

Modern meat production and animal welfare

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SUMMARY

Many consumers consider ethical quality to be important and are therefore concerned about the welfare of the animals used to produce the meat they eat. Their concerns can relate to practices in all parts of the production chain, from breeding and rearing through management and slaughter. Knowing whether animals' welfare needs are being met is sometimes difficult and a better understanding of these needs, informed by better methods of assessing and monitoring welfare, would help the industry address potential concerns. Where deficiencies are recognised there are potentially a number of ways that welfare can be improved. These include encouraging the objective discussion of welfare needs, the provision of appropriate information and education of the personnel involved, legislation to regulate minimum standards, codes of practice and quality assurance schemes to complement legislation and to inform and reassure consumers, and more direct linking of good welfare practices to increased profit.

INTRODUCTION

Consumers always want to pay the least money for the best quality product. This is what drives prices down and quality up and is as true for meat as for other products. Meat quality includes several different components, such as appearance, technological characteristics, palatability and wholesomeness (Warriss, 1996). Many people would also include ethical quality, of which there are two main parts. The first is that animals should be produced in agricultural systems that are sustainable and do not damage the environment; the second is that these animals should have been bred, reared, handled and slaughtered in ways that are sympathetic to their welfare.

The importance attached by consumers to ethical quality undoubtedly varies greatly between individuals and cultures. This is especially so for animal welfare. However, it is also apparent that in many countries, particularly within the European Union, consumer concern for animal welfare is increasing and, moreover, these consumers are becoming increasingly articulate in voicing their concerns. Selling meat to consumers who perceive animal welfare to be important therefore requires compliance with good welfare principles. This is because, irrespective of the views of the producer, it is eventually the consumers' opinions that drive requirements for product quality. Producers with an ethical advantage will sell more meat to consumers who value this quality component.

What then are the major concerns for the welfare of meat animals in modern production systems? They can be categorised under four main

Keywords

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headings: those that relate to breeding objectives, to rearing conditions, to management practices, and to potential pain and fear at slaughter. Additionally, there is concern about the welfare of culled animals generally, which are usually of inherently low value. Before discussing these in detail it is important to put them into perspective. The welfare of a large number of the animals we rear for meat is probably good, and in the domestication of livestock man has improved many aspects of their lives. Domesticated animals are protected from predators and adverse environmental conditions. They are fed and given veterinary treatment if injured or diseased, and much research and effort has been devoted to developing optimal nutritional regimens. In many situations strong bonds develop between man and animals, reflecting the importance attached to animals as companions rather than just a resource. Moreover, some people might consider that any potential reduction in the welfare of animals should be considered against the benefits of plentiful, cheaper meat production to the welfare and enjoyment of humans.

Examples of some specific welfare concerns

(1) Breeding objectives: Broiler chickens have been selected to grow very quickly and efficiently so birds reach slaughter weight in six weeks or less. However, the growth of muscle has outpaced the ability of the skeleton to support it, resulting in skeletal deformities of the legs that cause varying degrees of lameness (Bradshaw, Kirkden and Broom, 2002). The lameness affects the birds' behaviour and in severe cases is apparently painful. Because the birds sit for long periods on soiled litter they may also develop lesions on their legs (hock burn). Surveys have shown relatively high prevalences (up to 30 %) of lame birds in some flocks (Kestin, Knowles, Tinch and Gregory, 1992). Bacterial infections of the leg joints have been implicated in contributing to lameness, and the severity of the condition can be influenced by husbandry factors such as stocking density, lighting and food restriction during the early growth period. However, the fundamental cause of the problem is the extreme genetic selection for rapid growth that has taken place.

The selection for extreme muscularity in pigs has led to the production of desirable lean carcasses with very good conformation. Unfortunately, it has also resulted in the development of some genotypes with a high proportion of stress-susceptible animals. The stress-susceptibility results from the inadvertent selection for so-called halothane positive animals. The sensitivity to stress results from a mutation in the ryanodine receptor gene. The ryanodine receptor is the calcium release channel of the sarcoplasmic reticulum and therefore can drastically influence the metabolism of affected animals. The susceptibility to stress may result in animals reacting badly to handling and in extreme cases dying. For example, breeds particularly susceptible to stress, such as the Pietrain and the Belgian

Landrace, or genotypes containing blood from these breeds, show higher mortality in transit (Lister, Gregory and Warriss, 1981). This is illustrated by the effect of selecting against the gene. Selecting against halothane sensitivity in Swedish breeding stock in the 1980s reduced transit deaths from 0.22 to 0.08% (Petersson and Gahn, 1998). Selecting for muscularity in the pig has therefore to a degree reduced its welfare.

