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Original Research Article

Effect of Light Color and Stocking Density on some Behavioral Traits of Broilers and Layers

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Abstract

This study was designated to investigate the effect of light color and stocking density on some behavioral traits of broilers and layers. A total of 675 Ross 308 one-day-old broiler chicks were used in this study with an average of 135 birds in each of five treatments were exposed to white light as a control, red light, blue light, green light, and Blue – Green mixed light by a light-emitting diode system applied for 24 hours daily in separated rooms with light intensity 5 watt/m^2. The birds were randomly housed into 9 wooden sealed pens of 1m^2 in three replicates for each density 12, 15 and 18 birds/m^2. In the second treatment, 180 Isa Brown layers were divided into 5 treatments with an average of 36 birds for each of five color light rooms (16 hours light- 8 hours dark) in three replicates for each density 5 and 7 birds/m^2 in the room. The results indicate that light color and stocking density influenced broiler and layers and significant differences were reported in the present study. It was concluded that broilers raised under red and white light were more active than those raised under blue and green light.

Keywords: Behavior, broilers, color light, layers, stocking density.

INTRODUCTION

Chickens are one of the most studied animal species, and researchers observed chicken behavior extensively. The term behavior can be defined as the way in which an animal or person acts in response to a particular situation or stimulus (Wood-Gush, 2012). Behavior is a useful indicator of animal well–being. A composite average feed ingestion behavior of birds in a treatment may mask useful dynamic information (Puma et al., 2001). Welfare is often difficult to measure, but behavior can be one of the strongest indicators of animal welfare available to scientists (Duncan, 2005). Behaviour can aid in the interpretation of an animal feelings, both positive (such as playful behaviours, comfort behaviours and exploratory behaviours) and negative (including frustration, fear or pain).Observing behavior is simpler now than ever before because of new technology. The use of cameras, especially those with infrared capabilities, allows the observation of animals with no human influence (Dawkins, 2004).

There are several types of behavior, Locomotive behavior includes walking, running, flying and wing flapping. Hens will walk about 1 to 1.5 km per day and fly to and from elevated places if they have the opportunity to do so (Keppler and Folsch, 2000). Resting behavior includes standing, lying, sleeping and dozing. Chickens prefer to roost on higher rather than lower perches, they probably do this for safety reasons (Brake, 1987). Maintenance-Comfort behavior consists of preening, stretching, flapping, dust bathing, sunbathing and body shaking to keep their feathers in good condition (van Liere and Bokma, 1987). Social behavior includes pecking, threatening, chasing, kicking, fighting, avoiding, crouching and vocalizing. . The social structure of a flock depends on the physiological, psychological and physical

state of each member (Keppler et al., 1997). All hens show elements of the typical nesting-and-laying behavior sequence, separating from the flock, examining potential nest sites, scratching and pecking at nest material, building a nest or choosing an already formed nest, entering the nest, forming a hollow, laying an egg, rolling the egg under the body, lying on the egg, getting up, standing, leaving the nest and cackling. (Gunnarsson et al., 2000).

Chicks, especially broilers, were lying for about 70% of the time and they walked for only 5% of the time during the starting period. This low level of activity could result from several environmental factors such as diet and the housing system (Bizeray et al., 2000). Mishra et al., (2005) verified that ISA Brown layers spent, during 24 hours, around 97% of the time in the nest, feeding, walking, resting, or dust bathing, and that 57% of these behaviors did not depend on environmental enrichment. It was also observed that hens had preferred behavioral sequences, which included foraging and comfort behaviors, such as wing stretching and preening. There are many indicators of welfare in agricultural animals, and one of the most obvious is health. In broiler chickens, management practices, such as lighting programs, can impact health (Lewis and Morris, 2006). Whereas reports on behavioral responses to colored light are few, the findings support the commonly held belief of poultry farmers that low wavelength light colors (blue and green) has a calming effect on birds (Lewis and Morris, 2000).The colour vision of domestic chicks (*Gallus gallus*) was investigated by training them to small food containers decorated with tilings of grey and coloured rectangles. Chicks learn the colour quickly and accurately (Osorio et al., 1999). Birds reared in dim blue light throughout spent significantly more time sleeping and sitting. There were no significant differences in the behavior of male and female birds, except that female birds spent longer sleeping than male birds. There were significant interactions between color and intensity of lights in all behaviors, except for time spent in feeding and sitting. An increase in intensity of the red light increased the proportion of time spent standing, walking, drinking, wing stretching, and being aggressive, whereas an increase in blue light intensity only slightly increased stretching and aggression. A decrease in dozing, sleeping, and pecking occurred with increased intensity in the red, but not the blue light. Feeding times were longer and sitting time less in red than blue light. Feeding time also increased at high intensity in both colors (Prayitno et al., 1997b).

Khosravinia (2007) investigated bird behavior under different light intensities, although not focusing on preference, it was noted that birds do have preference for green light when compared to red, orange and yellow lights. It was also concluded that birds had a preference for orange-dyed feed when fed under low light levels and green-dyed feed under high light levels, thus indicating housing birds under colors they prefer has the potential to increase interest in feed. Blatchford et al., (2009) indicated that feeding behavior was not affected by the different light intensities. Kjaer and Sorensen (2002) found that light intensity had no effect on the rate of feather pecking in any of the tested genotypes, although about twice as much feather pecking was observed at 10 lux compared to 3 lux in Isa breed. From as early as 5 week of age, Isa brown birds reared under bright light started to chase each other, and at 6 week of age, two birds were cannibalized. The pecking behavior intensified as the birds got older. The birds reared under bright light were chasing each other constantly, many birds started to develop feather sucking behavior and eventually pecking. The pecking was often directed to the back and lower part of the birds (Hartini et al., 2002).In broilers that are usually reared at a high stocking density social factors may be more important than environmental factors in causing stress and affecting behavior patterns (Marin et al., 2001). Keeling and Duncan, (1991) reported that aggressiveness is relatively higher in small flocks than in large flocks, as birds adopt strategies to avoid negative social interactions. Studies on the behavior of broiler chickens also suggest a negative influence of high densities on welfare. Resting and preening are increasingly disturbed at high densities (Cornetto et al., 2002). Decreases in locomotion and foraging suggest that broilers' freedom of movement is increasingly limited at higher stocking densities (Sanotra et al., 2002). There was no effect of stocking density on the time spent feeding or standing, but birds stocked at the low rate in week 4 spent more time sitting and less time dozing . Walking was increased in birds stocked at the low density, particularly in week 4. There was no difference in the time males and females spent feeding (Andrews et al., 1997). Tablant et al., (2000) evaluated the incidence of cannibalism and its relationship with mortality in a commercial layer farm, and observed that it was the third cause of mortality in Babcock White Leghorns between 21 and 54 weeks of age reared in cages at a stocking density of 150 cm^2. Most lesions were observed in the cloaca after the peak of egg production.

