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DO HENS SUFFER IN BATTERY CAGES?

A REVIEW OF THE SCIENTIFIC EVIDENCE

COMMISSIONED BY THE ATHENE TRUST

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October 1991

1. INTRODUCTION

In those parts of the world where the poultry industry is most developed, including Europe and the USA, over 90% of laying hens are housed in battery cages. Before discussing whether this causes suffering, it is important to clarify the terms 'laying hens', 'battery cages' and 'suffering'.

'Laying hens' (also called 'layers') produce the eggs which are sold for human consumption. In common with many other birds, eggs may be produced without any intervention by males, so males are identified and culled shortly after hatching. The eggs are infertile, so it is necessary to keep breeding flocks to produce the fertile eggs from which the laying hens will hatch; these birds are called 'layer breeders'. The two other main categories of chicken in the modern poultry industry are 'broilers', both male and female, which grow rapidly and are killed for meat well before reaching sexual maturity, and 'broiler breeders'. Despite the fact that female layer breeders and female broiler breeders lay eggs, neither are included in common use of the term 'laying hens'. Neither broilers nor either sort of breeders are usually kept in cages. This is often misunderstood, as illustrated by the common phrase 'I won't eat battery chicken': laying hens are not sold for eating, except in processed form such as soups.

Cages were originally introduced for single laying hens to allow recording of individual egg production and culling of poor layers. Later, several birds were placed in each cage, and group sizes of 3 to 6 are now most common. Cages are usually arranged in tiers; the large number of cages in one house necessary to accommodate a flock came to be called a battery of cages, and hence laying cages are often called 'battery cages'. Space allowances for laying hens in cages vary in different countries from about 300 sq cm per bird upward, but in the UK and other member countries of the EEC there is a legal minimum of 450 sq cm per bird. This is laid down by a Directive of the Commission of the European Communities (86/113/EEC) which also sets other specifications (Baker, 1988); these will be covered where appropriate.

Views on the existence, nature and definition of suffering in animals, and conversely of animal welfare, are diverse. There is, however, a general consensus that animal suffering does exist: most people believe that animals can suffer in ways that in certain respects are comparable to human suffering. There are obviously different kinds of suffering, and Dawkins has given a broad definition of suffering as including "a wide range of unpleasant emotional states" (Dawkins, 1980). Similarly, animal welfare has many different aspects. For example, the UK's Farm Animal Welfare Council has proposed (Webster and Nicol, 1988) that a husbandry system should provide animals with:

> Freedom from hunger and thirst;
> Freedom from thermal and physical discomfort;
> Freedom from pain, injury and disease;
> Freedom from fear and distress;
> Freedom to exercise most normal patterns of behaviour.

Welfare problems for hens in battery cages will be considered in these five areas. It is beyond the scope of this review to make an overall assessment of the welfare of hens in large-scale poultry production, so emphasis will be placed on those problems which are greater or less in battery cages than in other husbandry systems, rather than on those which

are common to all husbandry systems. Most detail will be given on hens in the UK, with consideration of other countries where appropriate.

2. HUNGER AND THIRST

For most of the time, laying hens in all systems have unlimited food and water available, because restriction might limit egg production. There are probably only three circumstances in which hunger and thirst (more severe than that which will simply prompt feeding or drinking) are likely in battery hens. First, crowding sometimes prevents a bird from reaching the food trough or drinkers. However, this rarely persists for more than a few minutes. Second, automatic food and water supply systems sometimes break down. This is a particular problem in closed houses (including battery houses), where the birds' daylight period usually starts soon after midnight (so that most eggs are laid before the beginning of the operatives' working day). Breakdowns may therefore not be discovered for any hours. They are no more common in batteries than in other systems, but the effects are worse, because hunger and thirst in the barren environment of battery cages cause more frustration than in more complex environments (section 6).

A third cause of hunger and thirst is the practice of induced moulting, which is achieved by reducing daylength and simultaneously restricting food and water supplies. As well as causing moulting, this procedure also stops the hens laying, and it is occasionally used to adjust the supply of eggs to the market. After a break in laying, daylength is increased again, and laying then resumes at a greater rate than before; egg size also increases after such a break. It used to be common to withhold food and water altogether for several days. This is now illegal in the UK, but various alternative methods are common which also cause hunger. One such method is to provide, quite suddenly, a type of food which the hens have never encountered before. Hens are cautious about novel types of food and this can therefore cause them almost to stop eating, even for as long as several days. Induced moulting is only practised in batteries. In other systems birds would eat other material, such as litter, in reaction to prolonged food restriction.

Wild and feral fowl have varied diets, and it is sometimes suggested that hens need similar variety, as is potentially available to farmyard and free range hens. There is no evidence that birds fed a nutritionally adequate mash are hungry, but restriction of feeding to a single, monotonous and easily consumed food contributes to other problems (sections 4, 6). Other problems associated with feeding in battery cages, such as prevention of birds from feeding synchronously, will also be covered in section 6.

