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Physiological Responses of Corticosteroid, Dexamethasone in Broiler Chicken

M Afrose[1], N Sultana[2], M R Islam[3]

[1] Lecturer, Department of Livestock Science and Veterinary Medicine, Bangabandhu Sheikh Mujibur Rahman Science and Technology University, Gopalgonj, Bangladesh

[2]Associate Professor, Department of Anatomy and Histology, Bangladesh Agricultural University, Mymensingh, Bangladesh

[3]Professor, Department of Anatomy and Histology, Bangladesh Agricultural University, Mymensingh, Bangladesh

Abstract: ***The synthetic corticosteroids, dexamethasone (DEX) are widely used in veterinary medicine. Their illicit use as a growth promoter in fattening is well known in animal. The illegal uses of the growth promoters and its residues present in food producing animals may have potential risk for the human health. The present study is aimed to observe the effects of DEX in blood profile of broiler chicken. Ninety 'COBB 500' broilers were divided into control, experimental group A and B. The control, group A and B were maintained with homemade ration, commercial broiler type ration and homemade ration with DEX (7mg/kg feed) respectively in their diets. The percentage of hemoglobin concentration, packed cell volume (PCV), differential leukocyte count (DLC), total erythrocyte count (TEC), productive performance (body weight, dress body weight, feed intake) were investigated at days 7, 14, 21, 28 in broilers. The weight gain and dressed weight of broilers receiving DEX in their diets was significantly lower than that of the control and group 1 on day 14, 21 and 28 (p<0.05). The percentage of TEC, PCV, HB, DLC (neutrophil) is significantly increased at day 28 in group 2 as compared to control and group 1 (p<0.05). Significantly decrease amount of lymphocytes are found in DEX treated group at day 28 (p<0.05). The percentage of monocyte and basophil were remaining normal in all groups of chicken. The present results indicate that DEX had effects in the physiology of broiler chicken.***

Keywords: Growth promoter, Dexamethasone, Blood parameters, Broiler chicken

1. Introduction

Corticosteroids are used as a growth promoting agents for increasing the body weight in livestock legally or illegally (Jeong *et al.,* 2010; Yuan *et al.,* 2008; Serratosa J. *et al.,* 2006). Steroid hormones are applied for increasing the growth rate of broiler to meet up the demand of total meat consumption (Schumacher et al, 2010). At present, the growth promoters are widely used in Bangladesh. Total production of steroids and growth promoters are 0.64 &1.2 tons respectively (Khatun *et al.,* 2016) and 40 tons of feed additives are imported annually in Bangladesh (Turkson *et al.,* 2008). Growth promoters as a feed additives become getting popularity due to their favorable effect on gut health and immunity, and growth performance (Panda *et al.,* 2009). Corticosteroids are a class of steroid hormone that is produced from the adrenal cortex of the adrenal gland of vertebrates. Mainly two classes of corticosteroids, glucocorticoids and mineralocorticoids, which are involved in a wide range of physiological mechanisms, including stress response, immune response, and regulation of inflammation, carbohydrate metabolism, protein catabolism, blood electrolytes balance and behavior of the vertebrates. Glucocorticoids (GCs) are steroid hormones including both natural and synthetic derivatives (Cantiello *et al.,* 2009). Dexamethasone (DEX) is the synthetic derivatives of GCs, which is therapeutically used to combat inflammation or allergy (Watteyn *et al.,* 2013). The administration of these coticosteroids agent is also thought to enhance the animal weight gain through their positive effects on animal health and food intake. In meat cattle industry, DEX is used as a growth promoter alone or in combination with other steroids or β- agonists and is commonly misused for enhancing the growth performance of cattle (Reig *et al.,* 2006; Carraro *et al.,* 2009; Cantiello *et al.,* 2009). The growth promoters used for the promotion of growth of food producing animals may be cancer causing and could adversely affect the human health (Yuan *et al.,* 2008). Human illness caused by the ingestion of the livestock products containing a veterinary drugs residue that is why the European Union (EU) has banned the overuse or long time use of these steroid drugs in food producing animals (Courtheyn et al., 1993). Farmers have gradually decreased the dosages of these drugs in the last 15 years to avoid the punishments due to the preventative action carried out by the public veterinary services though many countries overuses these drugs for fattening of the animals (Tarantola M.*et al.,* 2004). Day by day, over use of steroid growth promoters may alters the cellular elements of blood and causes worst impacts on children's mental and physical growth and women's fertility (Elmajdoub *et al.,* 2016). Therefore, the objective of this study was to determine the effects of DEX in blood profile of broiler chicken.