MATERIALS AND METHODS

A total of 675 Ross 308 one-day-old broiler chicks were used in the first experiment. All broilers were cared for in 5 light-controlled rooms (n = 135) and were exposed to white light as control (400 to 700 nm WL), red light (660 nm RL), blue light (480 nm BL), green light (560 nm GL), and Blue – Green mixed light (480-560 nm BGL) respectively, at birds eye level with an light-emitting diode system (LED) for 7 weeks applied for 24 hours daily in separated rooms (3 x 3 x 4 meters) with light intensity 5 watt/m^2.The birds were randomly housed into 9 wooden sealed pens of 1m^2 in three replicates for each density

Table 1. Effect of color light and stocking density on some behavioral traits of broilers at 25th day of age (M±SE)

Behaviors	Color light / Stocking density	WL	RL	BL	GL	BGL	Effect of stocking density
Feeding bouts	12 bird/m^2	26.00±1.00	10.00±1.15	4.00+0.57	5.00±1.52	5.00±0.57	10.00^{b}±0.96
	15 bird/m^2	26.33±0.66	35.66^{A}**±3.4	3.00±0.57	12.00±0.57	4.33±0.66	16.26^{a}±1.18
	18 bird/m^2	8.66±0.88	13.00±0.57	2.33^{B}±0.33	5.33±0.88	8.33±1.20	7.53^{c}±0.77
	Effect of color light *	20.33^{a}±0.84	19.55^{a}±1.73	3.11^{c}±0.49	7.44^{b}±0.99	5.88^{b}±0.81	*
Eating	12 bird/m^2	208.0±3.6	226.3±7.7	135.0+6.4	81.3^{B}±7.2	368.3±15.3	203.8^{c}±8.0
	15 bird/m^2	174.6±6.1	399.6±26.2	218.3±3.7	330.6±15.7	109.6±2.4	246.6^{b}±10.8
	18 bird/m^2	150.3±15.3	435.6±7.5	491.6^{A}±21.5	462.6±4.8	168.3±8.1	341.7^{a}±11.4
	Effect of color light *	177.6^{d}±8.3	353.8^{a}±13.8	281.6^{b}±10.5	291.5^{b}±9.2	215.4^{c}±8.6	*
Drinking	12 bird/m^2	2.00±0.00	1.00^{B}±0.00	1.00±0.00	12.66^{A}±0.88	2.00+0.57	3.73^{a}± 0.29
	15 bird/m^2	1.00±0.00	1.00^{B}± 0.00	2.00±0.00	3.00±0.57	1.00±0.00	1.60^{c}±0.11
	18 bird/m^2	2.00+0.00	1.00^{B}±0.00	3.00±0.00	6.66±0.88	2.00± 0.00	2.93^{b}±0.17
	Effect of color light *	1.66^{b}±0.00	1.00^{c}±0.00	2.00^{b}±0.00	7.44^{a}±0.77	1.66^{b}±0.19	*
Walking	12 bird/m^2	3.00±0.57	8.00^{A}±0.57	3.00± 0.00	7.33±0.66	6.00±1.00	5.46^{a}± 0.56
	15 bird/m^2	5.33±0.88	2.00^{B}±0.57	3.00± 0.57	5.00±0.00	5.00±0.57	4.06^{b}±0.51
	18 bird/m^2	3.00±0.57	3.33±0.33	5.66± 0.66	7.66±0.33	8.00^{A}±1.00	5.53^{a}±0.57
	Effect of color light *	3.77^{b}±0.67	4.44^{b}±0.49	3.88^{b}±0.41	6.66^{a}±0.33	6.33^{a}±0.85	*
Standing	12 bird/m^2	3.00±0.00	10.66^{A}±0.88	3.00±0.57	8.00±0.57	3.33±0.33	5.60^{a}±0.47
	15 bird/m^2	6.66±0.88	4.33±0.66	3.33±0.33	4.00± 0.00	4.00±0.57	4.46^{b}±0.48
	18 bird/m^2	4.33±0.88	2.33^{B}± 0.33	7.00±0.57	6.33±0.66	5.33± 0.88	5.06^{a}±0.66
	Effect of color light *	4.66^{b}±0.58	5.77^{a}±0.62	4.44^{b}± 0.49	6.11^{a}±0.41	4.22^{b}±0.59	*
Feather pecking	12 bird/m^2	0^{B}	0^{B}	0^{B}	0^{B}	1.00±0.00	0.20 ±0.20^{b}
	15 bird/m^2	0^{B}	0^{B}	0^{B}	1.00±0.00	0^{B}	0.20 ±0.20^{b}
	18 bird/m^2	3.00^{A}±1.00	3.00^{A}±1.52	0^{B}	0^{B}	0^{B}	1.20^{a}±0.84
	Effect of color light *	1.00^{a}±0.33	1.00^{a}±0.50	0^{b}	0.33^{ab}±0.00	0.33^{ab}±0.00	*
Sitting	12 bird/m^2	2.33±0.33	8.66± 0.88	5.66±0.88	7.00±1.00	4.33±0.88	5.60±0.79
	15 bird/m^2	6.00±0.00	6.33±0.88	4.00±0.00	4.66±0.88	5.00±0.57	5.20±0.46
	18 bird/m^2	3.33±0.33	3.00± 0.57	6.66± 0.88	5.00±0.57	6.33±0.33	4.86±0.53
	Effect of color light *	3.88^{b}±0.22	6.00^{a}±0.77	5.44^{a}±0.58	5.55^{a}±0.81	5.22^{a}±0.59	**N. S.**