3. THERMAL AND PHYSICAL DISCOMFORT

Chilling and overheating of battery hens in the UK are rare. The heat produced by the birds in a densely-stocked battery house is considerable, so supplementary heating is not necessary in the UK climate and the rate of ventilation in the house is adjusted to keep the temperature down to that required. Even at very low ambient temperatures, producers avoid chilling because this would result in increased food consumption. Thermal discomfort is thus rarer in battery cages than in any other system. In the event of power failure, most units have emergency generators, or at least fail-safe mechanisms for ventilation which are triggered by the loss of electricity.

At very low ambient temperatures, reduced ventilation sometimes results in a build-up of ammonia and dust in the air of the house. This is unpleasant for humans and probably also

for birds. Ability to vary ventilation rate means that this problem is less common in batteries than in other closed houses with lower stocking density, although more common than in open houses (such as strawyards). Long exposure to high concentrations of ammonia and dust, which results in lesions in the lungs and other problems (Oyetunde et al., 1978; Appleby and Hughes, 1991), will not occur in battery houses.

It is often suggested that certain features of battery cages, such as the small space allowance, low ceiling and wire floor, result in other aspects of physical discomfort being more common in batteries than in other systems. Lack of space restricts the performance of comfort behaviour such as wing-flapping, stretching and shaking (Nicol, 1987) and of other behaviour patterns (Dawkins and Hardie, 1989). The minimum height for cages specified by the EEC is 40 cm over 65% of the cage area and 35 cm over the remainder; yet in unconstrained hens, 25% of head movements are above 40 cm (Dawkins, 1985). A wire floor may be supposed to be an uncomfortable substrate for behaviour such as food-scratching and nesting. Such problems do seem to be more numerous in cages than elsewhere. However, there is almost no firm evidence that they cause discomfort. The strongest evidence is probably the high incidence of foot and claw damage in cages (section 4): physical discomfort is presumably a precursor of most such injuries.

4. PAIN, INJURY AND DISEASE

Pain and injury will be considered first, as inflicted by the cage, by hens or by humans. Disease, with which pain may also be associated, will then be covered.

Foot and claw damage are more frequent in cages than in other systems, with lesions, fissures and hyperkeratosis on the feet and with overgrown, twisted or broken claws (Tauson, 1980). Damage to the sole of the feet is caused by the high, localised pressure from thin floor wire; thin wire is used because thick wire causes more egg breakage (Carter, 1971). Pressure is also high on the ends of the toes pointing down the slope, and damage here is common, even though floor slope is limited to 8° in the EEC. Claws grow too long because there is nothing to wear them down, and long claws are easily damaged. This problem can be prevented by adding a strip of abrasive tape to the manure deflector behind the food trough, where birds perform most food-scratching (Tauson, 1986); this is now compulsory in cages in Sweden. Foot and claw damage are also reduced by including perches or dust baths in cages (Robertson et al., 1989; Duncan et al., 1991). Foot condition is generally good in floor-housed systems, but it may deteriorate severely if litter becomes wet (Hill, 1986).

Poor cage design used to result in birds being occasionally trapped, most often by the head or neck. However, recent improvements in design have resulted in this problem now being rare (Tauson, 1988).

Bone breakage during the laying period is probably less common in cages than in systems where birds have more freedom of movement: birds from one perchery were found to have healed breakages at end of lay (Gregory et al., 1990). However, restriction of movement in cages results in bone weakness by the end of lay; for example, the tibia has been shown to be up to 41% stronger in floor-housed hens than in caged birds (McLean et al., 1986; Knowles and Broom, 1990). Partly as a result of this, up to 30% of caged birds suffer broken bones during catching and transportation, and more during processing (Gregory and Wilkins, 1989). Another factor which contributes to breakages during catching is the physically difficult process of removing the birds from the cages, through doors which are often restrictive.

There are around half as many breakages in birds from free range or percheries (Gregory et al., 1990).

Of the two main sorts of injury inflicted by hens, feather pecking is more common in cages but cannibalism in non-cage systems. Loss of feathers is generally worse in cages than in other systems (McLean et al., 1986); Appleby et al., 1988), and this loss is partly due to abrasion but more due to feather pecking (Hughes, 1985). While the importance of feathers to the welfare of hens is not clear, the actual removal of a feather by pecking is probably painful, often resulting in bleeding, and exposed skin is more likely to be injured. Feather pecking is worse in barren conditions, where the availability of varied stimuli for pecking is reduced (Blokhuis, 1989). It is exacerbated by provision of a food which can be eaten quickly, because feeding in natural conditions occupies up to 50% of the time (Savory et al., 1978), and feather pecking is most widely considered to be aberrant feeding behaviour (Wennrich, 1975).