2. Materials and Method

Birds and Husbandry

A total of ninety, day old broiler chicks ("Cobb 500" strain) were purchased from Provita Feed and Hatchery Ltd., Shombhuganj, Mymensingh and reared in an environmentally controlled room for 28 days at the experimental shed of the department of Anatomy and Histology, Bangladesh Agricultural University, Mymensingh-2202.The brooding temperature was maintained at 35^0 C (65% relative humidity) for the first 2 days and then decreased gradually to 21^0C (45% relative humidity) until 28 day. The light regime was 23 h light: 1 h

darkness. This experiment was performed during January-March, 2018.

Experimental design

Total ninety chicken were divided into three groups (control group, group A, and group B). The birds were then randomly assigned to one of three equal groups; each consists of thirty birds. The control group, group A, group B were reared on homemade feed, commercial broiler type feed and homemade feed with DEX (7mg/ kg feed) respectively. Experiments began after a 3 day adaptation period.

Sampling

To clarify the physical and behavioral changes in control and treated animals the body weight gain, dress broiler yield were recorded. Blood samples were collected after 12 hour feed withdrawal from each broiler direct from the heart at day 7, 14 and from the wing vein at day 21 and 28. Blood samples from seven birds per treatment were collected and transferred to tubes containing EDTA as an anticoagulant. From blood samples, following parameters were measured- Total erythrocyte count (TEC) by electronic cell counter, differential leukocyte count (DLC) performed using staining method (Thanasak *et al.*, 2003). Packed cell volume (PCV) was determined by the manual method using hematocrit tube and centrifuging at 3000 rpm for 30 minutes. Hemoglobin concentration (HB) was measured by acid-hematin method (Aengwanich, 2007).

Statistical Analysis

HB concentration, TEC, DLC, PCV, ESR, total body weight, dress broiler weight were analyzed by using the repeated measurement procedure of the SPSS software. Differences among the mean were identified by Duncans Multiple Range Tests. The level of significance was determined by the P- value ($p< 0.05$).

3. Results and Discussions

Gross observation

Body weight and dress broiler weight in DEX treated group was significantly ($p<0.05$) reduced in comparison to the control group and group A, presented in figure 1and 2 respectively. Chronic consumption of CORT in diet stimulated protein catabolism was further reflected in the significantly suppressed body weight gain and decreased feed efficiency in broiler chickens (Hayashi *et al.*, 1994). The body weight decreased may due to excessive catabolism, muscle atrophy and mobilization of free fatty acids from adipose store. Song *et al.*, 2011 stated that DEX treatment restrained body mass gain and skeletal muscle development due to increased circulating urate which indicates enhanced protein catabolism. Aengwanich, 2007 explained that dexamethasone increases plasma T3 levels and metabolism of protein in muscle which responsible for muscle dystrophy.

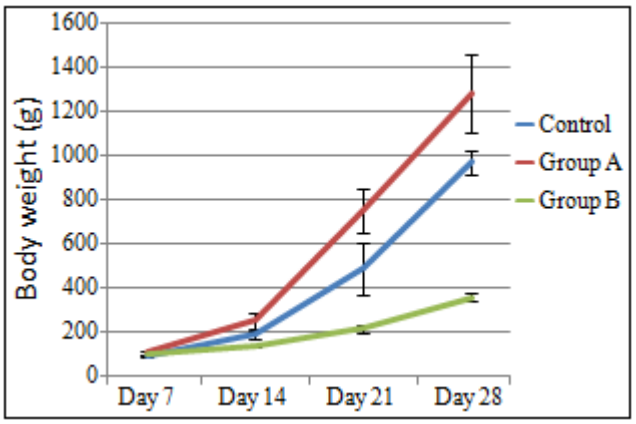

Figure 1: Effects of additional supplementation of DEX on body weight (Mean±SE) of broilers (N=30).

