BEHAVIOURAL TIME-BUDGETS AND BEAK RELATED BEHAVIOUR IN FLOOR-HOUSED TURKEYS

B O Hughes[†] and P N Grigor[1]

Roslin Institute (Edinburgh), Roslin, Midlothian, EH25 9PS, UK

[1] Present address: Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB9 2QJ, UK

[†] Contact for correspondence and requests for reprints

Final Acceptance: 1 September 1995

Abstract *Animal Welfare 1996, 5:* 189-198

The behavioural time budget of 140 turkey poults housed on litter in groups of 10–11 in small pens was recorded by individual scan sampling from 1-day-old to 12-weeks-old. Over this time period some behaviour (sitting/sleeping) remained relatively constant, some (feeding) declined and remained low, some (standing/walking, drinking) declined and rose again, while some (environmental pecking, bird pecking, preening) rose and then declined. By 12 weeks the incidence of some behaviours appeared to have stabilized, though others were still changing. A substantial proportion of their activity could be categorized as beak-related behaviour. Feather pecking and cannibalism are major behavioural and welfare problems in intensively-housed turkeys; it is postulated that one reason for this may be because a major proportion of their beak-related behaviour is strongly directed towards plumage, either their own or that of other birds, rather than towards food or environmental stimuli. One possible solution may be to seek ways of increasing the proportion of time they spend feeding.

Keywords: *animal welfare, cannibalism, pecking behaviour, time-budgeting, turkeys*

Introduction

Although the turkey is an important commercial species of poultry and world production is rising year by year (Sainsbury 1992) there has been little scientific study of its behaviour under normal commercial conditions. Modern strains offer an extremely efficient means of converting feedstuffs into meat but concern is beginning to be expressed about the welfare of these rapidly-growing birds. These welfare problems include featherpecking and cannibalism, breast blisters and locomotor disorders (Hocking 1993; Farm Animal Welfare Council 1995).

Rather little is known about turkey behaviour and there appear to be no detailed reports describing the behavioural time-budgets of growing turkeys up to the age of 12 weeks. We need this information so that we can begin to understand the behavioural background of some important welfare problems, such as severe featherpecking and cannibalism.

In this paper we describe the time-budget of a flock of turkey poults, including its development over time from 1-day-old to 12-weeks-old, examine the central role of beak-

related behaviour and discuss the implications for welfare, especially the occurrence of pecking damage.

Materials and methods

The turkeys were 140 female BUT8 poults – birds of a female parent line used to produce the UK's most widely grown commercial turkey. Being breeding stock, they are kept at a higher light intensity than their offspring and they require beak trimming on a routine basis to prevent cannibalism. The birds were housed from 1-day-old till 12-weeks-old on litter in groups of 10 or 11 in 13 pens 2.4x1.5m. The experiment was part of a larger study involving different methods of beak trimming; the findings reported here were obtained from normal, untrimmed control birds. They were fed on turkey starter crumbs from 1–5 weeks and turkey finisher pellets from 6–12 weeks of age. Food and water were supplied *ad libitum* from one tower feeder and one bell drinker per pen. The photoperiod was 20h light per day, because this was similar to the normal commercial rearing regimen. Observations were made throughout the 12-week study period, with about 7 each week, totalling 84 in all. They were fairly evenly spread over various times of day between 0900 and 1700h, using a scan-sampling (on the dot) method. This covered the central period of their day but no observations were carried out during the early or the late parts of the photoperiod. The starting pen and order of watching were varied. The observer stood outside the pen for 45s to allow the birds to become accustomed to his presence, then recorded the behaviour of each individual bird. One scan was made for every group per observation. Behaviour was classified into one of seven categories: sitting/sleeping (lying down resting on the littered floor, either sitting awake with head and neck raised, or asleep with head lowered or under wing); standing/walking (standing upright or moving around the pen and not performing any other categorized activity); feeding (pecking at or eating food); drinking (dipping beak into water or swallowing); pecking at the environment (walls, litter, feeders or drinkers); pecking at other birds (plumage, appendages, tissue); and preening own plumage (manipulating feathers with the beak).

