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Overcrowding Stress Management in Broiler Chicken with Herbal Antistressor

Research Article

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ABSTRACT

Overcrowding of broiler chicks due to lack of space induces harmful effects which act as predisposing factor in the reduction of production and performance in poultry. Supplementation of antistressor products can ameliorate adverse effect of various stressors in poultry. An experiment was designed by inducing overcrowding stress and its management by supplementation of polyherbal antistressor, adaptogenic and immunomodulator formulation Stresroak in broiler chicken. One hundred and fifty day old broiler chicks were randomly divided into five groups of 30 chicks each. Groups I, II and III served as control and were only offered with basal diet. Group I served as control with a normal space. The chicks in groups II and III (positive control) were provided with space 25% and 50% lesser than normal, respectively. The bird in therapeutic group IV and V were provided with 25% and 50% less space along with antistressor Stresroak@1g/1kg of feed, respectively. Growth and performance related parameters like feed consumption, body weight, feed conversion ratio (FCR) were evaluated in addition to haematological, serum biochemical and gross pathological studies. Polyherbal formulation not only improved growth and performance related parameters, but also normalized the haematological and serum biochemical parameters. Gross pathological lesions in vital organs also showed improvement in therapeutic group compared to control. It was concluded that Stresroak exhibits antistressor and adaptogenic activity to ameliorate the overcrowding stress in poultry.

KEY WORDS haemoconcentration, haematobiochemical, overcrowding, polyherbal, stressor.

INTRODUCTION

Stress evokes harmful responses that interferes with the general health, productivity and result in immunosuppression (Saxena and Madan, 1997). Anything which disrupts physiological and psychological stability of chicken is the stressor and reaction of stressor is termed as stress (Pande, 2002). Variation in feed intake, protein deficiency, starvation, shortage of feeding space leads to stress which ultimately cause immunosuppression in chickens (Glick *et al.* 1981). Most of today's problems in poultry are caused by combinations of factors such as management, stress, nutrition, overcrowding, poor ventilation, high intensity of light, immunosuppression and exposure to disease agents. Stress is an important cause of reduced performance and increased susceptibility to disease (Isohe and Lillehoj, 1992). Broilers are subjected to frequent stress factors and therefore, it is important to have an effective management program to mi-

minimize their effects on the performance and health of the birds (Rosales, 1994).

Among the entire stress factors, overcrowding is an important common stressor in poultry, which ultimately results in poor production and growth. Overcrowding also increases the exposure to disease causing organism (Scahawat, 2000). With increased environmental temperatures and overcrowding stress, feed utilization efficiency is decreased (Suk and Washburn, 1995). For ameliorating the adverse effects of different managemental stress conditions, use of prebiotics and probiotics was reported by Ghareeb *et al*. (2008). Polyherbal formulation Stresroak (*M/s Ayurvet Ltd. Baddi, India*) is scientifically proven to be adaptogenic, immunomodulatory, free radical scavenging and antioxidant rejuvenating actions (Shukla and Srivastava, 1999). The Present experiment was designed to study the efficacy of polyherbal product in counteracting overcrowding stress among commercial broiler chicken.

MATERIALS AND METHODS

A study was conducted at Instructional poultry farm, Department of Veterinary Pathology, College of Veterinary and Animal Sciences, Parbhani, Maharashtra (India). Healthy day old Vencob 150 broiler chicks of either sex were randomly divided into five groups of three replicates each and each group comprising 30 chicks, 10 in each replicate. Day old chicks were maintained for 6 weeks under standard managemental conditions and were vaccinated against Ranikhet disease (RD) and Infectious Bursal Disease (IBD). All the experiemental groups were offered similar basal ration throughout experiement (Table 1). Groups I, II and III served as control and were only offered with basal diet. Group I served as negative control and was provided with normal space one square feet per bird (sq. ft./bird). Chicks of group II, III, IV and V were induced with overcrowding stress by providing lesser space throughout the experiment. Group II and IV were provided with 25% less space than normal and group III and V were provided with 50% less space than normal, respectively. Groups II and III served as positive control and were not given any antistressor, while group IV and V were supplemented with Stresroak @1g/1kg feed from 0-42 days. The constituent herbs of polyherbal formulation Stresroak, namely *Phyllanthus emblica, Withania somnifera, Magnifera indica, Ocimum sanctum* and many more are scientifically proved for their antistressor, immunomodulator, adaptogenic and performance enhancing property (Manoharan, 2004 and Oyagbemi *et al*. 2008). Weekly recording of growth and performance parameters was done to record weekly body weight and feed conversion ratio (FCR).