*a, b,c Means in horizontal rows with different superscripts were significantly different of light colour and in vertical rows of stocking density at ($p<0.05$). SE: standard error.
**A, B, C Means in vertical rows with different superscripts were significantly different of interaction between light color and stocking density at ($p<0.05$). SE: standard error. N.S. not significant.

12, 15 and 18 birds/m^2. In the second treatment, 180 Isa Brown layers 25 week ages were divided into 5 treatments with an average of 36 birds for each of five color light rooms (16 hours light- 8 hours dark) in three replicates for each density 5 and 7 birds/m^2 in the room. Half cylinder plastic feeders were placed in each pen. The birds were supplied with feed and water *ad libitum*, and Pellet diets were formulated to meet the nutrient recommendations for poultry according to NRC (1994). In broilers, total dietary metabolic energy for the starter, grower and finisher were 2925, 3111 and 3171 kcal/kg respectively, while the values of crude protein were 22.21, 20.14 and 18.08 % respectively. In layers, total dietary metabolic energy was 2759 kcal/kg and 17.75% crude protein according to Isa Brown programs (Isa Brown, 2010). A nipple water drinking system was set up in each pen and was manually adjusted as birds grew to ensure the watering system was kept at a proper level. At 25th day of age for broilers and 28th week of age for layers, one bird from each pen were randomly selected and recognized with color marker. A group of observers were used in the monitoring of different behaviors for 15 minutes according to Shawkat et al., (2002).

The following behavioural patterns were recorded:

Table 2. Effect of color light and stocking density on some behavioral traits of layers at 28th week of age (M±SE)

Behaviors	Color light / Stocking density	WL	RL	BL	GL	BGL	Effect of stocking density
Eating	5 bird/m^2	316±10.39	139±3.46	**134^{B}±6.5	481+12.70	275+4.61	269^{b}±7.54
	7 bird/m^2	470±46.18	584^{A}±40.99	159±4.61	214±5.19	243±6.92	334^{a}±20.77
	Effect of color light *	393^{a}±28.28	361^{ab}±22.2	146^{d}±5.58	347^{b}±8.94	259^{c}±5.76	*
Social life (Eating together)	5 bird/m^2	3.00±0.00	3.00±0.57	2.25^{B}±0.10	3.66±0.19	2.42+0.18	2.86^{b}±0.21
	7 bird/m^2	4.50^{A}±0.35	3.40±0.11	4.50^{A}±0.08	4.50^{A}±0.20	3.57±0.13	4.09^{a}±0.17
	Effect of color light *	3.75^{ab}±0.17	3.20^{c}±0.34	3.37^{bc}±0.1	4.08^{a}±0.19	2.99^{c}±0.15	*
Drinking	5 bird/m^2	0.66^{B}±0.33	13.00±2.30	1.00±0.00	17.00^{A}±1.7	5.00±0.57	7.33^{a}±0.98
	7 bird/m^2	7.00±0.57	8.66±2.39	2.00±0.57	2.00±0.00	2.00±0.57	4.33^{b}±0.82
	Effect of color light *	3.83^{b}±0.45	10.83^{a}±2.34	1.50^{c}±0.28	9.50^{a}±0.85	3.50^{bc}±0.57	*
Sitting	5 bird/m^2	0^{B}	0^{B}	4^{A}±0.57	0^{B}	0^{B}	0.8^{a}±0.11
	7 bird/m^2	0^{B}	0^{B}	0^{B}	0^{B}	0^{B}	0^{b}
	Effect of color light *	0^{b}	0^{b}	2^{a}± 0.28	0^{b}	0^{b}	*
Feather pecking	5 bird/m^2	0^{B}	0^{B}	2.33^{A}±0.33	0^{B}	0^{B}	0.46^{a}±0.06
	7 bird/m^2	0^{B}	0.66 ±0.33	0^{B}	0	1.00±0.0	0.40^{b}±0.06
	Effect of color light *	0^{c}	0.33^{b}±0.16	1.16^{a}±0.16	0^{c}	0.50^{b}± 0.0	*

*a, b, c Means in horizontal rows with different superscripts were significantly different of light colour and in vertical rows of stocking density at (p<0.05). SE: standard error.
**A, B, C Means in vertical rows with different superscripts were significantly different of interaction between light color and stocking density at (p<0.05). SE: standard error. N.S. not significant.

•Feeding bouts: meal time started to be counted when the bird placed its beck inside the feeder (start of the bout) and stopped when it moved away from the feeder (end of the bout) (Neves et al.,2010).
• Eating: Pecking at the feed in the feeder.
• Drinking: Pecking at the drinker, followed by tilting of the head.
• Walking: Locomotion, the first foot is put down on the floor before the second one is lifted.
• Standing: Not moving, body not touching the floor.
• Sitting: Body and both hocks touching the floor underneath or directly on either side of the bird.
• Feather pecking: only pecks to feathered parts of the body were classified as feather pecking.
• Social life: Sociality refers to the motivation animal possess to be with or near other Conspecifics and eat together in the same time (Ruth et al., 2006; Buijs, 2011).
Data were compiled, and comparison and analysed were done according to ANOVA by used Graph Pad's analysis.

