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Full Length Research Paper

The Effect of Color Light and Stocking Density on Antibody Titer of Broilers Vaccinated Against Newcastle Disease

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This study was designated to investigate the effect of color light and stocking density on immune response of broilers after vaccination against Newcastle disease. A total of 675 Ross 308 one-day-old broiler chicks were used in this study were exposed to white light (WL) as a control , red light (RL), blue light (BL), green light (GL), and Blue – Green mix light (BGL) by a light-emitting diode system (LED) 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. Vaccination of broilers was performed at 21 days of age by the use of Newcastle (ND) LaSota Strain. At the end of 5 week, 1 birds from each replicate were selected and blood was collected and prepared for Elisa technique. No differences were noted in the titer of antibodies against Newcastle disease in broilers reared under different color lights and densities.

Keywords: antibodies, broilers, color light, stocking density.

INTRODUCTION

Light is as an important management tool to regulate broiler production. Birds sense light through their eyes (retinal photoreceptors) and through photosensitive cells in the brain (extra-retinal photoreceptors) (El-Fiky et al., 2008). The color of light is determined by the relative power of different wavelengths in the visible part of the light spectrum (Senaratna et al., 2011).Antibody responses have been used as measures of the humoral immune status of birds and a viable part of the immune system (Scott, 2004).Most photoperiod studies on immune function to date show an increase in immune response in short compared with long days. Cockerels grown under constant lighting had a lower anti-SRBC titer than those grown under 12 hours light:12 hours darkness (Kirby and Froman,1991). A short photoperiod could enhance both cellular and humoral responses of the immune system compared with a long photoperiod (Demas et al., 1996).Both the cellular and humoral immune responses were greater when birds were placed in daily light-dark cycle treatments as compared with constant light (Moore and Siopes, 2000). Onbasilar et al. (2007) reported that broilers housed in intermittent lighting had higher antibody titers of anti-Newcastle disease virus (NDV) compared with continuous lighting. Among spectra of light, it has been suggested that green and blue lights enhance the immune response better than others (Xie et al., 2008, 2011). The

onset of cellular immunity enhancement occurred at various phases of photo-stimulation according to different monochromatic lights. The enhancement with GL and YL occurred at the early growth stage at 18 days, whereas the enhancement with GL was less than other lights at 30 days (Sadrzadeh et al., 2011).

Stocking density is a much discussed topic in animal science. Increasing stocking density generally leads to a decrease in welfare in many farm animal species (Petherick and Phillips, 2009). Stocking density is inherently confounded with either the number of animals in a group, or with the total amount of space available to this group (Buijs et al., 2012).It has been proposed that the factors that affect antibody production in broilers include the cage floor and density conditions. Antibody titers in cages with one hen was similar to that with three or five hens; however, those with three hens had higher titers than those with five hens. he results suggest that the allocation of three hens per cage had no measurable effect on health and welfare(Onbasilar and Aksoy, 2005).

MATERIALS AND METHODS

Birds and husbandry

A total of 675 Ross 308 one-day-old broiler chicks were used. The chicks were reared in the poultry farm at the College of Veterinary Medicine, Basra University for 7 weeks. All broilers were cared for in 5 light-controlled rooms (n = 135) and were exposed to white light as control (WL), red light (RL), blue light (BL), green light (GL), and Blue – Green mixed light (BGL), at birds eye level with an light-emitting diode system (LED) 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 12, 15 and 18 birds/m^2 . 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). The 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. 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.

Vaccination

Vaccination of broilers was performed at 21 days of age by the use of La Sota Strain of Newcastle disease vaccine manufactured by AL- Kindi of Veterinary Vaccines which contains 1,000 doses and used according to the manufacturer's recommendations. Initially thirsty chicks for 3 hours prior to inoculation and then dissolved vaccine with distilled water 1000 ml. Each bird was received one dose of ND vaccine in 1 ml distilled water, given intra crop using a syringe and blunted needle to ensure that all birds has been received the vaccine (Ali et al., 2004).

Blood collection

At the end of 5 week age, 1 birds of average weight from each replicate were selected and blood was collected from the wing vein. Blood samples were taken in test tubes without anticoagulant and labeled according to each replicate and then the samples centrifuged and the collected serum stored at -20^{o}C until analyzed (Al-Daraji et al., 2008).

Antibody titer

An antibody titer is a measurement of how much antibody an organism has produced by used indirect Enzyme-Linked Immunosor bent Assay (ELISA) which is a common means of determining antibody titers. Specific kit of SYNBIOTIC were used for this test according to manufacturer's procedure. The results quantified by using a spectrophotometer and the wavelength (410-405) nm as indicated by (Synder et al., 1984).

