Modification of the human-broiler relationship and its potential effects on production

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Abstract

The present study was designed to investigate the effects of additional human contact on the human-animal relationship in broilers and on the birds' productivity. A total of 1558 broiler one-day-old chicks were distributed into 12 equally sized pens at two different stocking densities (SD); calculated on estimated weight at slaughter (4 pens with 32 kg/m^2 and 8 pens with 16 kg/m^2). Six groups (2 high and 4 low SD) received Additional Human Contact (AHC),which consisted of 30 min sessions with visual human contact three days/week.. The remaining 6 groups received as little human contact as possible and served as controls. A Touch Test was used to assess the human-broiler relationship and the production parameters measured were: growth rate, mortality, feed consumption and feed conversion. The AHC-treatment had a positive effect on the quality of the HAR but failed to affect any production parameter.

Keywords

Touch test, feed conversion, growth rate, mortality, human-broiler relationship, welfare

Introduction

In all livestock production, the stockperson interacts with the stock to varying degrees depending on the species and production system. This interindividual interaction forms a human-animal relationship.(Estep & Hetts, 1992). The different types of contact include visual, tactile, olfactory and auditory and these may have different relevance in different production systems (Waiblinger et al. 2006). For instance, a stockperson in a particular type of production system may only be visible to the animals while in others he/she may move around in the herd/flock with or without making regular physical contact. The stockperson may talk, sing or make other noises, and may also make several tactile contacts every day. The quality of the human-animal relationship (HAR) is affected by whether the animal perceives such interactions as negative, positive or neutral (Jones, 2001). This effect was summarized by Waiblinger et al. (2006) on an emotion-based level in two dimensions: positive/pleasant and negative/unpleasant. Pleasant emotions are thought to be generated by 'positive events', such as being fed or groomed, whereas unpleasant emotions (fear, pain, frustration) can be elicited by restraining the animal, painful or aversive procedures (such as de-horning or beak-trimming) or 'rough'or unexpected contact etc.

Poultry production systems often consist of large flocks with thousands of birds, where the stockperson has no or very little day-to-day physical contact with individual birds. Notwithstanding the lack of physical contact, a human-animal relationship is still formed between the birds and the stockperson based on mainly visual contact (Cransberg et al. 2000, Waiblinger et al. 2006). If the quality of the human-animal relationship is low it is conceivable that the birds perceive the stockpersons as frightening predators (Jones, 1987; Duncan, 1992). A high and/or prolonged level of fear is likely to have a negative impact on animal welfare and production (Hemsworth et al. 1993; Duncan, 1992; Jones, 2001). Moreover, the relation between animals and stockperson also affect productivity in both layers and broilers (Hemsworth et al., 1993; Barnett et al., 1994; Waiblinger et al. 2006). More specifically, laying hens that were regularly handled showed less stress, lower fear and higher egg production and body weight than non-handled ones (Barnett et al. 1994). Hemsworth et al. (1994) also found that broilers with low levels of fear of the experimenter had betterfeed conversion than more fearful birds .It is conceivable that the improved feed conversion reflected lower activity and reduced stress among less fearful animals resulting in lower energy requirements and less feed consumption. Mortality during the first week of rearing was significantly lower at farms where the stockpersons spent more time among the flocks (Cransberg et al., 2000). Faster movement of the stockperson was positively correlated with greater first week mortality in the flock but not over the whole production period, suggesting a sensitive period in young birds (Cransberg et al., 2000).

Various tests have been used to explore fearfulness in poultry, including novel object, open field, human approach, social dispersal, tonic immobility etc (Jones, 1996; Jones and Boissy, 2011). 'General fear' and 'fear of humans' are thought to be two distinct states because chicks exposed to environmental enrichment showed reduced fearfulness in a variety of tests whereas those receiving regular handling or visual contact with people were less fearful only in tests incorporating a strong human component, i.e. the effect was stimulus specific (Jones; 1994; Jones, 1995; Jones and Waddington (1992). Similar findings were reported by Barnett et al. (1994) and Graml et al. (2008) and may be relevant to the choice of assessment methods.

Objectives

The main aims of the present study were to determine if regular exposure to people reduced fear of humans and whether productivity parameters were affected by a better human-broiler relationship. It was hypothesized that broilers given additional human contact would be less frightened of people and might therefore show increased productivity, including lower mortality, better growth rate and improved feed conversion.

