Effect of light programmes, bird densities and litter types on broilers welfare.

V. FERRANTE1*, S. LOLLI1, S. MARELLI1, G. VEZZOLI1, F. SIRRI2 and L.G. CAVALCHINI1

1 Faculty of Veterinary Medicine, Istituto di Zootecnica, via Celoria 10 - 20133 Milan Italy, 2 Department of Food Science, via S. Giacomo 9 - 40126 Bologna.
* Corresponding author: Valentina.Ferrante@unimi.it

The aim of this study is to investigate the influence of different lighting programmes, litter types, bird densities, prevalence of foot-pad lesions and growing performance on broilers behaviour and welfare. The experiment was conducted on broiler males (Ross 508) for a 7 weeks period. The one-day-old chicks have been reared in two groups: Control and Treated. Each group was divided in 18 (3m x 2m) boxes. The photoperiod was 23L:1D in Control group and 16L:8D in Treatment group. Control group had a higher density than Treated group: 35 kg/sqm vs 28 kg/sqm. Each group was divided in two litter types boxes: straw and wood shavings. The evaluated variables were birds behaviour, reactivity, weight gain, plumage and foot-pad lesions, recorded at 15, 35 and 49 days of age. Broilers behaviour was recorded by 8 cameras placed over the boxes. Emergency test and Tonic Immobility test were performed on 10 animals/box (40 animals/group); chicks were randomly caught from pens and tested. During Emergency test the times the chick put the head or one leg outside the box before it emerged, the vocalizations intensity and defecations were recorded. Plumage conditions and foot pad lesions were scored (from 0 = no lesions to 4 = severe damages). Data were analysed using GLM procedure and ANOVA test. Behavioural observations and tests showed some differences among the treatment. Emergency test latency was significantly higher in the second (P<0,05) and in the third (P<0,005) repetition in Treated group. Vocalization intensity was always higher in Treated group and there were some significant differences (P<0,05) in the first and in the second repetition. These data can be interpreted as a greater hesitancy to engage novel places in animals reared in more intensive conditions. The lower plumage and foot-pad lesions scores were in Control group on straw litter. The feeding, drinking, moving and resting times showed significant differences between lighting programs. In Treated group daily chicks rhythms of activity could be consider closer to the specie-specific ethogram than in Control group.

Keywords: broilers welfare; behavioural test; lighting program; density; litter type

Introduction

Housing and management are leading factors affecting animal welfare. Welfare is good when all needs associated with the maintenance of good health and needs to show species behavioural patterns are met. Health is a basic aspect of welfare and behaviour is important in many regulatory systems. It is also clear that different needs involve the necessity for the animal to express different behaviours.

Broiler production is extremely intensive and there are many aspects that may impair animal welfare. One of the main problems is the litter quality. In fact it is of great importance for the broiler welfare as they generally spend their entire life in contact with it. Poor litter quality is recognised as a welfare problem in modern broiler production. Litter quality will affect birds’ environmental situation. Litter quality also has a direct influence on birds’ skin condition, wet litter being a major risk factor for contact dermatitis. Litter materials with high water-holding capacity, such as wood shavings, are believed to result in better litter quality than litter materials with poorer absorption capacity such as
straw. Shanawany (1992) showed that broilers raised on litter with high water-holding capacity had lower incidence of breast blisters than birds raised on litter with lower water-holding capacity. Peat moss or sawdust, which has a high water-holding capacity, can also be used as litter material for broilers but often result in a dusty environment. If straw is used it should be chopped very short in order to improve its water-holding capacity even if Sørensen et al. (2002) hadn’t found any difference in foot pad lesion with different length of straw. Also litter depth seems to be important: thin layers of litter (<5 cm) resulted in lower levels of foot pad dermatitis than thicker layers probably because the chickens are less prone to peck, scratch and turn the litter particles over, and thereby help to ventilate the litter, if the layer of litter is thick and compact. An increase in stocking density has been reported to negatively influence litter quality leading to an increased incidence of foot-pad dermatitis. Berg (1998) suggested that this relationship may not be so evident when the increased stocking density is compensated by improvements in ventilation capacity.