The light intensity, initially about 10lux at ground level, was reduced in two steps during the seventh week, first to 4–5lux and then to 1.3–1.8lux to limit the incidence of pecking damage. This darkening of the house was in response to cannibalism starting – the first reduction had little effect so the intensity was reduced further after 2–3 days. Greater detail of the methods can be found in Grigor *et al* (1995).

The data are presented on a weekly basis as percentages of all observations falling into each class of behaviour. The program CricketGraph 1.3® on the Apple Macintosh was used to generate best-fit curves.

For scoring feather and skin damage the birds were all caught at 5 and at 12 weeks, individually examined and assigned a score on the basis of the following scale: 0 = no evidence of pecking; 1 = small (< 2 cm) bare area on wings, base of tail or base of neck; 2 = larger (> 2 cm) bare area on wings, tail or neck or slight tissue pecking; 3 = large bare areas on wings, tail or neck, substantial tissue damage; 4 = widespread bare areas, severe fresh or healing tissue damage. Mean pen feather and skin damage scores were then calculated from the individual ones. Any bird with an injury as a result of being pecked by another bird was removed from its pen, the wound was rinsed with water, Vaporub® (methyl salicylate cream) was applied around the wound in an attempt to discourage further pecking

and the bird was returned to its pen. If pecking continued and the injury failed to heal the bird was culled.

Results

The changes in the incidence of each behaviour in the turkey poults over the 12 weeks of the study are shown in Figure 1. The percentage of sitting/sleeping (Figure 1a) tended to increase a little over time, while standing/walking declined slightly then rose (Figure 1b).

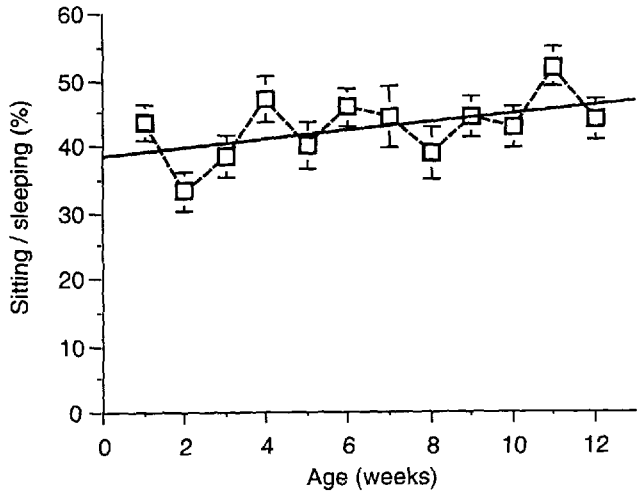

Figure 1a **Sitting or sleeping as a percentage of all behaviour. Best fit line is a linear regression.**

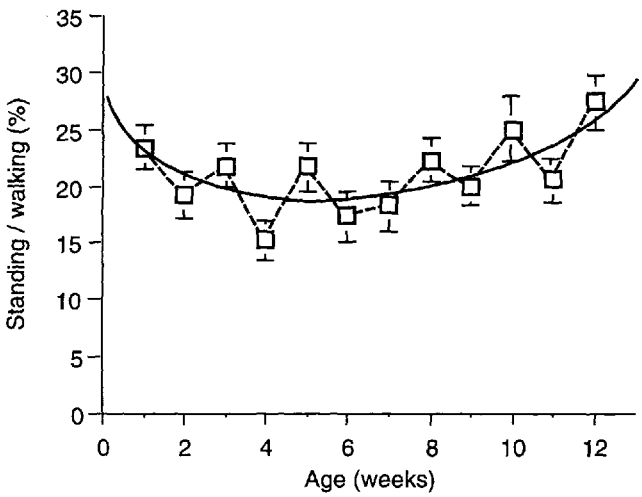

Figure 1b **Standing or walking as a percentage of all behaviour. Best fit curve is a 4th order polygonal.**