Materials and Methods

Animals and housing

The study took place at the Swedish Livestock Research Centre in Uppsala, Sweden with ethical approval by the Swedish Ethical Committee on animal research (permit number: C 308/11). The poultry house was divided into 12 pens, each measuring $12m^2$. The pen walls were 700 mm high and allowed visual contact through a mesh between animals in the same treatment groups. Wood shavings were used as litter substrate. A total of 1558 broiler chickens of the hybrid Ross 308 (Aviagen group Ltd) was placed in the house as day old chicks and reared on the floor until 33 days of age. To evaluate if stocking density had any effect on the parameters measured, the birds were placed in the pens as follows: 4 pens with approximately 195 birds (32 kg/m^2, high density (HD)) and 8 pens with approximately 97 birds (16 kg/m^2, low density (LD)). They were given a standard broiler diet, weighed and delivered by hand, and both feed and water were provided *ad lib*.

Treatment

Six groups (2 HD and 4 LD) received Additional Human Contact (AHC). This consisted of 30 minutes sessions on each of 3 days/week (see Figure 1). The treatment started on day 2 of the experiment (bird age: 2 days) and were repeated 3 days/week until end of experiment at week 5. The sessions began when a person entered the pen and sat still on a 30 cm high plastic box at location A for 5 minutes, then slowly walked (carrying the plastic box), to location B and sat down for 5 minutes and finally sat down at location C for 5 minutes. The person then left the pen, entered it again at location A and repeated the procedure one more time. Two people applied the treatments, but the same person carried out all treatments on the same day. The assessors were allowed to talk gently during the procedure. Talking or silence during the test procedure was not standardized. The remaining six groups were regarded as control and received as little human contact as possible with only the usual day to day management tasks performed, i.e. the flocks were checked twice a day for feed, water and presence of sick birds (which required the person to enter the pens). The daily check was carried out by a third person, who was not involved in the treatment procedures. The control and AHC groups were kept in the same large house but there was no visual contact between the two treatment groups (see Figure 2). The AHC-groups were placed on the same side as the entrance of the stable and all manual work took place on the AHC side, to minimize the exposure of humans to the control groups.

Figure 1.

Figure 2.

The birds' responses to humans were assessed once a week (day 4, 11, 18, 25 and 32) using the Touch Test (TT) described by Graml *et al.* (2008). The assessor approached a group of at least three birds, squatted, counted the number of birds within arm's length and the number that could actually be touched. This was repeated 5 times per pen. The proportion of animals t touched was calculated by dividing the number of animals touched by the number of animals within an arm's length. The results are presented as percentage birds that could be touched out of the number of birds within an arm's length. .

To follow the birds' performance, approximately 50 birds/pen were randomly selected by separating a smaller proportion of the pen with a portable fence. These approximately 50 birds were then caught and weighed by hand every week. . The number of dead and culled birds was recorded every day and the reasons for culling, e.g. leg problems or sickness, were carefully noted. The feed was weighed when provided and total feed consumption per pen during the 33 day rearing period was calculated. Feed conversion was calculated as kg feed per kg weight gain. Lameness was assessed at 3, 4 and 5 weeks of age using a gait scoring method (Welfare Quality®, 2009) Approximately 50 birds/pen were captured using the same procedure as for weighing and released from the smaller pen one by one. The birds´ walking ability was scored using a scale from 0 (perfect walk) to 5 (not able to walk).

Statistical analysis

Statistical analyses were performed using the program Statistical Analysis Systems (SAS version 9.4, SAS Institute Inc., Cary, NC). Statistical models were developed stepwise backward, i.e. starting with full models including all relevant available effects and interactions between effects followed by stepwise elimination of non-significant effects and interactions. The final models include the effects of treatments and biologically relevant and significant interactions of these effects. All analyses were performed on group level and results are presented as Least Square Means ± Standard error.

Differences in response to the Touch Test between handling treatments, stocking density treatments and over time were analyzed using procedure MIXED using MODEL 1. Differences in gait score and bird weight between handling treatments, stocking density treatments and over time were analyzed using procedure MIXED using MODEL 2. Differences in mortality and average feed conversion ratio (FCR) over the whole rearing period between handling treatments and stocking density treatments were analyzed using procedure GLM using MODEL 3.