Table 1 Gross compositions of basal diets used during experiment

Ingredients (%)	Starter diet (0-21 days)	Grower/Finisher diet (22-49 days)
Maize	60.00	63.00
Ground nut cake	23.11	18.00
Fish meal	13.00	15.00
Common salt (NaCl)	0.22	0.33
Mineral mixture1	3.00	3.00
Vitamin A, B2, D32	0.02	0.02
TM-1003	0.01	0.05
Amprosol4	0.05	0.05
Nuvimin5	0.05	0.55
Nutrient composition		
Moisture (%)	6.29	6.22
Crude protein (%)	23.29	21.28
Total ash (%)	8.02	9.34

[1]Calcium-20%, Phosphorus-12%, Magnesium-5%, Iron-0.4%, Iodine-0.026%, Copper-0.1%, Manganese-0.12, Cobalt-0.12%, Flourine-0.07%, Zinc-0.08%, Sulphur-1.8-3.0%, Acid Insoluble Ash-3.0%, Lead-not more than 7.0 mg/kg.
[2]Vitamin A-82500 IU/g, Vitamin B-50 mg/g, Vitamin D_2-1200 IU/g.
[3]Oxytetracyclin-100 g/kg.
[4]Amprolium HCl-20% w/w.
[5]Vitamin A-700IU/g, Vitamin D_3-70 IU/g, Vitamin E-0.25mg/g, Nicotinamide-1.0mg/g, Calcium-25.5%, Phosphorus-12.75%, Magnesium-6.0 mg/g, Iron-1.5 mg/g, Iodine-0.0325 mg/g, Copper-1.2 mg/g, Manganese-1.5 mg/g, Cobalt-0.15 mg/g, Zinc-9.6 mg/g, Sulphur-0.0072 mg/g, Selenium-0.1 mg/g.

Haematological and biochemical parameters were estimated on day 15th, 30th and 42nd of experiment. Haemoglobin (Hb), Total leukocytic count (TLC) and Differential leukocytic count (DLC) were estimated by the method described by Dacie *et al.* (1984). Among serum biochemical parameters, the total serum proteins and serum glucose were evaluated as per the method described by Gornell et al. (1949). For recording the gross pathological lesions of liver, lung, heart, spleen, kidney and brain were collected at the end of the study after sacrificing the replicate group birds and were also examined for any leisions such as haemorhages, spleenomegaly, hepatomegaly or any other gross changes. Statistical analysis of data was done using complete randomized design as per the method given by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Growth and performance parameter

Flooring system and stocking density affect the performance of birds by inflicting additional stress on birds, thus deteriorating growth and feed efficiency (Takahashi *et al.* 1991). The average body weight of control birds provided with normal space (Group I) after 6th week was (1873±6.10g). In group II (25% less space) was (1808±7.99 g) significantly (P<0.01) lower than group IV (Stresroak+25% less space). Group III (50% less space) showed significant (P<0.01) decrease in body weight (1750±8.85g) as compared to group V (50% less space+Stresroak), (1781±5.99g), (Table 2). Similar results were reported by (Rizk *et al*. 2003; Camci and Erensayin, 2004 and Thomas *et al*. 2004). Singh and Sharma, (2003) reported depression in body weight in birds exposed to overcrowding at 0.75 sq.ft. per bird and 0.50 sq.ft. per bird. The adverse effect of overcrowding stress resulted in poor growth, performance and FCR of broilers. Singh and Sharma, (2003) and Rizk *et al*. (2003) revealed that overcrowding resulted in poor FCR and depression in body weight gain. The birds of therapeutic groups V (50% less space+Stresroak) showed better FCR 1.45 as compared to positive control group III (50% space) 1.68 (Table 2). However, no significant variation in feed intake was evident throughout experiement among the experiemental groups. Rajmane and Sonawane (1996) also observed that supplementation of Stresroak in stress conditions, help in improving body weight gain and FCR. Results reveal a significant improvement in the body weight and feed conversion in Stresroak administered group in contrast to overcrowding stressed birds owing to the immunomodulating and antistress properties of the constituent herb.