Cannibalism does occur in cages, but relatively infrequently. This is probably due to the small group sizes, which limit the number of birds which a cannibalistic individual can attack and restrict the possibility of birds imitating this behaviour from each other. When it does occur in cages, it is also sometimes possible to identify and remove the birds responsible, which is rare in a large flock.

The main injury caused by humans, knowingly rather than accidentally, is beak trimming. This is used in all systems, but more commonly with floor housing than with cages, because it is the main preventative measure against cannibalism. It is now known to cause pain, in the short term and probably also in the long term, in a way similar to other amputations (Gentle, 1986). In the UK, it is now recommended that beak trimming should be carried out only as a last resort (MAFF, 1987), but this is widely ignored.

There have been few systematic studies of disease incidence, but the risk of diseases spread by contact between birds, or by contact between birds and faeces, is generally regarded as more severe in non-cage systems. Free range hens also come into contact with pathogens from wild animals. By contrast, metabolic diseases which are not spread by infection have been reported as having higher incidence in cages than in other systems (Duncan, 1978). In general, there is ever-improving control of disease in poultry production, for example with development of vaccines against former major problems such as coccidiosis. Partly as a result of this, mortality during the laying period continues to decrease, and is generally low and similar in all systems.

5. FEAR AND DISTRESS

Fear may be associated with some of the problems in section 4, and distress is probably associated with most of the problems in both sections 4 and 6. Fear and distress also occur independently of these problems.

Hens in cages tend to react adversely to an approaching human (Jones et al., 1981) and to particular husbandry operations such as dusting of cage fronts (Rutter and Duncan, 1989). By contrast, little or no avoidance of humans occurs in floor housing: hens tend to cluster round people entering strawyards or deep litter systems. There is other evidence that pen-housed birds are less fearful than caged ones: birds in cages show marked fear responses when exposed to a novel stimulus, whereas similar groups in pens are completely indifferent

(Hughes and Black, 1974). Similarly, tonic immobility (an index of fear) is much longer for hens housed in cages than for those from pens (Jones and Faure, 1981).

In extreme cases, fearfulness in cages results in hysteria, and in flapping frantically against the rear of the cage birds may actually injure themselves (Rutter and Duncan, 1989). Hysteria is associated both with large group size, which allows positive feedback between birds, and with barren environments. In batteries, feedback occurs between cages so group size in this respect is effectively large. Hysteria used to occur in Pennsylvania systems (pens for 50 to 100 birds with sloping wire floors), but is rare in the more complex environments of other floor-housing systems. In one series of experiments, varied treatments were applied in the attempt to reduce the incidence of hysteria in colony cages housing groups varying in size from 15 to 40. Some improvement was achieved by adding tranquillizer to the diet, by claw trimming, by force moulting and by reduction of group size or stocking density. Complete prevention of hysteria, though, was only achieved by enrichment of the cage environment, by addition of nests or perches (Hansen, 1976).

Fear and distress may also be caused by aggressive behaviour. Aggression is less frequent in cages than in most alternative systems, probably because movement is restricted and subordinate birds are close to a dominant, which inhibits their aggression to each other (Hughes and Wood-Gush, 1977). The 'peck order effect' (Duncan, 1978) is also less likely in cages than in larger groups, where it is common for a small number of birds at the bottom of the order to be pecked continually by others.

6. BEHAVIOURAL RESTRICTION

Battery cages obviously do not allow hens 'to exercise most normal patterns of behaviour'. Furthermore, they contravene a more basic principle, which was laid down by a committee set up by the UK Government in 1964 to consider welfare in intensive husbandry systems, under Professor Rogers Brambell. The Brambell Committee stated that "An animal should at least have sufficient freedom of movement to be able without difficulty to turn round, groom itself, get up, lie down and stretch its limbs" (HMSO, 1965); the data in table 1 demonstrate that battery hens do not have such freedom. In fact, there is no scientific evidence that general freedom of movement is actually important to hens – except the fact that restriction of movement causes bone weakness. However, restriction of certain specific behaviour patterns is likely to cause suffering. Consideration is given here to pre-laying behaviour, comfort behaviour, feeding and foraging, and dust bathing.

Table 1. Area used by medium hybrid hens housed singly in small litter-floored pens (from Dawkins and Hardie, 1989). This compares to a standard allowance in battery cages of 450 sq cm per bird.

	Area (sq cm)	
Behaviour	Mean	Range
Standing	475	428-592
Ground scratching	856	655-1217
Turning	1272	978-1626
Wing stretching	893	660-1476
Wing flapping	1876	1085-2606
Feather ruffling	873	609-1362
Preening	1151	800-1977

Inability to perform normal pre-laying behaviour is generally regarded as one of the most important problems for the welfare of hens in cages (Farm Animal Welfare Council, 1986). The reaction of at least some strains of hens indicates frustration (Wood-Gush, 1972).