In both the case of the broiler chicken and the pig therefore, selection for improved growth efficiency and carcass value has had deleterious effects on the animals' welfare. It has either produced the potential for pain in the case of the broiler chicken, or excessive reactions to stressors in the case of the pig. Our quest for economic gains has in effect been made at the expense of animal welfare.

(2) Rearing conditions: Many pigs and poultry are now reared under very intensive conditions. These are characterised by relatively barren environments and high stocking densities designed to promote production efficiency. Wild pigs and birds, and farmed animals kept under extensive conditions, spend a lot of time foraging for food. Their intensively-reared domesticated descendants retain the motivation for these behaviours which, however, are unnecessary under intensive rearing systems where food is usually supplied *ad libitum* to promote the fastest possible growth. The animals' normal behaviour is therefore frustrated and their psychological needs are not fulfilled. The frustration possibly leads to stress and may lead to redirected, or misdirected and inappropriate, behaviours often referred to as iveries. Examples are tail biting in pigs and feather pecking in birds. The latter is especially a problem in laying hens but is also not infrequently seen in broiler chickens and ducks. It can lead to cannibalism. High stocking densities restrict movement and, by increasing competition for limited resources, may promote aggression. Barren environments can also prevent the animal from carrying out normal behaviours, for example dust bathing in birds and wallowing and rooting in pigs, because the resources required to fulfil these activities are not available.

Before giving birth, wild sows, and domesticated sows if allowed to, build a nest in which the piglets are born. Modern intensive systems do not allow this. The sow is frequently confined in a stall, or tethered, during pregnancy and gives birth in a farrowing crate (pregnancy stall) with no access to nesting materials. This gives the stockman control over her behaviour and reduces the chances of her lying on her young piglets. It also prevents the bullying that some sows suffer from other, more dominant, animals when sows are group housed. However, confining the female pig, and preventing her from selecting a nest site and building a nest, is undoubtedly distressing to her because it frustrates her normal maternal instincts.

To produce very pale meat, which some consumers find desirable, veal calves have sometimes been kept in very small pens that prevent interaction with other calves and normal behaviour. To minimise their intake of iron they are also fed a diet made up completely of milk with

no opportunity to consume roughage. Undoubtedly, the confined and barren environment, and the restriction in diet, have implications for the calves' welfare. Cattle and sheep are sometimes kept on inappropriate surfaces or floors. These may be too wet, too hard, or have a surface that does not wear away the growing hoof normally. The conditions often lead to lameness, which is painful.

In summary, housing animals in barren environments, often with little space and few resources other than food and water, frustrates their ability to carry out normal behaviour and may dispose them to develop abnormal behaviours. These abnormal behaviours probably reflect the animals' attempts to cope with the deprivation. Many of these behaviours are damaging to, and therefore compromise, the welfare of, other animals and lead to injuries. Inappropriate environmental conditions may also lead to direct physical damage to animals.

(3) Management practices: A number of things that we do to animals to control their behaviour, or facilitate their handling during rearing, may compromise welfare by causing pain. Most of these practices involve mutilations in which parts of the body are removed. To reduce problems of aggressive behaviour and poorer meat quality many male animals are castrated soon after birth. This is usually done without anaesthesia or analgesia and may well therefore be very painful. Lambs' tails are cut short to reduce soiling and pigs' tails may be similarly docked to prevent or discourage tail biting by other pigs. Piglets' teeth are clipped to prevent damage to the sow's udder when they suckle. To discourage feather pecking, poultry are often beak-trimmed, a process in which a lesser or greater part of the upper beak is cut off with a hot knife blade that cauterises the wound. The beak is a very sensitive organ and the cut ends of the nerves form neuromas that may continue to produce pain sensations throughout the bird's life.

Other potential concerns relate to the branding of cattle, which is undoubtedly painful, and the treatment of broiler chicken breeding stock. Because modern broilers have been selected to grow so fast on *ad libitum* feeding the parent stock must have their food intake severely reduced to maintain their viability and egg laying ability. They therefore probably suffer considerable hunger throughout most of their lives.