The primary biological rhythms in poultry are seasonal and diurnal, both mediated by lights. Traditionally, broilers have been reared in near continuous light in order to maximise food intake and daily weight gain. Different authors demonstrated that such long photoperiods (22-24 h light per day) can adversely affect the functional birds’ eyes development. There is also evidence that broilers can benefit from a period of reduced growth rate early in life, through reductions in incidence of skeletal and metabolic disorders, mortality, downgrading, fat deposition, and FCR. Broilers also benefit from a clear pattern of day and night by having distinct periods of rest and more vigorous periods of activity; some developmental processes such as bone mineralisation are affected by diurnal rhythms.

Stocking density has become a major issue in the debate on broiler welfare. Very high densities may impair the birds welfare directly through physical restriction of the movement. Indirect effects through poor litter quality, high ammonia level and heat are also suggested to affect welfare. Some technopaties (breast blisters, chronic dermatitis and leg disorders) are a result of high stocking density and the presence of infectious agents and hock born has been shown to be worse at 30-40 kg/sqm than at 24 kg/sqm. Some studies showed that walking ability is severely affected at 45 kg/sqm and is worse at 32 kg/sqm than at 25 kg/sqm. There is no clear effect of stocking density on physiological stress measures. Increasing stocking density has been found to reduce behavioural activities. Different studies showed that locomotors behaviour, preening and general activity are reduced and disturbance of resting is increased at the higher stocking density comparing 25 and 30, 24 and 32, 28 and 33 and 30 and 36 kg/sqm. These findings are all indicative of poorer welfare at higher stocking densities (SCAHAW, 2000). Üner et al. (1996) compared commercial systems for broiler chicken housing at 24 and 32, 28 and 33, 30 and 36 kg/sqm. The birds kept at the lower stocking density in each case showed more walking, running, preening and calm behaviour, spent less time concentrated in the areas around the feeders and drinkers and were more active in the last week before slaughter than birds kept at the high densities. Increased activity in feeding and drinking area but lower activity elsewhere at 30 kg/sqm than at 25 kg/sqm was also reported by Lewis and Hurnik (1990) and by Üner et al. (1996). It seems that birds have to move closer to feeders and drinkers in order to obtain enough food and water when reared at stocking density higher then 25 kg/sqm. In the latter growth period birds’ movements are considerably reduced elsewhere and activity levels are lower. This great locomotion activity and other normal behaviour restriction is a direct indication of poorer welfare and is likely to result in greater leg problems. Murphy and Preston (1988) reported that at 14 birds/sqm, many birds stopped lying when other birds stepped on them and restlessness was very high because only 4% of lying bouts were of more than 3 minute's duration and 60% were of less than 1 minute's duration. At 28 kg/sqm the stocking density was too high for normal resting to occur. It is clear from behavioural and leg disorder studies that the stocking density must be 25 kg/sqm or lower in order to avoid major welfare problems and that above 30 kg/sqm, even with very good environmental control systems, there is a steep rise in the frequency of serious problems.

There is a clear tendency for reduced growth rate at high stocking densities in broilers. The negative effects of stocking density on growth rate are reduced when adequate ventilation rates are provided. This indicates that problems of heat dissipation are the main causes of poor growth under high stocking rate. The effect of stocking density on feed conversion and mortality is not consistent among the experimental reports. It seems that poor feed conversion and high mortality occur only concurrently with other stressors such as heat stress.
The aim of this experiment was to evaluate the effect of photoperiod, litter type and density on the behavioural rhythms of activity and reactivity in broilers.

Materials and Methods

Two thousand and four hundreds (2400) broilers (Ross 508®) were used. Birds were housed in 2 conditioned rooms (16 boxes/building). Room 1 (control): birds’ density 35 kg/sqm; 8 boxes with straw litter (1.5 kg/sqm) and 8 with wood shavings (2.5 kg/sqm); photoperiod 23L:1D. Room 2 (treated): birds’ density 28 kg/sqm; 8 boxes with straw litter (2.5 kg/sqm) and 8 with wood shavings (4 kg/sqm); photoperiod after the first week of age 16L:8D.

Both in the control room and in the treated one 4 boxes (2 with straw litter and 2 with wood shavings) were continuously video recorded for a 48 hours period at 16, 36 and 50 days of age. The videotapes were analysed by the scan sampling method using 10 minutes as scan interval. The observed behaviour were: the number of birds at the feeding trough or at the drinker, the resting time, the movement and the aggression.