Models of analysis

Data was analyzed using completely randomized design (CRD) according to SPSS (2009). The significant tests for the differences between each two means for any studied trait were done according to Duncan's multiple rang test.
The model was: $Y_{ijk} = M + L_i + D_j + (LD)_{ij} + e_{ijk}$
Where: Y_{ijk} = Observation on the ij individual
M = Overall mean
L_i = light effect
D_j = density effect
$(LD)_{ij}$= Interaction between light and density
e_{ijk} = Random error

RESULTS AND DISCUSSION

Immune response to a given antigen is good parameter that has been widely used in assessing the stress level of broiler chickens (Turkyilmaz, 2008) and there is a close relationship between the environmental factors (such as light and temperature) and immune responses (Sadrzadeh et al., 2011).Table 1 indicated to the effect of light color and stocking density on antibody titer of broilers at the age of 35 day. The table referred to the lack of significant differences of color light used in various treatments but the highest rate mathematically was 3943.44 in the serum of chickens reared under the influence of a combination of blue and green lights, while less value 2538.33 recorded in

Table 1: the effect of color light and stocking density on antibody titer of broilers at 35 day

	Color light / Stocking density	WL	RL	BL	GL	BGL	Effect of stocking density
Titer of AB	12 birds/m^2	4165.33 ± 1480.58	3797.00 ± 1281.73	1407.00 ± 312.72	2254.00 ± 551.22	3363.33 ± 1508.05	2997.33 ± 1012.46
	15 birds/m^2	5486.66 ± 1817.81	1565.33 ± 210.93	3404.33 ± 1057.85	2872.00 ± 1013.00	3160.33 ± 1733.63	3297.73 ± 1166.64
	18 birds/m^2	2145.66 ± 884.41	2831.00 ± 665.71	2803.66 ± 349.76	3089.66 ± 1407.24	5306.66 ± 1475.49	3235.33 ± 956.52
	Effect of color light	3932.55 ± 1394.26	2731.11 ± 719.45	2538.33 ± 573.44	2738.55 ± 990.48	3943.44 ± 1572.37	N. S.
	N. S.						

M: mean SE: standard error N.S. not significant.

the serum of chickens reared under the influence of blue light in. The immune status of the birds and the absence of significant differences between the various treatments may be due to sufficient administrative procedures and food rations provided and the birds are not exposed to stress or injuries sick.

The results of current study is consistent with Xie et al. (2008) who found that the anti-NDV antibody titers were greater in the GL and BL groups than in the RL group during the entire experimental period. However, no significant difference was seen between the GL and BL groups at 42 day of age. By 49 day of age, the antibody titer of the BL group was 62.8% greater than that of the RL group. The researcher suggest that BL and GL could maintain longer antibody effective times and promote greater antibody production and humoral immune function in broilers as compared with RL.

Sadrzadeh et al.(2011) studied the effects of monochromatic light on the cellular immune response with light sources were equalized at the intensity of 25 lux, with a light period of 23 hours daily (23Light:1Dark) and administer at 25 day (La Sota strain) days of age in all groups. Among the four groups (WL, RL, YL and GL), maximum T lymphocyte proliferation appeared in YL group that was not significant. After 37 days of photo-stimulation There was significant ($P < 0.05$) increase of T-lymphocyte proliferation in GL and WL groups as compared to other groups. The results of Xie et al.(2007) showed that immune function would be increased in broilers when who was illuminated with either green light in early stage of broiler growth or blue light in latter growth stage under 15 lux light intensity , moreover , blue light could, to an extent, show an action of alleviating immunologic stress. Previous studies demonstrated that green and blue monochromatic lights were effective to stimulate immune response of the spleen in broilers (Xie et al.,2011).Lewis and Morris (2000) proved that the hypothalamic photoreceptors of chicken are more sensitive to blue/green light when illuminated directly. Blatchford et al. (2009) showed that light treatment did not significantly affect any of the immune parameters examined, although there was a trend ($P = 0.07$) for a greater IgM response in chicks in the 50 lux (6.21 titer) than the 5 lux group (5.78 titer), with those in the 200 lux group being intermediate (5.92titer). Onbasilar et al. (2007) reported that broilers housed in intermittent lighting had higher antibody titers of anti-Newcastle disease virus (NDV) compared with continuous lighting. As for stocking density, no differences were recorded on antibody titer of broilers vaccinated against Newcastle disease. The high rate was 3297.73 in the treatment of chickens reared at the level of density 15 birds/m^2 while the least value was 2997.33 in the treatment of broilers reared at the level of density 12 birds/m^2. These findings are consistent with Turkyilmaz (2008), who recorded that Newcastle disease antibody titers (log10) were 3.99, 4.10, and 3.88 for 15, 20, and 25 birds/m^2, respectively, on day 42. These results indicated that stocking density had no significant effect on immune response in broilers. The results was in agreement with Erisir and Erisir (2002) who observed a significant decrease in immune response with an increase in stocking density in Japanese quails. There was a consistent trend to elevate the heterophil to lymphocyte ratio when bird density was increased, mean value in the highest density (20 birds/m^2) differing significantly from those in the two lowest densities (4 and 8 birds/m^2) (Campo et al., 2005).Heckert et al. (2002) reported a significant reduction in bursa weights and bursa/BW ratios with increasing densities (ranging from 0.10, to 0.05m^2 per bird), suggesting a higher degree of stress particularly for birds at densities above 0.066m^2/bird (15 birds/m^2). Other

parameters such as humoral immune response to SRBC, heterophil :lymphocyte ratios, or lymphocyte blastogenesis were not different across. The Analysis of variance appeared no significant interaction between the light color and stocking density on the level of antibodies in blood serum of broilers vaccinated against Newcastle disease at the age of 35 day.

CONCLUSION

The results of this study indicate that chickens under five different color lighting schedules and three densities revealed that there were no significant effects on antibody titer. However, little information has been published to date regarding the effect of light color on the immune response for avian species.

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