Feeding was relatively high during week 1, fell sharply until week three then remained relatively constant at a low level (Figure 1c). Drinking was curvilinear, falling to a minimum at 7 weeks of age then rising again (Figure 1d). Environmental pecking and bird pecking were low during week 1, when feeding was high, rose sharply in week 2 and then, with some reversals, declined (Figures 1e and f). Preening was also low in week 1, rose gradually till week 5 then declined slightly (Figure 1g). The total time spent carrying out the various forms of beak-related behaviour (feeding, drinking, preening, environmental and bird pecking) is shown in Figure 2; after rising to reach a peak of 45 per cent in week two it declined gradually to around 28 per cent.

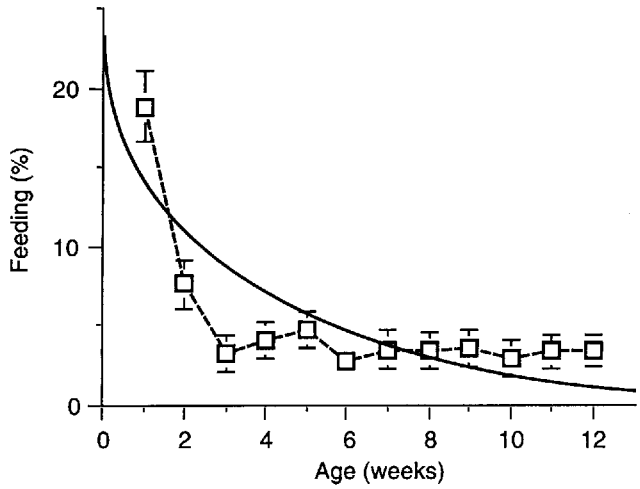

Figure 1c **Feeding as a percentage of all behaviour. Best fit is a log curve.**

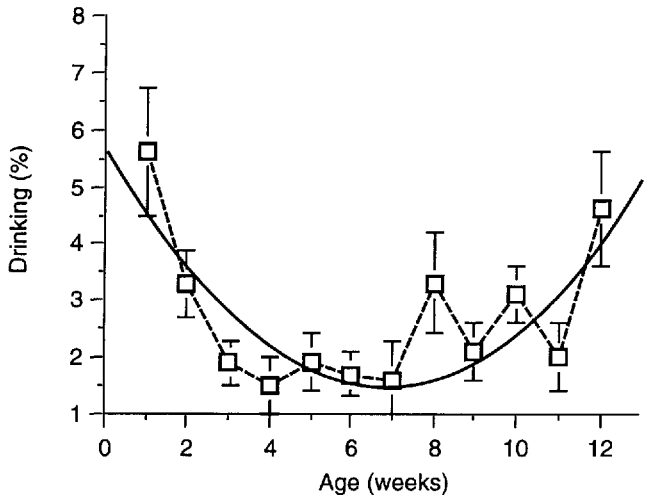

Figure 1d **Drinking as a percentage of all behaviour. Best fit curve is a 2nd order polygonal.**

https://doi.org/10.1017/S0962728600018613 Published online by Cambridge University Press

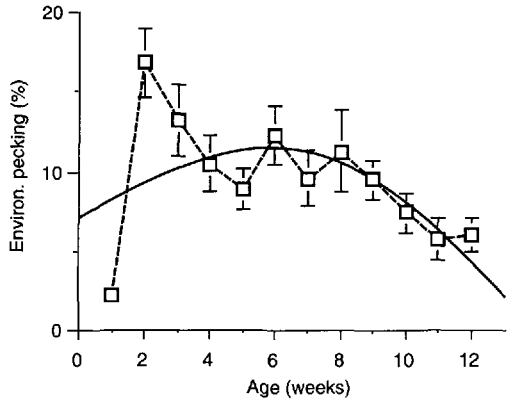

Figure 1e **Environmental pecking as a percentage of all behaviour. Best fit curve is a 2nd order polygonal.**