RESULTS

Behavioral Traits of Broilers

The results of broilers as in Table 1 showed that the WL recorded a significant effect (P < 0.05) on feeding bouts 20.33times.The results revealed that eating behavior was significant (P < 0.05) in broilers reared under RL (353.8) compared with other groups. Broiler chickens in the experiment presented here, drinking behavior increased significantly (P < 0.05) in birds reared under GL which recorded 7.44 times. Table 1 also revealed that walking and standing behaviors were significantly higher in broilers under GL 6.66 and 6.11 respectively. The results on feather pecking recorded significant mean (P < 0.05) in broilers reared under RL and WL reached 1.00 aggressive behaviour in both groups. The mean of sitting behavior recorded a significant increase (P < 0.05) in broilers of red light group (6.00 times) compared with other groups.

The effect of stocking density on behavioral traits of broilers as in Table 1 showed a significant decrease in feeding bouts (7.53) and significant increase ($P < 0.05$)in most behaviors such as eating, walking, standing and feather pecking in birds reared under 18 bird/ m^2 which recorded 341.7, 5.53, 5.06 and 1.20 respectively.

Behavioral Traits of Layers

In the present experiment, as in Table 2, eating activity was significant higher ($P < 0.05$) under WL (393 bouts), whereas, drinking behavior differed significantly in broilers reared under RL (10.83). The high mean of feeding together as a part of social life was 4.08.This value revealed that broilers reared under GL showed a significant increase ($P < 0.05$) compared with other light groups. These findings as in Table 2 showed a significant increase in sitting behavior in birds reared under BL in which was 2.00. The mean incidence of feather picking of the study was significantly higher ($P < 0.05$) in flocks kept under BL which recorded 1.16cases. The present study referred to the effect of stocking density on eating and social life, the results were differed significantly ($P < 0.05$)in layers reared under 7 bird/m^2 which recorded 334 and 4.09 respectively, whereas, drinking, sitting and feather pecking recorded high significance in layers reared under 5 bird/m^2 which were 7.33, 0.80 and 0.46 respectively.

DISCUSSION

Behavioral Traits of Broilers

The previous researches concerned the monochromatic light of red, green, blue and white without yellow. Because of four types of cone in the retina of eye, poultry probably see color differently from trichromatic humans (Lewis and Morris, 2000). Bizeray et al., (2000) revealed that birds walked significantly more in feeding bouts than in non-feeding bouts. Feeding bouts represented 21% of the recorded bouts and 74% of the total time observed (Bizerayet al., 2000).The results showed that the WL recorded a significant effecton feeding bouts. This result was in agreement with the results of Rierson, (2011) who found that birds showed a preference for white light and chose not to feed under blue light.

A possible explanation as to why broilers prefer to consume feed under white light could be because it helps them identify texture differences they cannot see under different colors. Adopting a strategy allowing broiler chicks to feed under white light would be relevant for animal comfort and may benefit performance. Broilers have a large motivation to feed, and frustration may be demonstrated when feeding is restricted (Bokkers et al., 2004). Birds prefer to eat and drink during the photophase period and therefore increasing exposure to darkness generally reduces feed intake (Schwean-Lardner, 2011). The results of the present study revealed that eating behavior was significant in broilers reared under RL compared with other groups. Prayitno et al., (1997b) referred to bright red light considerably increased walking, feeding and stretching, particularly when applied early in the growth period. The increase in activity of birds in red than blue light confirms the results of a comparison of color effects on broiler behavior, although this may have been confounded by different perceived intensities of the different colored lights. Bowlby (1957) believed that red light made the feed more attractive, and this effect could be greatest at the start of the growth period, when the attractiveness of the feed could have greater effect on intake than later on.

Feeding and drinking behaviours are functionally necessary behaviours, required for livability. Drinking is a vital behavior that birds are highly motivated to perform (Schwean-Lardner, 2011). Chickens must have access to a supply of clean fresh water, chickens rely on gravity to draw water into the crop. This is why chickens lift their heads after dipping their beaks in water. Researchers have observed that chicks will not peck at a sheet of water, even if they are thirsty and standing in it. They will, however, peck at shiny objects or bubbles in the water (Wood-Gush, 2012).Drinking behavior increased significantly in broilers reared under GL. This result agreed with that of El-Husseiny et al., (2000) who found an increase in drinking behavior under green light due to increase in feed consumption, while disagreed with the results of Jingsong et al., (2012) who showed that broilers drunk more in red and incandescent group while least in the yellow group.

Locomotor activity is a component of many behavioural patterns but it may have lost part of its adaptive value for meat-type fowl in the present housing systems where heat, food and water are dispensed within easy reach. Locomotor behaviour was not significantly related to age but to genetic type, except running, which was very rare (Bizeray et al., 2000). Locomotory behaviours can indicate leg health, and a lack of motion can be due either to lack of motivation to move or an increase in leg disorders (Cooper, 2008). Gordon and Tucker (1993) found that individual birds that walked more at an early age were also more likely to walk more at a later age. The present study revealed that walking and standing behaviors were significantly higher in broilers under GL. These results confirmed by Khosravinia , (2007) who reported that around 85 per cent of the birds preferred to walk or stay in one of the four (green, yellow, orange and red) colored light zones, irrespective of light intensity. However, the proportion of the birds which preferred to walk or stay on green light zone was significantly greater (by approximately 3 folds) than the birds on the other colored light zones ($P < 0.01$).

On the other hand, Prayitno et al., (1997b) within his treatment found that the increase in walking and feeding with red light were greater in the early red treatment than in the late red treatment. Estevez et al., (2007) referred to the failure of increased intensities of blue light to increase standing and walking, suggest that the perception of long wavelength light by the pineal gland is central to the effect on activity. Long wavelengths penetrate the avian skull more than short wavelengths and stimulate reproductive development.