MODEL 1: *Average percent birds touched in TT = Handling treatment + Density treatment (Bird age) + Bird age + Handling treatment*Bird age + Group (Handling treatment and Density treatment) + e*

MODEL 2: *Gait score or Weight = Handling treatment + Density treatment + Bird age + Handling treatment*Bird age + Handling treatment*Density treatment + Density treatment* Bird age + Group (Handling treatment and Density treatment) + e*

MODEL 3: *Mortality percent or FCR = Handling treatment + Density treatment + Handling treatment*Density treatment + e*

For all three statistical models, the included effects were handled as follows when the specific effect or interaction was included in the model. Handling treatment (AHC or Control), Density treatment (HD or LD), Bird age (1, 2, 3, 4 or 5 weeks) and the interactions between Handling treatment and Bird age, Handling treatment and Density treatment and Density treatment and Bird age were included as fixed effects. Group (12 groups) was nested within Handling treatment and Density treatment was included as a random effect. In MODEL 1, Density treatment was nested within Bird Age (High Density (HD) or Low density (LD) for week 1, 2, 3 and 4 and LD for week 5, as TT was not possible to perform in HD groups week 5 due to crowding.

Residuals of all dependent variables were examined for normal distribution using procedure UNIVARIATE, considering the Shapiro-Wilks test for normality and a normal probability plot, and all were found to be normally or approximately normally distributed. Homoscedasticity was determined by examination of standard deviations in the compared groups, showing equal or approximately equal standard deviation and thus variances (threshold when Std in group 1 is more than 2 x Std in the group 2, equal to variance in group 1 is more than 4 x the variance in group 2).

Results

Results are presented as Least Square Means ± Standard error.

Touch Test responses

The overall proportion of birds touched in the Touch Test was significantly higher in the AHC broilers than in the controls (81 ±2.3% vs. 60±2.3% respectively, p <0.001, N=56 tests, F=46.6, DF = 9) and increased with age (p <0.001, N=56 tests, F=29.4, DF = 33) as illustrated in the AHC and Con handling treatment groups in Figure 3 and in the HD and LD density treatment groups in Figure 4 . Moreover, the proportion of birds touched was significantly greater in the high than the low density groups (p <0.001, N=56 tests, F=9.1, DF = 33) as illustrated in Figure 4.

Figure 3.

Figure 4.

Gait score

Average group gait score did not differ between AHC (1.48 ±*0.05)* and control (1.39±*0.051)* groups, p=0.232, N=36 assessments, F=1.7, DF = 8) or between density treatments (1.47 ±*0.059* vs. 1.41±*0.042* in the high and low density groups respectively, p=0.407, N=36 assessments, F=0.8, DF = 8). The birds' gait became significantly poorer as they aged (scores of 0.60^{a}±*0.060*, 1.69^{b}±*0.060* and 2.02^{c}±*0.060* in weeks 3, 4 and 5 respectively, p<0.001, different superscript letters indicate pairwise differences of p<0.001, N=36 assessments, F=160.8, DF = 18).

Mortality

The proportion of birds that died during the experimental period (from all groups) was 5.6 %. Of these, 60.6% were found dead and 39.4% were culled. Criteria to cull birds were if they were too sick or injured to eat and drink, or had a gait score of 4 or 5. Of the culled birds 57.7 % showed leg weakness. . Of the birds that were found, 31.2 % were 'weak chicks' that died during the first 7 days of rearing. There were no significant differences in the total proportions of dead birds, of those found dead or those that were culled between either the AHC and control treatments or between high and low density groups (all p>0.05).

Weight and feed conversion ratio

Each bird ate an average of 3.8 kg feed during the 5 week study and weighed an average of 1.97 kg at 5 weeks of age. There were no significant effects of AHC on weight gain (Figure 5, p= 0.907, N=12 groups, F= 0.0, DF=1) or feed conversion ratio (1.93 ±*0.017* vs. 1.92±*0.017* kg feed per kg weight gain in AHC and Control groups respectively, p=0.673, N=12 groups, F=0.2, DF=1). There was no significant effect of stocking density on weight gain at 5 weeks of age (1.97 ±*0.027* vs. 1.96±*0.019* kg per bird in HD and LD groups respectively, p=0.959, N=12 groups, F= 0.0, DF=1)) but feed conversion was better (p= 0.011, N=12 groups, F=10.6, DF=1) in HD than LD groups (1.88 ±*0.020* vs. 1.96±*0.014, respectively)*.

Figure 5.