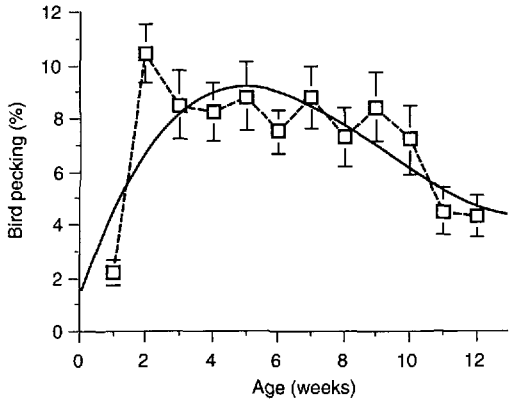

Figure 1f **Bird pecking as a percentage of all behaviour. Best fit curve is a 3rd order polygonal.**

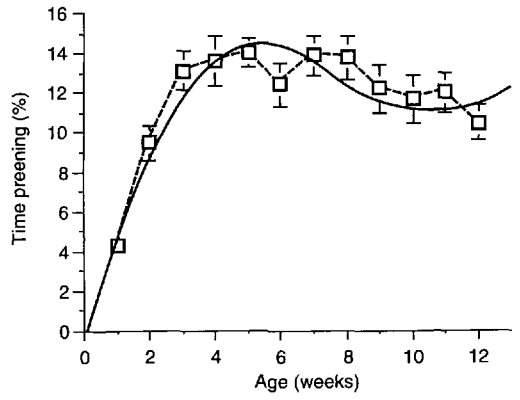

Figure 1g **Preening as a percentage of all behaviour. Best fit curve is 3rd order polygonal.**

Most of these changes are probably attributable to maturational factors, because the birds' environment remained relatively constant. One major husbandry change was the dietary switch from crumbles to pellets; this may have been associated with a reduction in time spent feeding between weeks 5 and 6 (Figure 1c). Another was the sharp reduction in the intensity of illumination during week 7 to limit outbreaks of pecking damage in the study birds. In this case there were few correspondingly sharp changes in the incidence of any behaviour noted between week 7 and week 8, except that locomotor activity, in the form of standing and walking, which in caged domestic fowls is depressed by low light levels (Hughes & Black 1974), actually began to show an upward trend at about this time (Figure 1b), as did drinking (Figure 1d). By 12 weeks the incidence of some behaviour patterns appeared to have settled at a relatively constant level (sitting/sleeping, feeding, preening, beak-related behaviour), though others still appeared to be changing (standing/walking, drinking, environmental and bird pecking).

The overall feather and skin damage scores were 1.42 (SEM 0.08) at 5 weeks and 1.01 (SEM 0.13) at 12 weeks; the lower score represents an improvement. A total of nine birds (6.4%) had to be culled because of pecking damage.

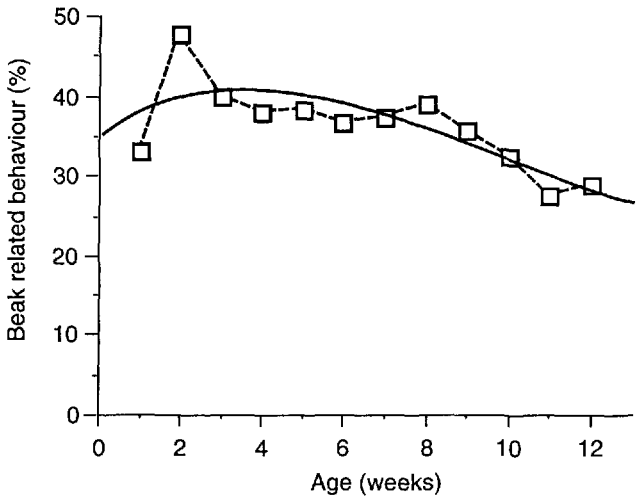

Figure 2 **Beak-related behaviour as a percentage of all behaviour. Best fit curve is a 3rd order polygonal.**