Feather pecking is an extensive problem in the poultry industry, with 77% of surveyed commercial poultry operations reporting feather-pecking behaviour (Huber-Eicher and Sebo, 2001). This behaviour can be divided into two categories: gentle feather pecks, by which the feather is nibbled and pecked at but not pulled out, and severe feather pecks, by which the feather is vigorously pulled or removed (McAdie and Keeling, 2002). Light management can play a part in reducing cannibalism in poultry (Olanrewaju et al., 2006). The results on feather pecking recorded significant mean in broilers reared under RL and WL. Prayitno et al., (1997a) reported that broiler chicks were more active in red or white color as expressed by greater walking activity in the white light and by grater floor-pecking, wing-stretching and aggression in the red light.Similar to Manser, (1996) suggested that broiler aggression is highest in red light, and lowest in blue. Xie et al., (2008), reported that blue light may play a role in alleviating the stress response in broilers due to reduction in the level of serum interleukin-1. In general, for all tested light sources lower feather pecking activity and incidence of aggressive behaviours was recorded for low light intensity. On the other hand the results on feather pecking and aggressive behaviour were in disagreement with observations of Leighton et al., (1989) that light sources do not affect these behaviours.

Resting was observed to be the major behavior pattern, irrespective of sex or light color (Son and Ravindran, 2009). It was suggested to keep growing poultry in houses containing different climatized sections for resting and for activity (locomotion, water, food intake) because birds are able to choose their optimum temperature area in relation to their needs (Tzschentke, 2004). Broiler chickens become increasingly inactive as they near market weight, spending as much as 80% of their time resting (Weeks et al., 2000). The mean of sitting behavior recorded a significant increase in broiler of red light group compared with other groups. These observations opposite the findings of Prayitno et al. (1997a). They observed that broilers were less active under blue or green light and spent more time sitting passively and dozing that under red or white light, whereas birds illuminated with red light showed more aggression and did more wing stretching and floor pecking than birds under white, green or blue light, similar to the results of Khosravinia, (2007) who reported that, in visual assessments, birds were found to be calm and comfortable under green lighting. The serenity and tranquility of the birds under green lighting could cause some appreciated responses in performance traits.

The birds' ability to move around freely, and hence to obtain access to feeders, may become increasingly limited because available floor space diminishes as birds grow bigger, and this effect would be greatest at the highest stocking density (McLean *et al*., 2002).The effect of stocking density on behavioral traits of broilers showed a significant decrease in feeding bouts and significant increase in most behaviors such as eating, walking, standing and feather pecking in birds reared under 18 bird/ m^2. High stocking densities were expected to lead to higher glucocorticoid levels, especially because these were combined with increasing group size in this study, as an expression of increased stress. Andrew et al., (1997) reported the possible that the rates of intake of feed and water were reduced due to greater competition at the dispensers, or difficulty in avoiding the feeder and drinker at the high stocking density because they occupied a larger proportion of each pen. The mechanism of action to explain the reduction in bird performance associated with density remains a critical unanswered question. In the studies that look to the effects of density on feed intake researchers found that birds at higher densities consumed less food. Dozier et al. (2006) suggested that the reduction in final body weight may be related to reduce feed intake because of limited feeding space and indicated that providing a larger number of feeders may help to reduce the negative consequences of density. Estevez et al., (2007) suggest that reduced final body weight may result from a reduction in appetite related to the deterioration of environmental conditions that goes along with higher densities. This mechanism of action would also explain the differences in bird performance that are commonly observed across producers that grow birds under similar densities but that may vary in the quality of the environment that they are able to supply.

Behavioral Traits of Layers

Behaviour is a good indicator for the assessment of the well-being of laying hens (Mohammed et al., 2010). Public concerns about the welfare of laying hens resulted in minimum welfare directives in the European Union (Chirila, 2008). It is known that the pattern, colour and intensity of lighting can affect many aspects of avian physiology and behavior, including skeletal and eye development and behavioral rhythms (Reiter and Kutritz, 2003). A further question to consider is not only how to prevent hens from suffering as a result of negative environmental influences but also how to provide them with positive features in their environment to improve welfare (Lay et al., 2011). The feed trough is a major attraction for laying hens, and the time spent

manipulating feed probably reflects the degree of behavioral activation experienced by a hen (Webster and Hurnik, 1991).

Eating activity was significant higher under WL, whereas, drinking behavior differed significantly in broilers reared under RL. Feeding related behavior in modern laying hens, however, is strongly affected by housing and management conditions. Mohammed et al., (2010) referred that feeding behavioral of hens in response to light sources: incandescent light IL, blue light BL, fluorescent light FL and day light DL showed no significant results. The study showed that light sources with low wave lengths spectrum may impair the behavior of laying hens and, thus, should not be used as a sole light source in layer houses. Furthermore, irrespective of light source high light intensity (50 Lux) may enhance pecking activity and aggressive behavior in laying hens. Thus, light sources affected feeding behavior, but the observed difference did not reach significance, as reported by Vandenberg and Widowski (2000), who found that feeding occurred more often than expected for incandescent light than for high-pressure sodium light (HPS). Feeding together as a part of social life revealed that broilers reared under GL showed a significant increase compared with other light groups. Almost all domesticated animals are social animals, which is one trait that is common to almost every domesticated species (Keeling and Gonyou, 2001). Febrer et al., (2006) showed that broiler chickens are socially attracted to one another and even at high commercial densities will seek to maintain close proximity with other birds. This requires social discrimination which is a specific type of memory that differs from other types of learning and memory (Bielsky and Young, 2004). The level of the sociality differs among species and individuals but is vital in a wild living social animal. The difference in the social environment may have caused some changes in the social behavior for the domesticated animals. It has been seen that domestic hens has a restricted social memory and that they will treat an individual as a stranger if it has been separated from the flock for a few weeks (Keeling and Gonyou, 2001). Several studies has strengthens the indication that eye sight is important in social recognition in chickens (D'Eath and Keeling, 2003).Recent research suggests that laying hens are able to recognize around 30 individuals (Wood-Gush, 2012).