Thus, while management practices often enable us to control the behaviour of animals, in doing so we may compromise their welfare. Moreover, some practices are responses to problems probably caused by the very rearing conditions to which we subject animals. An example is the docking of pigs' tails to prevent tail biting. Given enough space and a stimulating environment, pigs probably do not bite one another's tails and therefore do not need them to be cut short to discourage this.

(4) Handling at and before slaughter: Most meat animals in developed countries are slaughtered in relatively few large slaughterhouses operating at high line speeds. The marketing and preslaughter transport of these animals therefore often involves long journeys, prolonged

food and water deprivation, mixing of unfamiliar animals and exposure to extremes of temperature and novel surroundings, frequently while closely confined at high stocking densities (Warriss, 1995). During handling, the need for coercion and the use of goads is not uncommon. The whole process of marketing and slaughtering can therefore be very distressing to animals (Hails, 1978). Many will suffer fear, some will suffer pain from trauma such as broken bones and bruising, and a number will even die during the journey.

Stunning and slaughter procedures have considerable potential to cause pain and distress if carried out incorrectly (Grandin, 1994, 1998). There may be concern about the method itself, or the way in which it is applied. For example, the use of carbon dioxide gas for stunning is considered by some people to be undesirable. The gas is pungent and therefore apparently aversive to some animals, and insensibility is not instantaneous. Captive bolt pistols and guns may be placed in less than optimal positions on the animals' head so that stunning is ineffective and re-application is necessary. The currents applied in electrical stunning systems may be inadequate, or the electrodes applied in the wrong position, so that stunning is not instantaneous or painless. Animals may not be stuck promptly or effectively so that exsanguination is delayed with the danger of the recovery of consciousness at a time when they would be likely to suffer pain and distress.

The welfare of animals during transport and at slaughter can be a very emotive issue to consumers. Even though the time period is short in relation to the animals' life span it is one in which so many potential stressors can act, and potentially interact, that the overall impact on animal welfare may be very large. Moreover, humans often feel considerable empathy with animals when they are slaughtered, although some of their concerns may be in fact misplaced. For example, many people automatically but erroneously associate the process of killing with poor welfare. This is not necessarily true. The fact that we kill animals does not mean their welfare must be compromised; it is only if the act of slaughter and the handling beforehand is performed badly that there is an issue.

(5) Animals with inherently low commercial value: Generally, the more valuable an animal is, the greater the concern that tends to be given to its welfare. So, the welfare of high value pedigree breeding animals is usually very good. In contrast, the value of animals that have been culled at the end of their productive life is low and their welfare may be correspondingly poor. Examples are culled dairy cows and old sheep, surplus male dairy calves and spent hens at the end of economic egg production. Because they have brittle bones and are of almost negligible economic value, the welfare of spent hens can be very poor. Their weak bones are susceptible to breakage if the birds are handled roughly and their low economic value makes sufficiently careful handling at final depopulation at the end of lay unlikely (Gregory and Wilkins, 1989). The welfare of some culled animals can therefore be of great concern.

Assessing whether welfare is good or bad

The examples of potential welfare concern given above may seem straightforward but it is often difficult to define exactly what good welfare is. In fact, defining animal welfare in an exact and precise way that is universally applicable may be impossible (Duncan and Dawkins, 1983; quoted in Duncan, 2001). Measuring the welfare of animals is correspondingly not always easy. Partly this is because of the difficulty of knowing exactly what animals' needs are. Good welfare would seem to consist of both physical and mental wellbeing. So, if an animal appears fit and healthy, shows no sign of injury or disease and, if appropriate, is growing well, we imagine its physical well being to be acceptable. Assessing physical wellbeing therefore seems achievable. But, knowing whether an animal's mental well being is acceptable is a much more difficult question to answer. Mental wellbeing implies that the animal feels content or even happy, and measuring whether an animal is content or happy is rather difficult.

Different people attribute a greater or lesser importance to this notion of mental wellbeing and this appears to have produced two main schools of thought relating to the concept of good welfare. In the first, animal welfare is essentially about what an animal feels (Duncan, 2001). Good welfare is associated with the absence of suffering and the presence of pleasure (positive affective states), although it is quite difficult to detect in all but a few species. In the second school of thought good welfare is about the animal functioning without any evidence of a stress response, or at least without a large stress response, and being able to cope with its environment (Broom, 1986). Environment here includes both the physical environment and the presence or otherwise of other animals. Indicators of welfare reflect the animal's inability to cope, or the amount of effort required to cope.