Discussion

Behavioural time budget

There appear to be only two other reports of behavioural time-budgets for turkey poults. In one (Hale & Schein 1962), 12-week-old birds receiving either mash or pellets were compared. The categories of behaviour were slightly different but, compared to our birds at 12 weeks, Hale and Schein's pellet-fed birds spent rather longer feeding (7%), less time drinking (2%), a little less time preening (6%), much less time resting (20%) and much longer engaged in 'other' behaviour (65%). This final category is not defined in Hale and Schein's paper but it is likely to consist mainly of general activity – what we have categorized as standing and walking. Overall, therefore, Hale and Schein's birds appear to

have been considerably more active at 12 weeks than the birds in our study. Some of these differences may be attributable to environmental and methodological factors: for example, our birds were on a 20h photoperiod and we observed them only in the central 8h, so there were periods of 6h before and after this when they were not being observed. Hale and Schein do not state the length of their photoperiod nor the period over which their birds were studied. We are unaware of any investigations of diurnal variation in turkey behaviour; this should perhaps be examined in future research. Furthermore, in the 30 years separating the two studies there have been major genotypic changes in commercial turkey strains which have, at least to some extent, probably influenced the expression of behaviour. These changes are exemplified by the difference in 16-week body-weight, which in the case of the turkeys studied by Hale and Schein was 4.9 kg, whereas in 1995 the weight of a typical fast-growing line at 16 weeks would be 9.1 kg for a female and 13.6 kg for a male (Anon 1995).

In the other study (Savory 1982) turkey poults were compared with broilers in separate or mixed groups up to the age of 3 weeks. Only feeding and resting were recorded but the values for turkeys were similar to those in the present study. Feeding occupied 8.5–10.5 per cent of time compared to a mean value of 9.5 per cent over weeks 1–3 for our birds, while resting was 43–46 per cent compared to a mean value in our case of 38.2 per cent.

Beak-related behaviour

Our results show that behaviour which involves the use of the beak occupies, in one context or another, an important place in the turkey's repertoire. Investigative behaviour in our turkeys was almost entirely beak-based: foraging took the form of ground pecking, while ground scratching, which is common in domestic fowls, was observed very rarely or not at all (data not published). Hale and Schein (1962), too, noted that ground scratching did not occur in their turkeys, in contrast to wild turkeys which carry out semi-circular foot movements to expose food items hidden under leaf litter. As well as pecking at the litter our turkeys directed pecks towards the walls of the pen, to feeding troughs and to drinkers. In addition the amount of pecking at other birds, which at 12 weeks of age was 4.1 per cent of observed behaviour (with a mean of 6.1% from 1–12 weeks), was appreciable. This figure is markedly higher than that, for example, recorded for domestic hens ($< 1\%$) kept under straw-yard conditions (Gibson *et al* 1988).

The notion that various beak-related behaviours may be mutually substitutable is a controversial one but it has received some experimental support in the case of domestic fowls. When the behaviour of nine separate flocks of ISA Brown hens, all with access to litter and slats, was compared (Appleby *et al* 1989), it was striking that the proportion of time spent in beak-related behaviour was identical in both (56%) even though it was made up in different ways. On slats, feeding was the main behaviour – 38 per cent compared to 18 per cent on litter, whereas on litter general environmental pecking was predominant – 25 per cent compared to 5 per cent on slats. In ISA Brown flocks kept in a straw-yard (Gibson *et al* 1988) the total time spent in beak-related behaviour was again very similar (59%) and here the distribution pattern was similar to slats – 40 per cent of time feeding and 7 per cent on general pecking. There is evidence (Blokhuis & Arkes 1982; Blokhuis 1986) that pecking motivation can be increased by removing food from food-restricted chickens, and that the increased pecking tendency observed during the post-feeding period is expressed as ground pecking where birds have access to litter and as pecking of conspecifics where they do not.