Some comfort behaviours may be performed at inappropriate times, and can indicate stress or frustration (Schwean-Lardner, 2011).Shields et al., (2005) revealed that behaviors such as sitting and preen sitting increased with time, whereas behaviors that required more energy expenditure such as locomotion, stand feeding, standing, aggression and chase decreased on both bedding types sand and wood-Shavings. These findings of the present study showed a significant increase in sitting behavior in birds reared under BL, suggest that it was due to calming effect of blue light. Mohammed et al., (2010) reported that sitting resting activities were much higher under fluorescent (FL) and under blue light (BL). The same observation for blue light was described by Prayitno et al., (1997b) whilst Kristensen et al., (2007) stated that sitting behaviour was not influenced by light sources. For fluorescent light a lower sitting and resting activity has been expected due to the assumption that flickering of the light may make birds nervous.

Severe feather pecking is an abnormal behaviour found in laying hens that could be potentially classified as stereotypic behaviour (Mason, 2006). Rooijen, (2010) observed that some commercial layer strains still carry the wild genotype that has this behavior; however, environmental stimuli are required for its expression. Feather pecking is considered as one of the most serious problems in laying hens. Although, the reasons for feather pecking are still not clear (Mohammed et al., 2010). Bird color has been associated with increased risk of being a victim of feather pecking (Keeling et al., 2004). The incidence of feather picking of this study was significantly higher in flocks kept under BL. Feather pecking was observed in 77% of the commercial layer farms surveyed by Huber-Eicher and Sebo (2001).This behavior involves pecking and possible removal of the feathers of one bird by another. Shinmura et al., (2006) could not observe a significant difference in aggression between before and after decreasing light intensity in any housing system. Furthermore, Mohammed et al., (2010) recorded that walking and feather pecking activity as well as aggressive behaviour was higher under the blue light, especially, for high light intensity. Probably, results were caused by the reduction in the wavelength distribution of blue light (< 500 nm). Light with a longer wavelength (red to infrared) is needed for a normal function of hypothalamus and pituitary gland. Insufficient emission of light with long wavelengths obviously increased activities of hens. Under blue light activities of walking, feather pecking and aggression were higher (Mohammed et al., 2010).

Higher density appears to cause increased levels of nervousness and feather-pecking activity. Some strains have a greater ability to adapt to high density environments and this may explain the differences between experiments (Onbasilar and Aksoy, 2005). The present study referred to the effect of stocking density on eating and social life, the results were differed significantly in layers reared under 7 bird/m^2 whereas, drinking, sitting and feather pecking recorded high significance in layers reared under 5 bird/m^2.El-Deek and Al-Harthi, (2004) found that birds stocked at 18 bird/m2 showed lower growth than those stocked at 10 or 14 bird/m2. They also consumed less feed than those stocked at 10 bird/m2. While those stocked at 14 bird/m2 showed intermediate feed intake. Perhaps, this may be due to increasing competition for feed as a result of increasing stocking density. The decrease in growth performance resulted from increasing stocking density

could be attributed to the increase in stress resulted from competition for feeds and water, increased house temperature, microbial activity, and ammonia production. On his study of Motivation tests Faure, (1994) revealed that layers could influence their cage size by pecking a button, but results seemed inconsistent as the layers were found to work for smaller cages as well as for larger ones.

CONCLUSION

In general, the effects of colour light and stocking density treatments on welfare indicators were inconsistent. These data indicate that light color can influence broiler and layers. Significant differences were reported in the present study when comparing broiler and layer behaviors under white, red, blue, green and mix of green and blue lighting. It was concluded that broilers raised under red and white light were more active than those raised under blue and green light. More research needs to be conducted further investigating these possibilities.
Broiler and layer welfare is increasingly becoming important to consumers who prefer that birds are raised in improved and confortable conditions.

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REFERENCES

Andrew SM, Omed HM, Philips CJC (1997). The effect of a single or repeated period of high stocking density on the behavior and response to stimuli in broiler chickens. Poult. Sci. 76:1655–1660.

Bielsky IF, Young LJ (2004). Oxytocin, vasopressin, and social recognition in mammals. Peptides. 25: 1565-1574.

Bizeray D, Leterrier C, Constantin P, Picard M and Faure JM. (2000). Early locomotor behaviour in genetic stocks of chickens with different growth rates. Appl. Anim. Behav. Sci. 68: 231–242.

Blatchford RA, Klasing KC, Shivaprasad HL, Wakenell PS, Archerand GS and Mench JA (2009). The effect of light intensity on the behavior, eye and leg health, and immune function of broiler chickens. Poult. Sci. 88:20-28.

Bokkers EAM, Koene P (2004). Motivation and ability to walk for a food reward in fast- and slow-growing broilers to 12 weeks of age. Behav. Process. 67:121-130.

Bowlby GMS (1957). Some preliminary investigations into the effect of light on broilers. World. Poult. Sci. J. 13:214-226.

Brake J (1987). Influence of presence of perches during rearing on incidence of floor laying in broiler breeders. Poult. Sci. 66: 1587-1589.

Buijs S (2011). Using spatial distribution and behaviour to determine optimal space allowances for poultry and rabbits. Ph.D. Thesis. Faculty of Veterinary Medicine and Animal Science, Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Uppsala, Sweden.

Chirila D (2008). Variations in some biochemical indicators of blood plasma of laying hens depending on the housing system. Lucrari Sci. Med. Vet. Vol. XLI: 556-559.

Cooper RG (2008). Walking and behaviours of birds kept in captivity. World. Poult. 24:24-25.