The best example of a measure of the animal's inability to cope is the mortality rate. The welfare of animals is poorer in systems or after processes that result in greater numbers of animals dying. Mortality here is a reflection of the welfare not only of the animals that die but also of other animals in the group since they will have been subjected to the same poor conditions even though they have not succumbed. Rates of traumatic injury can be used in a similar way since they are likely to result in animals suffering pain even if they do not die. The higher levels of bruising in sheep and cattle sold through live auction markets, rather than being sent to slaughter directly from the farm, shows that the welfare of animals sold through live markets is generally poorer (Cockram and Lee, 1991; McNally and Warriss, 1996).

The amount of effort required by animals to cope with their environments can be assessed by monitoring their behavioural and physiological responses. Animals whose welfare is good should show the normal repertoire of behaviour and no abnormal behaviour. Calves reared closely confined in small crates, which apparently reduce

the amount of stimulation the animals receive, show much higher levels of oral activities, self grooming, licking or chewing their pen when compared with calves reared in group housing systems (Webster and Saville, 1981). As mentioned before, abnormal behaviours such as tail biting in pigs, and feather pecking in poultry, probably reflect misdirected behaviours caused by inadequacies in the rearing environment. Stereotypies, which are repetitive and unvarying behaviours without obvious purpose, are a widespread form of abnormal behaviour. An example is the bar biting seen in some sows housed in farrowing crates. Presumably carrying out the stereotypy enables the animal to fulfil some motivation for a normal behaviour that its restricted environment does not allow expression for.

Simple comparisons based on behavioural observations of resting, drinking and feeding can sometimes indicate if animals are fatigued, thirsty or hungry. Physiological measurements of changes in the blood profile and tissue concentrations of energy reserves can support this kind of information (Knowles and Warriss, 2000). So, the concentrations of blood creatine kinase (CK) and lactic acid, and muscle glycogen, are indicative of physical exertion, blood glucose and non-esterified fatty acids (NEFA), and liver glycogen, may point to hunger, and indices of dehydration such as plasma osmolality and total protein concentration, may indicate thirst. Body temperature can give us information about the animal's thermoregulation.

Poor welfare is often associated with high levels of psychological stress. Stress assessment relies on measures of the function of the sympatho-adrenal and hypothalamo-adrenal systems. Stimulation of these results in the production of catecholamine and corticosteroid hormones. High levels of hormones like adrenaline or cortisol therefore imply high stress and poor welfare. Secondary responses, such as elevations in heart rate or ventilation rate, or suppression of the immune response, can also be used to assess stress levels. Long term responses to stress often compromise the immune response, evidenced by a reduced antibody production in response to antigens. Eventually pathological changes occur, such as stomach ulcers and enlargement of the adrenal glands. In meat animals pre-slaughter stress is of course often associated with poor meat quality, particularly PSE (pale, soft, exudative) and DFD (dark, firm, dry) meat.

Pain is a particular type of stressor that is difficult to define precisely. It is usually associated with aversiveness and tissue damage, or potential tissue damage. Measuring pain is also difficult (Moloney, and Kent, 1997). However, often animals in pain will show observable behavioural changes. The administration of analgesics can also be used to investigate and quantify pain.

A summary of some measures that can be used to assess welfare is given in Table 1.

In many cases, having better ways to assess welfare, particularly in relation to the animal's mental well being, would probably allow the development of production methods that were more welfare-friendly.

Table 1. Summary of some measures that can be used to assess welfare:

- Mortality, reproductive success & the prevalence of disease
- Trauma levels (bruising, broken bones, lameness)
- Behaviour (normal and abnormal), choice tests
- Physiological measurements of HR, BP, body temperature
- Measures of psychological stress (catecholamines, cortisol)
- Measures of physical stress (blood CK, lactic acid)
- Measures of physiological changes probably associated with hunger (glycogen reserves, blood NEFA) and thirst (plasma osmolality, total plasma protein)
- Assessment of pain in potentially painful procedures using self administration of anaesthetics
- Chronic pathological measures (adrenal enlargement, gastric ulcers)

How can we promote improvements in welfare?