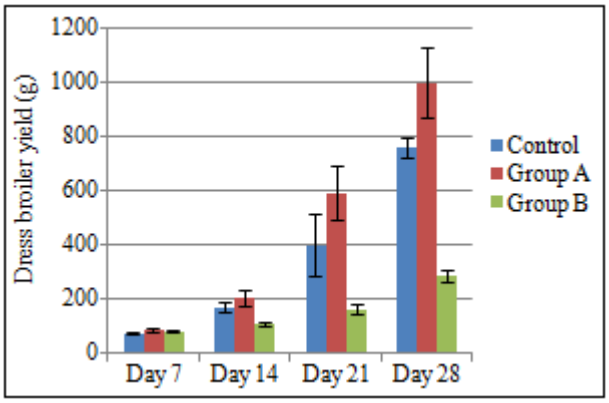

Figure 2: Dress broiler yield (Mean±SE) in different broiler groups after feeding growth promoter.

Haematological parameters

In this study, in case of differential leukocyte count (DLC), the increases of neutrophil count was significant ($p<0.05$) in group B after treatment with DEX. The increase number of may be due to the increase rate of neutrophils in to the blood from the bone marrow and a diminish rate of their removal, this in line with the previous report of Aengwanich, 2007; Vicuna *et al.*, 2015. The similar result also found in cattle (Thanasak *et al.*, 2003; Anderson *et al.*, 1999); in mice (Maziz *et al.*, 2003); and in pigs (Flaming *et al.*, 1994).

Lymphocytopenia was found in DEX treated group at day 28 of the experimental period. The decrease number of lymphocyte may be a relative one, because when the neutrophil count was increases the lymphocyte count decreases respectively. Similar result have been stated by many workers (Aengwanich, 2007; Huff *et al.*, 2005; Thanasak *et al.*, 2003; Anderson *et al.*, 1999; Maziz *et al.*, 2003).

The eosinophil number was decreased numerically in group A and group B in compared to the control group. This may be due to the immunosuppressive activities of the corticosteroid drugs. The changes in the monocyte and basophil count were not statistically significant. Similar results have also been stated by Thanasak *et al.*, 2003 in dairy cow.

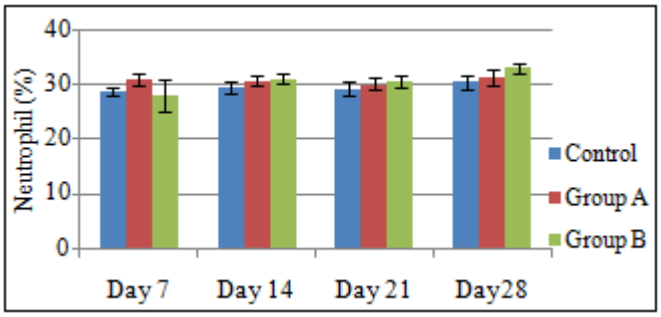

Figure 3: Differential Leukocyte Count (Neutrophil %) in blood; (Mean ± SE)

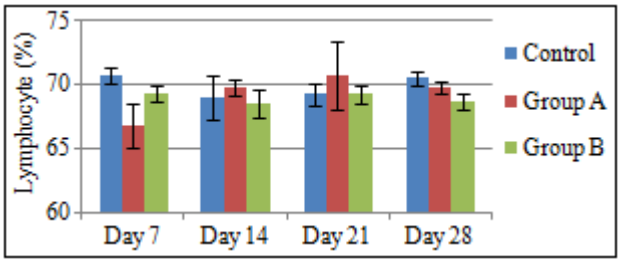

Figure 4: Lymphocyte % of blood in different experimental groups;
(Mean ± SE)