Haematological parameters

The Reduction in floor space induced marked increase in stress which is manifested by changes in haematological indices such as Haemoglobin level, TLC, DLC, MCH and MCHC values. Elevation in Hb level was evident in the untreated group II (25% less space) and Group III (50% less space) due to overcrowding stress (Table 3). Haemoconcentration in overcrowding stress is the result of less supply of oxygen to birds resulting in hypoxia, which is a stimulus for erythropoietin secretion and leads to erythropoiesis in stressed birds (Group II and III). The values of Hb concentration of group IV and V (Therapeutic groups) on day 15th and 30th were significantly (P<0.01) reduced in

Table 2 Mean (±SE) weekly body weight of boiler chicks before and after treatment of overcrowding stress at different intervals*

Parameters	Weeks	Experimental groups				
		I	II	III	IV	V
Body weight (g)	I	102±1-05[a]	94+0.6[b]	86+1.70[c]	98±0.56[a]	89±1.28[a]
	II	263+3.88[a]	250±3-02[b]	237±1.01[c]	255±3.94[a]	243±1.94[b]
	III	703+3.89[a]	683±2.85[b]	669±3.85[b]	689±2.76[a]	675±3.05[b]
	IV	1113+5.60[a]	1076±10.75[b]	1051±9.87[b]	1094±4.00[a]	1068±9.58[b]
	V	1426±10.75	1390±5.29[b]	1370±5.29[b]	1405+7.33[a]	1383±5.63[b]
	VI	1873+6.10	1808±7.99[b]	1750±8.85	1836±8.42[d]	1781±5.99[e]
Feed conversion ratio (FCR)	I	0.9±0.87	1.0±0.58	1.0±0.29	1.0±0.52	0.9±0.53
	II	1.2±1.21	1.3±0.82	1.5±1.02	1.2±0.33	1.25±0.91
	III	1.4±0.98	1.4±1.07	1.7±0.83	1.4±0.19	1.4±0.72
	IV	1.5±0.75	1.6±1.23	1.8±0.78	1.6±0.47	1.6±0.82
	V	1.6±1.30	1.7±0.62	1.9±1.05	1.7±0.85	1.6±0.61
	VI	1.8±0.79	1.9±0.91	2.2±1.46	1.9±1.01	2.0±0.71

*The means that have at least one common letter within the same column, do not have significant difference (P>0.05).

Table 3 Mean (±SE) Haematological values of Hb (g/dL) and TLC (10^3/cm) before and after treatment of overcrowding stress at different intervals in broiler chicken*

Parameters	Experimental group	Treatment interval		
		15th day	30th day	42nd day
Haemoglobin (g/dL)	I	9.56+0.26[a]	9.30±0.13[a]	10.56±0.88[a]
	II	9.05 +0.77[a]	8.76+0.20[a]	10.90±0.48[a]
	III	11.86+0.29[b]	10.8±0.22[b]	11.36±0.49[a]
	IV	9.96±0.56[a]	10.1+0.54[b]	10.76+0.67[a]
	V	9.56±0.40[a]	9.46±0.33[a]	10.63±0.40[a]
Total leukocyte count (TLC)(10^3/cmm)	I	37.00±1.55[a]	46.33±02.38[a]	44.00±3.60[a]
	II	30.00+1.05[b]	35.50±3.06[a]	39.00 ±3.56[a]
	III	20.66±2.30[c]	32.00±2.51[b]	35.50±3.06
	IV	35.66±1.28[a]	43.66±0.87[a]	39.66+1.10[a]
	V	30.66+1.15[b]	40.66+0.65[a]	42.66±1.47[a]