Cornetto T, Estevez I and Douglas LW (2002). Using artificial cover to reduce aggression and disturbances in domestic fowl. Appl. Anim. Behav. Sci.75: 325-336.

Dawkins MS (2004). Using behavior to assess animal welfare. Anim. Welf. 13:S3-S7.

D'Eath RB, Keeling LJ (2003). Social discrimination and aggression by laying hens in large groups: from peck orders to social tolerance. Appl. Anim. Behav. Sci. 84: 197-212.

Dozier WA, Thaxton JP, Olanrewaju HA, Branton SL and Roush WB (2006). Stocking density effects of male broilers destined for fast-food markets. Poultry Science. 85:344-351.

Duncan IJH. (2005). Science-based assessment of animal welfare: farm animals. Rev. Sci. Tech. Off. Int. Epizoot. 24:483-492.

El-Deek AA, Al-Harthi MA (2004). Response of modern broiler chicks to stocking density, green tea, commercial multi enzymes and their interactions on productive performance, carcass characteristics, liver composition and plasma constituents. Int. J. Poult. Sci. 3: 635-645.

El-Husseiny O, Hashish SM, Arafa SM, Madian AHH (2000). Response of poultry performance to environmental light colour. Egypt. Poult. Sci. 20: 385-402.

Estevez I (2007). Density allowances for broilers: Where to set the limits? Poult. Sci.86: 1265-1272.

Faure JM (1994). Choice tests for space in groups of laying hens. Appl. Anim. Behav. Sci. 39: 89-94.

Febrer K, Jones TA, Donnelly CA, Dawkins MS (2006). Forced to crowd or choosing to cluster? Spatial distribution indicates social attraction in broiler chickens. Anim. Behav. 72:1291–1300.

Gordon SH and Tucker SA. (1993). Broiler walking behaviour. In: Savory, C.J., Hugues, B.O. Eds, 4th European Symposium on Poultry Welfare, Universities Federation for Animal Welfare. p. 291.

Gunnarsson S, Matthews LR, Foster TM and Temple W. (2000). The demand for straw and feathers as litter substrates by laying hens. Appl. Anim. Behav. Sci. 65: 321-330.

Hartini S, Choct M , Hinch G, Kocher A. and Nolan J V. (2002). Effects of Light Intensity During Rearing and Beak Trimming and Dietary Fiber Sources on Mortality, Egg Production, and Performance of Isa Brown Laying Hens. J. Appl. Poult. Res. 11:104–110.

Huber-Eicher B, Sebo F (2001). The prevalence of feather pecking and development in commercial flocks of laying hens. Appl. Anim. Behav. Sci. 4: 223-231.

Isa Brown (2010). Commercial Management Guide.

Jingsong J, Jinming P, Yue W, Zhangyin Y and Yibin Y (2012). Effect of Light Color on Growth and Waste Emission of Broilers, Written for presentation at the Ninth International Livestock Environment Symposium Sponsored by ASABE Valencia Conference Centre Valencia, Spain.

Keeling L, Andersson L, Schutz K E , Kerje S, Fredriksson R , Carlborg O , Cornwallis C K, Pizzari T , and Jensen P.(2004). Chicken genomics: Feather-pecking and victimpigmentation. Nature 431:645–646.

Keeling LJ, Duncan IJH (1991). Social spacing in domestic fowl under semi-natural conditions: the effect of behavioural activity and activity transitions. Appl. Anim. Behav. Sci. 32: 205- 217.

Keeling LJ, Gonyou HW (2001). Social Behaviour in Farm Animals. CABI Publishing, New York.

Keppler C, Folsch DW (2000). Locomotive behaviour of hens and cocks (*Gallus gallus f. domesticus*): Implications for housing systems. Archiv fur Tierzucht 43: 184-188.

Keppler C, Schnurrenberger-Bolter U and Folsch DW. (1997). Activity and social relationships of chickens (*Gallus gallus f. domesticus*) in aviary systems - methods and preliminary results. In 5th Symposium on Poultry Welfare Koene P, Blockhuis, HJ (eds), 105-106. World´s Poultry Science Association, University of Wageningen, Netherlands