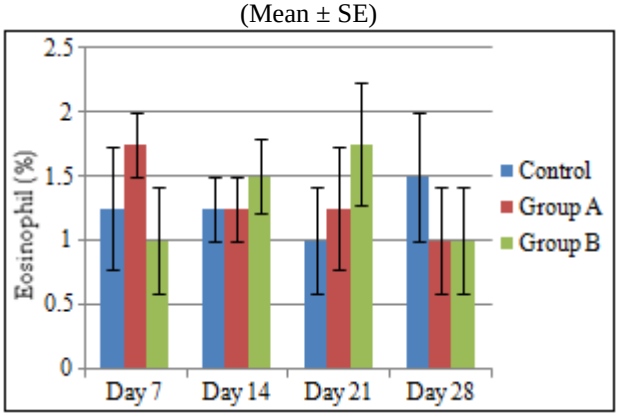

Figure 5: Eosinophil % of blood in different experimental groups; (Mean ± SE)

Treatment with steroid growth promoter (DEX) showed significant ($p< 0.05$) increase of total erythrocyte (TEC) count during the experimental period in group B. Amin, 2002 reported the similar result and the increase TEC may be due to the stimulation of erythropoisis by DEX but cause is unknown yet. Lv *et al.*, 2017 explained that exposure to 20 mg/L of DEX significantly increased hemoglobin (HB) levels and red blood cell count (RBC) at week 5 of experiment of broilers.

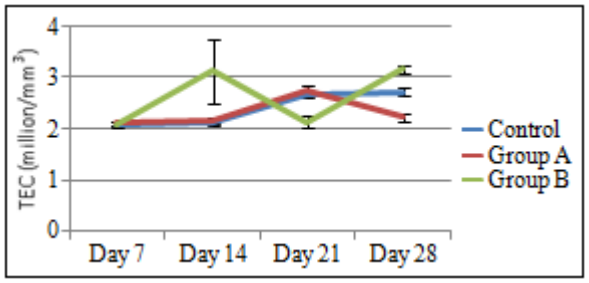

Figure 6: TEC; (Mean±SE) of blood in experimental broiler groups

In the present study, the packed cell volume (PCV) was found significantly increased in DEX treated group in compared to control group and group A. Pyrrho *et al.*, 2004 explained that dexamethasone improved total packed cell volume though the mechanism of produces this effects was unknown. Aengwanich, 2007 reported that broilers treated with dexamethasone 2 mg/kg feed, the PCV was found significantly higher at day 7 and 21.

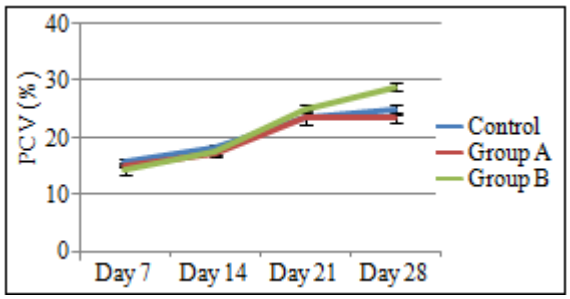

Figure 7: Measurement of PCV of blood in experimental broilers; (Mean±SE)

The hemoglobin content (HB%) increased significantly ($p<0.05$) at day 28 in group B (DEX treated group). The same findings have also been reported by Scott *et al.*, 1979, Aengwanich, 2007, Pyrrho *et al.*, 2004. The increase in hemoglobin content may be due to the increase in total erythrocyte count (TEC).