As growing broilers matured a decrease in feeding and foraging was partially matched by an increase in preening (Blokhuis & van der Haar 1990). Transfer of pecking activity was found when frustrated birds had a choice of objects at which to direct stereotyped oral behaviour: object pecking, litter pecking, preening and drinking all appeared to be substitutable post-feeding activities in restricted broiler breeders (Savory & Maros 1993). Thus, the evidence suggests that domestic fowls may have a tendency to spend a relatively constant proportion of time in beak-related behaviour and that there may be a degree of substitutability between almost all beak-related behaviours, including feeding.

In our turkey poults also there is a suggestion that beak-related behaviour may be at least partially substitutable. Over the 12-week period it varied (Figure 2) much less than its individual components: it ranged from 28 to 45 per cent with a coefficient of variation (CV) of 12.8, compared with CVs of 80.0 for feeding, 40.2 for drinking, 28.9 for environmental pecking, 34.5 for bird pecking and 18.7 for preening.

This notion of substitutability is consistent with an observation made by Lind (1957) who noticed that when one behaviour (A) switched to another (B) the patterns were often linked by what he called a 'transitional action', which was an activity common to both A and B. Lind proposed that the proprioceptive stimuli generated by the transitional action had a feedback effect and reduced the threshold required for B to be motivated. If this proposition is correct it could help to account for the ontogeny of feather pecking, which has behavioural elements common to feeding, foraging and preening, and would explain the transition from one to another.

Pecking damage

Feather pecking and cannibalism are among the major welfare problems of intensively-housed turkeys (Hocking 1993). The relationship between beak-related behaviour and pecking damage is a complex one. It has been argued (Hughes & Duncan 1972) that feather pecking and cannibalism are controlled by two main influences – an inherent general tendency to peck (itself governed by genetic, hormonal and nutritional variables) and the relative 'triggering' effect of various environmental stimuli. This model implies that there is a 'pecking requirement', that pecking behaviour may be directed at a range of different targets and that if the incidence of one behaviour is low another is likely to be high. The precise reason why turkeys are motivated to peck each other is unknown, though the concept of substitutability of beak-related behaviour may provide a clue to the high probability of damaging pecking in this species. Preening formed a substantial proportion of beak-related behaviour in the turkeys studied here (32%) as did pecking at other birds (18%), whereas feeding comprised only 15 per cent, suggesting a strong tendency in turkeys to direct investigative appetitive pecking towards plumage and towards other birds rather than towards food, even when food is still available.

In the case of domestic fowls there has been considerable debate as to whether feather pecking and cannibalism are two manifestations of the same behaviour or two separate behaviours (see, for example, Appleby *et al* 1992). There is evidence that both occur in turkeys and both can be welfare problems. Hale and Schein (1962) imply that they can be linked 'Breaking the skin during feather picking may produce bleeding and favour the

development of cannibalism'. Furthermore, in the outbreak which occurred in our birds at the age of 7 weeks, injury was more likely where a bird already had areas of bare skin exposed by feather pecking. It was relatively rare to find serious injuries on birds with good plumage. There were also indications that tissue damage at the base of the tail followed episodes where birds had first been pecking sufficiently hard at the tail feathers to wrench them out. The evidence, though limited, favours the hypothesis that there may be some sort of association between the two forms of pecking.

Strategies to limit pecking damage

Pecking damage can often be kept in check in growing birds by maintaining very low light intensities. This was the case in this experiment – after the light intensity was reduced, pecking damage declined and eventually the outbreak came under control. By 12 weeks the damage score was less than it had been at 5 weeks. However, in some cases this is not possible, for example, breeding stock have to be kept under brighter light to bring them into laying condition and on a restricted food intake to prevent them becoming too obese. Both these factors are likely to increase pecking damage, so breeding stock have to be beak trimmed to prevent cannibalism. Even light reduction is viewed by some as an undesirable practice – it is felt that it should be unnecessary to keep birds in near darkness to avoid pecking (Farm Animal Welfare Council 1995). If the causation of pecking damage was more fully understood then such drastic control methods might not be required.