*The means that have at least one common letter within the same column, do not have significant difference (P>0.05).

comparison to group II (0.75 sq. ft/bird) and group III (0.5 sq. ft/bird) (table 3). Present findings were corroborated with the findings of Rosales (1994), Dhal *et al*. (1997), Cheng Heg *et al*. (2000) and Bedanova (2006), who observed that overcrowding elevates Hb concentration in the stress. The mean values of TLC and DLC in birds of group III (0.5 sq. ft/bird) were significantly (P<0.01) reduced when compared with other groups (Table 3 and 4). Also, the values of TLC and DLC of lymphocytes, monocytes, heterophils and eosinophils in group III were significantly (P<0.01) decreased at different intervals when compared to negative control (group I). Similar findings were noticed by Hocking (1994); Saxena and Madan (1997) and Rizk *et al*. (2003), according to whom, overcrowding results in leucocytopenia, eosinopenia and lowers the monocyte and heterophil counts in broiler birds. The evidence of reduction in TLC was concomitant with Rosales *et al*. (1994); Saxena and Madan (1997) and Rizk *et al*. (2003). However, supplementation of polyherbal formulation Stresroak@1g per kg of feed to birds under overcrowding stress has led to normalization of haematological (Hb, TLC and DLC) values in therapeutic group IV and V at different intervals of study. The normalization in the haematological blood values may be attributed to the efficacy of indvidual constituent herbs of Stresroak namely; *Withania somnifera, Ocimum sanctum, Mangifera indica, Phyllanthus emblica and Shilajit* in ameliorating stress and restoring haemato-biochemical profile.

Biochemical parameters

In various research studies, it is evident that overcrowding stress not only results in poor productivity but also alters the biochemical profile of birds which is the 'indicator of stress'. The mean serum glucose and protein values in untreated and stressed groups were significantly (P<0.01) different from the rest of the treatments at day 15th, 30th and 42nd of study. Group III (210.74±8.55) showed significantly (P<0.01) higher value of serum glucose than negative control group I (174.14±8.61), (Table 4). The findings are in accordance with Puvadolpirods and Thaxton (2000); Scahawat (2000); Khan *et al*. (2002) and Olanrewaju *et al*. (2006), who reported that birds exposed to overcrowding stress resulted in elevation of serum glucose level. Mean serum glucose in therapeutic group IV (25% less space+Stresroak) (180±11.57) and Group V (50% less space+Stresroak) (199.33±13.49) were near to normal as compared to control provided with only normal space and basal diet (group I), but significantly lower than group III (25% less space) (Table 5). These results were concomitant with the findings of Khan *et al*. (2002); Kucuk *et al*. (2003). The Mean values of total serum protein of groups II (25 % less space) at 42nd day was not significantly (P<0.01) different from group IV (Stresroak+25% less space).

Group V (Stresroak+50% less space) showed significant (P<0.01) increase in total serum protein as compared to group III (25% less space) (Table 5). But the mean values of total serum protein in group III was significantly (P<0.01) decreased when compared with group I (control) on 42nd day observation. Similar observation was noted by Kucuk *et al*. (2003) in broilers.

Pathological studies

Stress due to overcrowding is known to exert various detrimental effects, which can also be observed as leisions on

Table 4 Mean (±SE) values differential leukocyte count of broiler chicken before and after treatment of overcrowding stress at different intervals of study*