At 18, 37 and 52 day of age three repetition of the Tonic Immobility test and Emergency test were carried out on 40 birds from each room. The immobility was induced by placing each birds on its back in a U shaped wooden device and restrained for 15 seconds according to the method described by Jones (1982). The number of attempt to induce immobility and the latency from induction till the birds righted itself were recorded. The maximum duration of the test was 3 minutes. The Emergency test was carried out according to the procedure described by Ferrante et al. (2005). At the same time each animal was scored for feather condition and foot pad lesion from 0=no lesions and damages to 4 =severe damages. All the data were analysed using the GLM procedure and ANOVA test.

Results and discussion

Under a behavioural point of view birds reared with a more natural photoperiod showed a prevalence of activity in the feed trough area mainly in early morning and late afternoon: a natural rhythm in this species in which food searching time is usually concentrate at dawn and in the late afternoon. On the contrary the pattern of this activity in control broilers seems to haven’t a specific rhythm (Figure 1).

![Figure 1 Activity to the feed trough during the day](image-url)
Birds reared in the room with a more natural photoperiod showed a more natural ethogram considering movement and activity in the drinker area. In both the control and the treated groups few aggression have been recorded probably due to the young age of the chicks.

The resting time was the observed behaviour showing the most relevant differences between the treatments: birds reared with 16L:8D used the dark period to rest, otherwise birds reared with 23L:1D didn’t show clear rest/activity periods.

The tonic immobility test didn’t evidenced significant differences between the two groups even if a tendency to a greater latency (72.3 vs 67.11) was recorded in the birds reared in a more natural photoperiod and low density. In wild Gallus gallus populations the large group size diminishes the risk of predation for the individual, consequently the attention behaviour diminishes: thus the birds could be less fearful and so they should show shorter immobility periods. Our findings seem to be in contrast with the hypothesis that the duration of TI should be lower in large groups but according to Bilcick et al. (1998) who described that broilers living in large groups are more fearful compared with birds living in smaller groups. Large group size increases above all feeding competitiveness with consequent high fear level among flock’s birds. In our experiment the longer lighting period (23L:1D) in control room could lead birds to express higher excitability levels with subsequent increasing latency time.

Even if no significant differences were recorded in the 2nd week of age and in the 7th week of age, a tendency in increasing tonic immobility duration was observed proportionally to the age of the birds (C: 67 sec vs 80.45 sec; B: 63.62 vs 83.08 sec). According to Heiblum et al. (1998) 1-4 day old chicks usually show an immobility period shorter then 1 minute, on the other hand a 90.4 second tonic immobility duration was recorded in sixteen day old birds. Thus it is possible to suppose that young birds are less frightened and that the early exposure to particular stimuli can be critical in order to generate fear responses. Emergency test latency was significantly higher in the second (P<0.05) and in the third (P<0.005) repetition in Treated group. Vocalization intensity was always higher in Treated group and there were some significant differences (P<0.05) in the first and in the second repetition. These data can be interpreted as a greater hesitancy to engage novel spaces in birds reared in more intensive conditions.

Litter characteristics affect the feather scoring: the highest score was recorded in birds reared on straw.

Although no significant differences were recorded, broilers reared on straw litter both in the control and in the treated birds showed higher feather scoring compared to the birds reared on wood shaving litter (C: 0.53 straw vs 0.40 wood; T: 0.58 straw vs 0.42 wood).

Our results showed the poor effectiveness of the straw litter under a welfare point of view although birds were at lower densities and less numerous conditions that could lead to suppose better abdomen feathering.

The higher straw density could be considered a conditioning factor for abdominal lesions development; thus as described from other authors birds can peck, scratch and turn litter more easily when litter layers are not too thick and compact, keeping the litter in optimal conditions.

In our experimental trial the best litter seems to be the wood shaving one; it caused less abdominal lesions according to Shanawany (1992) too.

According to abdominal lesion results foot pad dermatitis resulted to be significantly more present in straw litter reared broilers in both the two rooms (Figure 2).
Figure 2 Foot pad score with different litter (0=no lesion 4=severe damage)

Birds number and stocking density could have negatively affected foot pad lesions in control room. Anyway wood shaving resulted to be the best solution for foot condition too. Moreover it seems that lower birds density and a more natural photoperiod could lead birds to higher activity levels and lower lesions.

References


Martin e Bateson


SCAHAW (2000). The welfare of chickens kept for meat production (Broilers), pp 149.