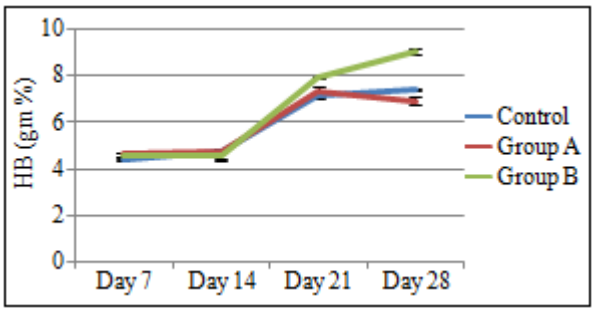

Figure 8: Hemoglobin Content (HB%) of blood; (Mean±SE)

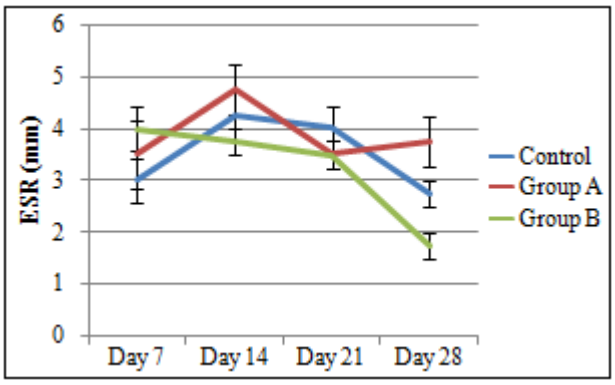

Figure 9: Measurement of ESR in blood of different broiler groups; (Mean±SE)

4. Conclusion

The physiological changes observed when DEX received by the broiler chicken orally. In gross study, it was revealed that exogenous growth promoter supplementation decreased growth of broilers in compared to others group. The body

weight in the group A was highest which followed in descending order in group B. The body weight was significantly ($p<0.05$) decreased in group B at the terminal day of experiment in comparison to that of the control group and group A. Blood parameters like TEC, HB concentration, PCV and neutrophil percentage were increased significantly ($p<0.05$) in the treated group as compared to that of control group and group A at 28 days of the experimental period. Whereas, ESR values were significantly decreased in group B in compared to group A. Finally it was said that DEX has negative effect on growth performance as well as cellular elements of blood of broiler chicken.

References

[1] Aengwanich W 2007: Effects of dexamethasone on physiological changes and productive performance in broilers. *Asian Journal of Animal and Veterinary Advances* 32(2): 157-161.

[2] Amin MR 2002: Effects of oral administration of corticosteroid drugs on some hemato-biochemical parameters in mice.

[3] Anderson B, Watson D, Colditz I 1999: The effect of dexamethasone on someimmunological parameters in cattle. *Veterinary research communications* 23(7): 399-413.

[4] Cantiello M, Giantin M, Carletti M, Lopparelli RM, Capolongo F, Lasserre F, *et al.* 2009: Effects of dexamethasone, administered for growth promoting purposes, upon the hepatic cytochrome P450 3A expression in the veal calf. *Biochemical pharmacology* 77(3): 451-463.

[5] Carraro L, Ferraresso S, Cardazzo B, Romualdi C, Montesissa C, Gottardo F, *et al.* 2009: Expression profiling of skeletal muscle in young bulls treated with steroidal growth promoters. *Physiological genomics* 38(2): 138-148.

[6] Courtheyn, D., Verheye, N., Bakeroot, V., Dal, V., Schilt, R., Hooijerink, H., Bennekom, E. O., Haasnoot, W., Stouten, P. and Huf, F. A. 1993. Detection of corticosteroids in animal feed and premixes: a new category of growth promoters. Proceedings of EuroResidue II 1, p. 262

[7] Elmajdoub A, Garbaj A, Abolghait S, El-Mahmoudy A 2016: Evaluation of boldenone as a growth promoter in broilers: safety and meat quality aspects. *journal of food and drug analysis* 24(2): 284-292.

[8] Flaming K, Goff B, Frank D, Roth J 1994: Pigs are relatively resistant to dexamethasone

[9] Hayashi K, Nagai Y, Ohtsuka A, Tomita Y 1994: Effects of dietary corticosterone and trilostane on growth and skeletal muscle protein turnover in broiler cockerels. *British Poultry Science* 35(5): 789-798.

[10] Holst-Schumacher, I., Barrantes, S. Q., Alpízar, M. Z., and Corella M. R. (2010). Serum sexual steroid hormones and lipids in commercial broilers (*Gallus domesticus*) in Costa Rica. Journal of Applied Poultry Research, 19: 279–287.