If we wish to improve welfare, for whatever reason, then how do we go about it? There are a number of potential ways open to us for promoting improvement.

(1) Improving people's understanding of animal welfare: The first way we can improve welfare is to ensure people understand the needs of animals and are sympathetic to them. Many people may treat animals inhumanely through ignorance of the animals' welfare requirements. In the case of physical well being, for example adequate nutrition, addressing this ignorance so the animal is fed properly may be a relatively simple matter. However, in the case of providing adequately for an animals' mental wellbeing this may be much more difficult since different people will often have quite different views on what is acceptable or not in this regard. These views can be influenced by cultural and economic factors. What is acceptable may also depend on the species of animal. The more individuality an animal shows, the more we tend to be concerned about its welfare even though this does not appear entirely logical. An overarching frame of reference for adequate welfare, such as the five freedoms defined by the Farm Animal Welfare Council in the UK, can be useful. These are listed in Table 2.

An animal must generally be reared and handled in ways that promote these freedoms for its welfare to be protected. So, freedom from hunger and thirst is ensured by the animal having ready access to water and a diet that maintains full health and vigour, freedom from discomfort by providing an appropriate environment in which to live, and freedom from pain, injury and disease by either prevention or rapid veterinary treatment. Freedom to express normal behaviour is ensured by providing sufficient space, proper

facilities and the company of animals of its own kind, and freedom from fear and distress by ensuring conditions and treatment which avoid mental suffering. These requirements can then form a basis for deciding exactly what needs to be done in practical terms to fulfil these freedoms. As pointed out by Webster (1994), it is unrealistic to try to attain all five freedoms in all situations. This is particularly true for freedom to express normal behaviour. We have to control animals' desires to pursue many of their normal behaviours, for example mating, to facilitate acceptable husbandry.

Table 2. The five freedoms as defined by the UK Farm Animal Welfare Council

- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury or disease
- Freedom to express normal behaviour
- Freedom from fear and distress

(2) Regulation by legislation: The second method of improving animal welfare is through legislation. People are forced to abide by these rules, rather than just choosing to follow their own standards, and laws are therefore often used to define minimum acceptable standards. Most developed countries have legislation to protect welfare, although it can vary widely in extent. Examples of UK legislation are given in Table 3. The Protection of Animals Act (1911) made it an offence to ill-treat or cause unnecessary suffering to any animal. The Agriculture (Miscellaneous Provisions) Act (1968) made it an offence to cause or allow livestock to suffer unnecessary pain or distress. The more recent legislation addresses specific occasions and practices for example when animals are handled in live auction markets, during transport and at slaughter.

Table 3. Examples of UK legislation to protect animal welfare:

- The Protection of Animals Act (1911)
- Agriculture (Miscellaneous Provisions) Act (1968)
- The Welfare of Livestock Regulations (1994)
- The Welfare of Livestock in Markets Order (1990)
- The Welfare of Animals (Transport) Order (1997)
- The Welfare of Animals (Slaughter or Killing) Regulations (1995)
- Welfare of Farmed Animals (England) Regulations (2000)

There can be a problem with the use of legislation to improve welfare. Legislation generally only applies in the country in which it is enacted. Stringent welfare

legislation in one country may therefore give unfair commercial advantage to producers in other countries with less stringent welfare laws and where production costs could be potentially higher. A situation may then arise where differences in legislation can be detrimental to animal welfare. Countries, where welfare legislation is more stringent may still import meat from places where it is less stringent. This trade will be encouraged by the possibly lower costs associated with production in systems that make fewer concessions to the requirements of animal welfare so the product is cheaper. In the European Union, to prevent this as far as possible, national legislation in the constituent countries is to a large degree harmonised. This is done through Directives that are legally binding on all the member states. So, the legislation governing the welfare of animals is effectively the same throughout Europe. However, there is still the potential concern that the interpretation and enforcement of international legislation may vary between the different countries in the Union.

The situation is potentially even more difficult between countries without harmonised legislation. In the interests of free trade, World Trade Organisation (WTO) rules prevent discrimination against products based on the way they have been produced. This stops countries where animal welfare is good from restricting imports from countries where welfare is poor. The requirements of free trade might therefore hinder welfare improvement. Addressing this problem could provide large benefits for animal welfare.