Khosravinia H (2007). Preference of Broiler Chicks for Color of Lighting and Feed. J. of Poult. Sci. 44: 213-219.
Kjaer JB, Sorensen P (2002). Feather pecking and cannibalism in free-range laying hens as affected by genotype, dietary level of methionine + cystine, light intensity during rearing and age at first access to the range area. Appl. Anim. Behav. Sci. 76: 21-39.
Kristensen HH, Prescott NB, Perry GC, Ladewig J, Ersboll AK, Overvad KC, Wathes CM (2007). The behaviour of broiler chickens in different light sources and illuminances. Appl. Anim. Behav. Sci. 103:75-89.
Lay Jr DC, Fulton RM, Hester PY, Karcher DM, Kjaer JB, Mench JA, Mullens BA, Newberry RC, Nicol CJ, O'Sullivan NP, Porter RE (2011). Emerging Issues: Social Sustainability of Egg Production Symposium, Hen welfare in different housing systems Poultry Science.
Leighton AT, Hulet RM, Denbow DM (1989). Effect of light sources and light intensity on growth performance and behaviour of male turkey. Brit. Poult. Sci. 30:563-574.
Lewis P and Morris T. (2006). Lighting for broilers. Pages 7-22, 145-148 in Poultry Lighting the theory and practice. Northcot, Andover Hampshire, United Kingdom.
Lewis PD and MorrisTR. (2000).Poultry and coloured light,World. Poult. Sci. J. vol 56 (3): 189-207.
Manser CE (1996). Effects of lighting on the welfare of domestic poultry: a review. Anim. Welf. 5:341-360.
Marin RH, Freytes P, Guzman D, Bryan Jones R (2001). Effects of an acute stressor on fear and on the social reinstatement responses of domestic chicks to cage mates and strangers. Appl. Anim. Behav. Sci. 71: 57-66.
Mason GJ, Latham NR (2004). Can't stop, won't stop: is stereotypy a reliable animal welfare indicator? Anim. Welf. 13: S57-S69.
McAdie TM, Keeling LJ (2002). The social transmission of feather pecking in laying hens: effects of environment and age. Appl. Anim. Behav. Sci.75:147-159.
McLean JA, Savory CJ and Sparks NHC (2002). Welfare of male and female broiler chickens in relation to stocking density, as indicated by performance, health and behaviour. Anim. Welf.11: 55-73.
Mishra A, Koene P, Schouten W, Spruijt B, van Beek P, Metz JHM (2005). Temporal and sequential structure of behavior and facility usage of laying hens in an enriched environment. Poult. Sci. 84:979–991.
Mohammed HH, Grashorn MA, Bessei W (2010). The effects of lighting conditions on the behaviour of laying hens. Arch. Geflugelk. 74 (3): 197–202. Verlag Eugen Ulmer, Stuttgart, Germany.
Neves DP, Naas IA, Vercellino RA, Moura DJ (2010). Do broilers prefer to eat from a certain type of feeder? Rev. Bras. Cienc. Avic.12 (3): 179-187.
NRC (1994). Nutrient Requirements of Poultry. 9th rev. ed. Natl. Acad. Press, Washington, DC.
Olanrewaju HA, Thaxton JP , Dozier WA, Purswell J, Roush WB, Branton SL (2006). A Review of Lighting Programs for Broiler Production. Int. J. Poult. Sci. 5 (4): 301-308.
Onbasilar EE, Aksoy T (2005). Stress parameters and immune response of layers under different cage floor and density conditions. Livest. Prod. Sci. 95:255–263.
Osorio D, Vorobyev M, Jones CD (1999). Colour vision of domestic chicks. J. of Exp. Biol. 202: 2951–2959. Printed in Great Britain.
Prayitno DS, Phillips CJC, Omed H (1997a). The effects of color of lighting on the behavior and production of meat chickens. Poult. Sci 76:452–457.
Prayitno DS, Phillips CJC, Stokes DK (1997b). The effects of color and intensity of light on behavior and leg disorders in broiler chickens. Poult. Sci. 40:332–339.
Puma MC, Xin H, Gates RS, Burnham DJ (2001). An instrumentation system for studying feeding and drinking of individual poultry. Appl. Eng. in Agric. 17(3): 365–374.
Reiter K, Kutritz B (2003). Behaviour and leg weakness in different broiler breeds. Archiv fur Geflugelkunde 63: 137-141.
Rierson RD (2011). Broiler preference for light color and feed form , and the effect of light on growth and performance of broiler chicks. M.Sc. thesis,College of Agriculture, Kansas State University, Manhattan, Kansas,USA.
Rooijen J (2010). Is feather pecking in laying hens a by-product of artificial selection? Appl. Anim. Behav. Sci. 122:133.
Ruth CN, Linda JK, Inma E and Boris B (2006). Behaviour when young as a predictor of severe feather pecking in adult laying hens: the redirected foraging hypothesis revisited. Appl. Anim. Behav. Sci. 107: 262-274.
Sanotra GS, Lund JD and Vestergaard KS (2002). Influence of light-darkschedules and stocking density on behaviour, risk of leg problemsand occurrence of chronic fear in broilers. Brit. Poult. Sci.43: 344-354.
Schwean-Lardner K (2011). The importance of day length and darkness exposure on the welfare and productivity of commercial broilers. Ph.D. thesis, Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Canada.
Shawkat TF, Hassan AS and Musa RK. (2002). Influence of density On the Iraqi broiler (Fabro) performance and its relationship to the welfare. Basrah. J. Agri. Sci. 15 (4):1-9.
Shields SJ, Garner JP, Mench JA (2005). Environment, Well-Being, and Behavior Effect of Sand and Wood-Shavings Bedding on the Behavior of Broiler Chickens. Poult. Sci. 84:1816–1824.
Shinmura T, Eguchi Y, Uetake K, Tanaka T (2006). Effects of light intensity and beak trimming on preventing aggression in laying hens. Anim. Sci. J. 77: 447-453.
Son JH, Ravindran V (2009). Effect of light colour on the behaviour and performance of broilers. Poultry Welfare Symposium Cervia, Italy.
Tablant NL, Vaillancourt JP, Martin SW, Shoukri M, Estevez I (2000). Spatial distribution of cannibalism mortalities in commercial laying hens. Poult. Sci. 79:705–708.
Tzschentke B (2004). Avian and Poultry Biol. Review. 15: 253.
van Liere DW, Bokma S (1987). Short-term feather maintenance as a function of dust-bathing in laying hens. Appl. Anim. Behav. Sci. 18: 197-204.
Vandenberg C, Widowski TM (2000). Hens preferences for high-intensity High-Pressure Sodium or low-intensity incandescent lighting. J. Appl. Poultry Res. 9: 172-178.
Webster AB, Hurnik JF (1991). Breeding and genetics: Behavior, production, and well–being of the laying hen: 2. Individual variation and relationships of behavior to production and physical condition. Poult. Sci.70: 421-428.
Weeks CA, Danbury TD, Davies HC, Hunt P, Kestin SC (2000). The behaviour of broiler chickens and its modification by lameness. Appl. Anim. Behav. Sci. 67:111-125.
Wood-Gush DGM (2012). The behavior of the domestic chicken: A review of the literature. Brit. J. of Anim. Behav. 111(3):81-110.
Xie D, Wang Z X, Dong YL, Cao J, Wang JF, Chen JL, Chen YX (2008). Effects of monochromatic light on immuneresponse of broilers. Poult. Sci.. 87:1535-1539.