[11] Huff G, Huff W, Balog J, Rath N, Anthony N, Nestor K 2005: Stress response differences and disease susceptibility reflected by heterophil to lymphocyte ratio in turkeys selected for increased body weight. *Poultry science* 84(5): 709-717.

[12] Jeong S-H, Kang D, Lim M-W, Kang CS, Sung HJ 2010: Risk assessment of growth hormones and antimicrobial residues in meat. *Toxicological research* 26(4): 301.

[13] Khatun R, Howlader MAJ, Ahmed S, Islam MN, Hasan MA, Haider MS, *et al.* 2016: Impact of Training and Monitoring of Drug Used by Small Scale Poultry Farmers at Different Location of Bangladesh. *American Journal of Food Science and Health* 2(6): 134-140.

[14] Lv ZP, Peng YZ, Zhang BB, Fan H, Liu D, Guo YM 2018: Glucose and lipid metabolism disorders in the chickens with dexamethasone-induced oxidative stress. *Journal of animal physiology and animal nutrition* 102(2): e706-e717.

[15] Maziz MNH, Hamzah I, Abdulla MA 2003: Effect of dexamethasone treatment on the hematological and histological parameters of mice following experimental bacterial infection. *Journal of Animal and Veterinary Advances* 2(4): 231-236.

[16] M. Tarantola, A. Schiavone, G. Preziuso, C. Russo, B. Biolatti and D. Bergero 2004: Effects of low doses of dexamethasone on productive traits and meat quality of veal calves. British Society of Animal Science 79: 93-98.

[17] Pyrrho AS, Lenzi HL, Ramos JA, Moura-Neto R, Cachem FCO, Da Silva CS, *et al.*2004: Dexamethasone treatment improves morphological and hematological parameters in chronic experimental schistosomiasis. *Parasitology research* 92(6): 478-483.

[18] Reig M, Mora L, Navarro JL, Toldrá F 2006: A chromatography method for the screening and confirmatory detection of dexamethasone. *Meat science* 74(4): 676-680.

[19] Scott D, Kirk R, Bentinck-Smith J 1979: Some effects of short-term methylprednisolone therapy in normal cats. *The Cornell Veterinarian* 69(1): 104-115.

[20] Serratosa J, Blass A, Rigau B, Mongrell B, Rigau T, Tortades M, *et al.* 2006: Residues from veterinary medicinal products, growth promoters and performance enhancers in food-producing animals: a European Union perspective. *Rev Sci Tech* 25(2): 637-653.

[21] Song Z, Zhang X, Zhu L, Jiao H, Lin H 2011: Dexamethasone alters the expression of genes related to the growth of skeletal muscle in chickens (Gallus gallus domesticus). *Journal of molecular endocrinology* 46(3): 217-225.

[22] Thanasak J, Jorritsma R, Hoek A, Noordhuizen JP, Rutten VP, Müller KE 2004: The effects of a single injection of dexamethasone-21-isonicotinate on the lymphocyte functions of dairy cows at two weeks post partum. *Veterinary research* 35(1): 103-112.

[23] Turkson P 2008: Use of drugs and antibiotics in poultry production in Ghana. *Ghana Journal of Agricultural Science* 41(1).

[24] Vicuna E, Kuttappan V, Galarza-Seeber R, Latorre J, Faulkner O, Hargis B, *et al.* 2015: Effect of dexamethasone in feed on intestinal permeability, differential white blood cell counts, and immune organs in broiler chicks. *Poultry science* 94(9): 2075-2080.

[25] Watteyn A, Wyns H, Plessers E, Russo E, De Baere S, De Backer P, *et al.* 2013: Pharmacokinetics of dexamethasone after intravenous and intramuscular administration in broiler chickens. *The Veterinary Journal* 195(2): 216-220.
[26] Yuan Y, Xu C, Peng C, Jin Z, Chen W, Liu L 2008: Analytical methods for the detection of corticosteroids-residues in animal-derived foodstuffs. *Critical Reviews in Analytical Chemistry* 38(4): 227-241.