Our findings suggest that beak-related behaviour plays an important part in the turkey's behavioural repertoire, and it may be worthwhile exploring the possibility of diverting this behaviour towards less injurious targets, such as the food. It has long been known that providing a diet for domestic fowls in a form which takes birds longer to consume, can reduce the incidence of pecking damage (Skoglund & Palmer 1961; Hughes & Duncan 1972; Appleby *et al* 1992). Perhaps a similar strategy should be investigated in turkeys. Hale and Schein (1962) reported that altering the form of the diet from pellets to mash, while at the same time raising the fibre content from 5 to 20 per cent, increased the overall proportion of time spent feeding from 7 to 33 per cent. It also reduced the proportion of birds with denuded feathers from 95 to 10 per cent. The main objection by turkey producers to this approach is economic – bulkier high-fibre diets cost more to produce, to store and to handle, while the rate of growth is likely to be slower when mash rather than pellets is fed.

Animal welfare implications

Feather pecking and cannibalism can, in some circumstances, be serious problems in turkeys, controllable at present only by extremely dim lighting and beak trimming. An increased knowledge of turkey behaviour and, more specifically, what governs pecking, as set out in this paper, should help in the development of other methods of controlling these behavioural problems.

Acknowledgements

The work described here was supported in part by the British Turkey Federation and in part by the Ministry of Agriculture, Fisheries and Food.

References

Anon 1995 Primary breeders up-date delegates at Orlando. *Turkeys 43 (1):* 3-6

Appleby M C, Hogarth G S and Hughes B O 1989 Behaviour of laying hens in a deep litter house. *British Poultry Science 30:* 545-553

Appleby M C, Hughes B O and Elson H A 1992 *Poultry Production Systems: Behaviour, Management and Welfare.* CAB International: Wallingford, UK

Blokhuis H J 1986 Feather pecking in poultry: its relation with ground pecking. *Applied Animal Behaviour Science 16:* 63-67

Blokhuis H J and Arkes J G 1982 Some observations on the development of feather pecking in poultry. *Applied Animal Behaviour Science 12:* 145-157

Blokhuis H J and van der Haar J W 1990 The effect of the stocking density on the behaviour of broilers. *Archiv für Geflügelkunde 54*: 74-77

Farm Animal Welfare Council 1995 *Report on the Welfare of Turkeys*. Farm Animal Welfare Council: Surbiton, UK

Gibson S W, Dun P and Hughes B O 1988 The performance and behaviour of laying fowls in a covered strawyard system. *Research and Development in Agriculture 5:* 153-163

Grigor P N, Hughes B O and Gentle M J 1995 An experimental investigation of the costs and benefits of beak trimming in turkeys. *Veterinary Record 136:* 257-265

Hale E B and Schein M W 1962 The behaviour of turkeys. In: Hafez E S E (ed) *The Behaviour of Domestic Animals* pp 531-564. Balliere, Tindall and Cox: London, UK

Hocking P 1993 Welfare of turkeys. In: Savory C J and Hughes B O (eds) *Proceedings of the Fourth European Symposium on Poultry Welfare* pp 125-138. Universities Federation for Animal Welfare: Potters Bar, UK

Hughes B O and Black A J 1974 The effect of environmental factors on activity, selected behaviour patterns and "fear" of fowls in cages and pens. *British Poultry Science 15:* 375-380

Hughes B O and Duncan I J H 1972 The influence of strain and environmental factors upon feather pecking and cannibalism in fowls. *British Poultry Science 13:* 525-547

Lind H 1957 The activation of an instinct caused by a 'transitional action'. *Behaviour 14:* 123-135

Sainsbury D 1992 *Poultry Health and Management, 3rd edition.* Blackwell Scientific Publications: Oxford, UK

Savory C J 1982 Effects of broiler companions on early performance of turkeys. *British Poultry Science 23:* 81-88

Savory C J and Maros K 1993 Influence of degree of food restriction, age and time of day on behaviour of broiler breeder chickens. *Behavioural Processes 29:* 179-190

Skoglund W C and Palmer D H 1961 Light intensity studies with broilers. *Poultry Science 40:* 1458