Comfort behaviour, such as wing flapping, body shaking and stretching, is constrained partly by cage area (Table 1) and partly by cage height (Nicol, 1987a). This probably also causes frustration (Nicol, 1987b), partly because some of these behaviour patterns have functions in addition to increasing body comfort (Nicol, 1989).

Birds in groups tend to feed synchronously, but it is not possible for all birds in a cage to feed simultaneously at the standard trough width (and therefore also cage width) of 10 cm per bird. Prevention of feeding, which also occurs when automatic food supply systems break down, is known to cause frustration in barren conditions (Duncan and Wood-Gush, 1972). It is less of a problem in environments where foraging is possible, which takes the form of pecking and scratching in loose material. Restriction of pecking and scratching also contributes to foot and claw damage and to feather pecking (section 4).

Evidence on strength of motivation for dust bathing has been equivocal (Dawkins and Beardsley, 1986). However, it also has physical effects, so its prevention in cages probably contributes to poor plumage condition.

7. OVERALL ASSESSMENT OF WELFARE

It is apparent from this review that welfare problems for laying hens occur in all the five areas considered. They also occur in all husbandry systems. However, in most systems other than battery cages, problems are mostly associated with two of these areas: 'pain, injury and disease' and 'fear and distress'. By contrast, battery cages compromise not only those two areas, but also the remaining three: 'hunger and thirst' (primarily during induced moulting), 'thermal and physical discomfort' and 'behavioural restriction' (Table 2). Of course, neither these areas nor different problems within these areas are of equal importance: certain problems will cause more suffering than others. Nevertheless, there are consistently more problems in cages than in many other systems. Furthermore, many of these problems affect most or all birds in cages: for example, bone weakness, fearfulness and behavioural restriction. By contrast, some problems which are more common in other systems, such as cannibalism, occur in fewer birds, albeit causing severe suffering for those particular individuals. The latter problems are also affected by management, and it has been pointed out that commercial alternative systems often compromise welfare through excessive stocking densities, large flock sizes and lack of adequate or well-sited litter areas (Dun et al., 1991); these are all mistakes which can be avoided. The burden of the evidence is that, overall, hens suffer more in battery cages than in well-run, alternative systems.

Increasing understanding of environmental effects on welfare also allows consideration of the particular characteristics of battery cages which cause suffering (Table 3). In no other system are birds so intimately affected by every feature of the man-made environment.

Table 2. Summary of the most important advantages and disadvantages of battery cages for welfare of laying hens.

Hunger and thirst	Not generally a problem; severe during induced moulting.
Thermal and physical discomfort	Thermal discomfort rare, although also uncommon in most other systems; physical discomfort probably more common than in other systems.
Pain, injury and disease	Pain and injury common, from foot and claw damage and feather pecking, and as a result of bone weakness. However, cages limit cannibalism and hence the need for preventative beak trimming. They are also hygienic, although disease is a declining problem in all systems.
Fear and distress	More common in cages than other systems, except in relation to aggression, cannibalism or beak trimming.
Behavioural restriction	A major problem, and also contributes to other physical and behavioural problems.

Table 3. Some welfare problems caused by different characteristics of battery cages.

Floor entirely of sloping wire	Foot and claw damage
Restricted area	Restriction of movement, causing bone weakness and breakage; restriction of specific behaviour patterns, some causing frustration
Restricted height	Frustration of comfort behaviour
Barren environment, no loose material	Frustration of foraging and pre-laying behaviour; claw damage; feather pecking

8. LEGISLATION

One possible conclusion from the scientific evidence discussed in the previous sections is that there should be legislation against those aspects of housing which cause suffering. Considering battery cages in particular, this would suggest that there should be legislation requiring that hens be provided with more space and height than that currently provided in battery cages, and with alternative substrates such as perches, loose material or nest sites. Such legislation could be complied with either by modification of cages or by adoption of more radical alternatives. In the current state of development of alternative systems there is no consistent welfare advantage known for either of these approaches, so the choice between them is likely to be an economic one. In either case, however, battery cages in their current form would cease to exist.

Similarly, legislation could also limit the problems found in alternative systems, for example by specifying maximum permissible group sizes and stocking densities.

9. CONCLUSIONS

1. Hens suffer in battery cages. Many aspects of suffering are chronic, and affect all individuals. Other aspects, which may be either chronic or acute, affect different individuals to a greater or lesser extent.

2. Hens suffer more in battery cages than in well-run, alternative systems.

3. Suffering is caused by specific characteristics of battery cages. It would be possible to legislate against such characteristics.

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