and hence some poor welfare.

The Committee also made the following Recommendation.

BST use causes a substantial increase in levels of foot problems and mastitis and leads to injection site reactions in dairy cows. These conditions, especially the first two, are painful and debilitating, leading to significantly poorer welfare in the treated animals. Therefore from the point of view of animal welfare, including health, the Scientific Committee on Animal Health and Animal Welfare is of the opinion that BST should not be used in dairy cows.

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