Interval (day)	Differential leukocytic count (DLC) (%)	Experimental groups				
		I	II	III	IV	V
15th day	Lymphocyte	83.50±1.26[a]	73.16±1.97[b]	70.50±1.10[b]	77.16±0.68[c]	82.16±0.79[a]
	Heterophil	14.50±2.43[a]	14.00±0.94[a]	6.33±1.97[b]	11.33±2.39[a]	12.66±2.95[a]
	Monocyte	8.16±1.21[a]	7.33±0.96[a]	6.50±0.31[a]	7.33±0.65[a]	7.66±1.24[a]
	Eosinophil	7.66±1.24[a]	3.33±1-05[b]	2.33±0.69[b]	4.16±0.36[a]	4.00±0.33[a]
30th day	Lymphocyte	85.50±1.70[a]	77.50±1.79[b]	74.16±2.47[b]	79.83±0.86[b]	78.33±0.96[b]
	Heterophil	14.16±2.83[a]	11.50±1.26[a]	6.16±0.28[b]	13.16±0.36[a]	12.16±0.86[a]
	Monocyte	8.16±1.21[a]	6.16±0.83[a]	3.50±0.39[c]	5.33±1.07[a]	6.16±0.28[a]
	Eosinophil	6.33±1.65[a]	5.16±0.43[a]	3.16±0.28[b]	4.00±0.81[a]	4.33±0.51[a]
42nd day	Lymphocyte	83.83±1.32[a]	80.83±2.02[a]	74.00±2.96[b]	81.83±1.32[a]	79.50±1.37[a]
	Heterophil	14.67±2.76[a]	12.33±0.80[a]	9.16±0.98[a]	12.33±0.79[a]	11.50±1.26[a]
	Monocyte	8.66±1.63[a]	5.66±0.45[b]	3.83±0.55[c]	6.16±0.83[b]	4.66±0.56[b]
	Eosinophil	5.66±0.51[a]	4.33±0.51[a]	3.66±0.69[a]	4.66±0.38[a]	4.33±0.61[a]

*The means that have at least one common letter within the same column, do not have significant difference (P>0.05).

Table 5 Mean (±SE) serum biochemical values of serum glucose (mg/dL) and total serum proteins (g/dL) before and after treatment of overcrowding stress at different intervals of study*

Parameters	Interval (days)	Experimental groups				
		I	II	III	IV	V
Serum glucose (mg/dL)	15th	171.67±12.67[a]	191.83±9.68[a]	205.50±10.70[b]	183.00±14.59[a]	199.33±13.49[a]
	30th	172.6±5.89[a]	199.33±13.49[c]	208.60±7.49[b]	182.50±13.08[a]	193.17±15.15[a]
	42nd	174.17±8.61[c]	193.17+15.15[a]	210.74±8.55[b]	180.00±11.57[a]	199.33±13.49[a]
Total serum protein (g/dL)	15th	5.10±0.65[a]	4.27±0.59[a]	3.15±0.71[b]	4.75±0.41[a]	4.93±0.68[a]
	30th	5.86±0.36[a]	4.75±0.41[a]	3.50±0.59[b]	5.57±0.44[a]	5.10±0.65[a]
	42nd	6.03±0.46[a]	4.95±0.35[a]	4.27±0.59[b]	5.19±0.31[a]	5.86±0.36[a]

*The means that have at least one common letter within the same column, do not have significant difference (P>0.05).

gross organs, such as: liver, kidney, spleen and lungs. For gross pathological studies, organs selected were liver, lung, heart, spleen, kidney and brain. The birds of group III (50% less space) revealed hepatomegaly, paleness with petechial haemorrhages on liver, while severe congestion was evident on lungs with slight enlargement. The rest of the organs did not reveal any appreciable changes. However, the lesions were found to be normalized in treated groups (IV and V).

The gross observations of the present study were in accordance with those of Ghodasara *et al*. (1990); Chauhan and Roy (1996); Takahashi *et al*. (2000) and Aengwanich and Simarakas (2003). The recovery of the gross pathological lesions after treatment with antistressor and immunomodulator product was evident in therapeutic groups. Oyagbemi *et al*. (2008), also, reported that polyherbal formulation Stresroak possesses the hepatoprotective and immunomodulator properties and has ameliorative action in the stressed broiler as evident on histopathological examination.

CONCLUSION

Overcrowding stress depresses the overall growth and performance of the chicken. Supplementation of polyherbal formulation Stresroak in basal diet improved growth and performance parameters viz. body weight and FCR. Serum biochemical and haematological parameters were normalized after the polyherbal treatment. Similarly, no appreciable change in the gross pathology of organs was evident in therapeutic groups. It can be concluded that the product Stresroak can be used in the amelioration of overcrowding stress in poultry.

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