(3) Improvement through codes of practice:

Modern retailers such as major supermarket chains and fast-food chains are often large and economically powerful. For example, at least 70% of meat bought by consumers in the UK comes from supermarkets, and fast-food chains specialising in meat account for a very significant proportion of the meat purchased for consumption outside the home. This economic power allows these companies to impose codes of practice on their suppliers. These codes often specify welfare standards for livestock which cover every aspect of meat production from breeding and rearing through to transportation, handling and slaughter. The codes are sometimes more stringent than government legislation and reflect the retailers' desire to supply what they perceive their customers want. If these customers demand products produced in systems having good animal welfare then the retailers correspondingly demand these from their suppliers. Obviously it is important to brand and label meat produced by methods complying with good welfare standards accurately so that consumers can make informed choices.

Having said this, such consumers may sometimes be unwilling to pay extra for welfare-friendly products unless these have other desirable quality characteristics. For example, they might be organically produced, which many people consider desirable because it reduces the likelihood of contamination with residues of harmful chemicals.

(4) Quality Assurance Schemes: Quality assurance schemes certify that particular standards have been followed in producing a product, so giving the consumer confidence in its quality. The schemes usually focus on the three main areas of particular interest to consumers: food safety, palatability and ethical quality. The standards governing ethical quality often include requirements directed at maintaining animal welfare. They therefore include a farm assurance component relating to the husbandry and treatment of the live animal during rearing through to slaughter. Compliance with the standards is monitored through regular auditing by independent assessors. A fundamental requirement is traceability so the provenance of the final product is known exactly and can be guaranteed. A criticism of some schemes is that, in terms of animal welfare, they are largely input based (resources available), rather than output based (the measured welfare of the animals). There are many schemes that overlap in their objectives. This leads to another criticism, which is that having many competing schemes, rather than a single one, is counterproductive because it confuses the consumer. However, the introduction of quality assurance schemes has undoubtedly benefited welfare generally.

(5) Economic reasons to improve welfare: In effect, retailer codes of practice and quality assurance schemes provide an economic pressure encouraging good welfare. Payments to producers are at least indirectly linked to welfare standards. Often, better welfare costs money, for example because it requires less intensive production systems. An example would be free-range broiler chickens that cost more to produce than those reared intensively in large barns. Sometimes however, good welfare is reflected in reduced costs and higher profits. If broiler chickens are housed on litter that becomes moist they can develop foot-pad dermatitis. This condition is probably painful and therefore compromises the birds' welfare. The affected birds also grow more slowly however so there is a financial loss associated with the condition. It has been demonstrated that the costs of reducing the prevalence of foot pad dermatitis would be easily offset by the increased economic returns resulting from the improved growth rate of the birds (Ekstrand, Carpenter, Andersson, and Algers, 1998).

Careful handling of animals pre-slaughter generally leads to lower carcass and meat quality as well as better welfare. This can be an important stimulus to people to take greater care in handling. Better handling will result in lowered transport mortality, lower levels of carcass bruising and reduced stress leading to smaller amounts of PSE and DFD meat. As well as improved welfare there is improved product quality and potential profit. To be effective in improving welfare, quality needs to be monitored effectively so there can be appropriate feed back to drive improvements and reward compliance, perhaps by higher payment for better quality.

CONCLUSIONS

The need to sell meat in often very competitive markets highlights the importance of quality. Many consumers perceive animal welfare to be an important component of ethical quality and the meat industry therefore needs to address concerns about the welfare of the animals it rears and processes. These concerns relate to practices in all parts of the production chain, from breeding and rearing through management and slaughter. A better understanding of the needs of animals, informed by better methods of assessing and monitoring welfare, would help the industry address potential concerns. Welfare can potentially be improved by a number of methods. These include ensuring that people think about welfare objectively, identifying optimal procedures and handling methods, ensuring that information on these is available and easily accessible, and that there is appropriate education of the personnel involved. Legislation can be used to regulate minimum standards, and codes of practice and quality assurance schemes can complement the legislative requirements, and inform and reassure consumers. Lastly there can be more direct linking of good welfare practices to increased profit through the production of a higher quality product. Certainly, a much greater awareness of the importance of animal welfare is likely to be a characteristic of successful companies in the future global market for meat products and enterprises that fail to recognise the ethical wishes of their consumers may find it hard to survive international competition.

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