Discussion

The overall difference in the TT-results between the AHC- and control groups can be interpreted as indicating that the additional human contact-treatment applied (30 minutes per day on 3 days/week) improved the human-broiler relationship. The difference was evident already in week one (day four), which can be explained by the fact that the AHC treatment had been applied three times before the assessment (day two, three and four). The general effect of increased age on the TT-results can be the result of the increasing stocking density (more kg bird per m^2) or caused by the stable chores carried out by humans (weighing birds and feed, daily check of the animals) and the experimental measurements (Gait Score, the Touch Test). When considering this in the statistical calculations, the fact that the AHC-treatment had effect on the human-animal relationship is evident (see Figure 3 and 4). The treatment mainly involved visual contact but there was also some vocal contact, since the experimenters were allowed to talk gently to the animals during the procedure. This method, although constrained by the experimental situation, was considered to mimic the everyday procedure when the stockperson walks through the flock. Although the present treatment is not practical in commercial settings our findings suggest that daily human contact could have a positive effect on the human-bird relationship, provided that the interaction is perceived as positive or neutral by the animals (Waiblinger et al., 2006). Of course, aversive human behaviours would likely have the opposite effect, resulting in elevated fear levels, stressed birds and impaired welfare (Waiblinger 2006). The quality and frequency of interaction are important features of the management of broiler flocks.

The Touch Test (TT) is described by Graml et al. (2008) as a valid way to measure the human-animal relationship in laying hens. Similar tests have been presented as suitable for broilers in welfare assessment schemes, such as the Welfare Quality®- protocol for poultry (Welfare Quality®, 2009), where an avoidance distance test is used to assess human-animal relationship. This supports the choice in this study to use the Touch Test to assess human-animal relationship in broilers. However, the Touch Test could not be carried out in the high-density groups during the last week of the rearing period, because the crowded conditions restricted the birds' ability to move away from the experimenter. Moreover, TT results differed between the HD and SD groups. Space limitations, but also locomotory difficulties are discussed by Waiblinger et al. (2006) as potential factors that may affect the results when using these types of tests to assess human-animal relationship. It might be argued that leg weakness could compromise the birds' ability to move away from the experimenter in this study, but both AHC and control groups recorded similar gait scores, thereby supporting our hypothesis that available space was the limiting factor. Age, weight and stocking density are therefore likely to be important considerations when assessing the human-broiler relationship and comparing results across studies.

The Touch Test may be more suitable in commercial broiler houses which offer more space for the birds to move away. For experimental purposes, other assessment methods, such as a Stationary Person Test (Graml et al. 2008) where the birds are allowed to approach a person standing still in their environment, could be combined with the Touch Test to exclude the space as a limiting factor. . Waiblinger et al. (2006) recommends the use a combination of one or more tests and to measure several parameters when assessing human-animal relationship. Another consideration regarding use of the TT is that by incorporating an attempt to touch the birds it might mimic a predator encounter (Duncan, 1992) and thereby elicit greater fear.

The positive effects of a ‘high quality’ human-animal relationship on production parameters have been reported in several studies in a variety of livestock species. However, the broiler literature is more limited and the results are not always conclusive. For an example Hemsworth et al., (1994) found significant effects of human-animal relationship on feed conversion, but not on growth rate or mortality. The present study showed that regular human contact elicited clear improvements in the quality of the HAR but had no effects on the birds’ production parameters. The latter finding might be explained in terms of the AHC and control treatments representing two levels of neutral contact and that it is not sufficient to exert a demonstrable effect on production. The differences in HAR are most likely a result of different levels of habituation towards humans. However, we must also remember that simple, regular visual contact with a person was enough to reduce chicks’ fear of humans (Jones, 1995) and that the control groups did receive some human contact here when stockpersons checked the flocks twice a day for food and water availability and the presence of sick birds. But, we do not know if this level of contact may also have improved performance and thereby dampened any treatment differences. Of course, negative human contact would be expected to damage production, e.g. young pigs that received unpleasant handling showed reduced growth (Hemsworth and Barnett, 1991).

The type of human contact applied in the present study (experimenter sitting down among the flock for 30 minutes a day) would not be practical in commercial conditions. However, since regular visual contact alone reduced fear of humans in chicks (Jones, 1993) and laying hens (Barnett et al., 1994) a more simplified regime of regular human contact might further enhance the development of a positive human-broiler relationship.

Conclusions

The present results are consistent with earlier findings that exposing broilers to regular human contact reduces their avoidance of an experimenter and thereby presumably improves the quality of the human-animal relationship. Further research on the effects of negative, neutral and positive human contact regimes on the HAR and the broilers’ production performance in commercial conditions is clearly merited.

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