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Haematological Study in Response to Varying Doses of Estrogen in Broiler Chicken

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Abstract: Present study was conducted at the Poultry Physiology Unit, Department of Physiology, University of Karachi. Study evaluated the response of varying Estradiol valerate (a synthetic estrogen) doses in broilers (chickens) on the RBC, ESR and Hb at different ages. Two trials were carried out on 100-day-old broiler chicks. Estrogen was injected in volumes of 1ml, 3ml and 5ml subcutaneously in neck. Birds were bled at every 6-hour for 24 hours. A highly significant difference was noted among the control and treated birds for the parameters evaluated. A decrease in RBC and Hb values with an increase in the ESR was observed. Increasing the dose produced more significant results. Statistical comparison between the control and treated birds was found significant ($P < 0.05$) whereas a non-significant difference was obtained upon comparison between ages i.e. 40 and 50 days for RBC, ESR and Hb values.

Key words: Broiler, estrogen, RBC, Hb, ESR

Introduction

Hematological profiles both in humans and in animal sciences is an important index of the physiological state of the individual. The ability to interpret the state of blood profile in normal and in diseased condition is among its primary tasks. It has been seen by many research workers that there is a definite change in the profile of the blood cells throughout the life (Juhn and Domm, 1930; Vezzani, 1939; Taber *et al.*, 1943; Wintrobe, 1956; Brace and Atland, 1956; Washburn and Myers, 1957; Sturkie and Textor, 1958; Chubb and Rowell, 1959; Jaffe, 1960; Sturkie and Textor, 1960; Prankred, 1961; Gilbert, 1962; Walter *et al.*, 1965; Siegel, 1968; Gilbert, 1968; Burton and Harrison, 1969; Abdel-Hameed and Neat, 1972; Khan *et al.*, 1987). This feature has attracted many workers and still much work is being done. Not only the blood picture changes with the advancement of the age but it also varies with certain conditions as stress, bacterial infection, viral infection and intoxication.

The blood of the domestic fowl contains erythrocytes, thrombocytes, non-granular leukocytes and granular leukocytes, suspended in plasma (Lucas and Jamroz, 1961; Maxwell *et al.*, 1979).

Most workers have studied the avian blood and found a great degree of variation for R.B.C. and considered it to be normal (Chubb and Rowell, 1959). It was concluded after an extensive study that R.B.C. and other parameters as Hb and E.S.R. of a bird vary among species, other factors, which affect the counts, include breed, sex and the nutrition supplied to the bird (Sturkie, 1965).

It is well documented from research studies that injecting synthetic estrogen results in an increase in the E.S.R. value and decrease in the circulating erythrocytes per unit of blood. A part from this estrogen is also known

to induce hyperlipemia in birds (Lorenz *et al.*, 1938; Zondek and Marx, 1939). This hyperlipemia is approximately proportional to the degree of sedimentation, keeping other things to be equal (Gilbert, 1962). Estrogen administration to chickens tends to decrease metabolism (Bird, 1946), and activity and fattening effects may be attributed in part to these factors. A slight over weight of the estrogenated birds is the result of increased abdominal fat and not actual growth and it also improves the grade of carcass of males. This has been demonstrated in broilers, roasters and cocks (Thayer *et al.*, 1945).

Female castrates (poultards) have the same number of red cells as normal females, indicating that estrogen has no positive effect on erythropoiesis but the androgen does (Sturkie, 1965; Gilbert, 1963).

It is reported from several research studies that the administration of estrogen to adult cock or to sexually immature Coturnix (quail) depresses the erythrocytes volume and presumably its number from 3.2 million to 1.6 million in males and from 3.19 to 1.44 million in females (Gilbert, 1963; Nirmalan and Robinson, 1972). The mean E.S.R. ranges from 0.5 to 9 mm/hr with most falls b/w 0.5 to 4 mm as reported by Sturkie (1965). The sedimentation rate is effected greatly by number of cell and to a lesser extent by the cell size (Sturkie and Textor, 1960; Gilbert, 1968). Hyperlipemia produced by estrogen (Gilbert, 1962) increases the sedimentation rate significantly.

Materials and methods

One hundred broiler chicks (specie: *Gallus domesticus*, breed: Arbor Acres), were obtained (day old) from Sarban poultry breeders and reared on deep litter at the farm of Poultry Physiology Unit of Department of

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Table 1: Haematological values of broiler chicken (Age 40 and 50 days)

Parameters	Control	Estrogen dose ml	Treated	
			40 Days post hatch	50 days post hatch
RBC (million per cu mm of blood)	2.84±0.02 (10)	1	2.11±0.09 (10)	2.35±0.05 (10)
		3	2.07±0.08 (10)	2.28±0.06 (10)
		5	1.96±0.03 (10)	2.23±0.07(10)
Hemoglobin (gm per dl)	10.23±0.11 (10)	1	8.45±0.36 (10)	8.90±0.35 (10)
		3	8.08±0.38 (10)	8.60±0.35 (10)
		5	7.73±0.41 (10)	7.63±0.43 (10)
ESR (mm in 1st hour)	5.01±0.07 (10)	1	17.33±3.41 (10)	19.18±4.25 (10)
		3	20.70±4.33 (10)	22.48±4.56 (10)
		5	25.25±4.97 (10)	27.25 ±5.61 (10)

All values are shown as Mean ± Standard Error

Physiology, University of Karachi and fed ad libitum on broiler starter and finisher obtained commercially.

Ten (10) birds per group were bled from brachial vein using sterile disposable syringe (23 gauge). Samples were obtained at an interval of 6 hours from the time of administering estrogen for 24 hrs. Sodium citrate (3.8%) freshly prepared was the anticoagulant of choice (Shum and Griminger, 1972). Investigations included total RBC count, Hb concentration and ESR and determined as described previously (Cook, 1937; Olson, 1937).

The results so obtained were subjected to statistical analysis using students T-test.

Estradiol valerate: Estrogen in the form of Estradiol valerate is available locally as synthetic estrogen by the name of Progynon Depot 10mg, a product of SCHERING pharmaceuticals, Germany.

One ml of the Progynon depot contains 10 mg of estradiol valerate in oily solution. The synthetic estrogen in the form of estradiol valerate was injected in different doses of 1ml, 3ml and 5ml to the birds of age 40days and 50 days, sub-cutaneously in the neck.

Results and Discussion

Estrogen, a steroidal hormone secreted by ovaries enhances lipid metabolism, increases sedimentation rate of red blood cells and lowers the count of red blood cells. Present study was designed in the light that limited reports have been made on the effect of estrogen on broiler chickens. Two age groups of broilers were used in this study i.e. 40 and 50 days post hatch. Moreover the parameters, which were evaluated, included total red blood cell count, hemoglobin concentration and erythrocyte sedimentation rate. Results for control and treated (estrogenized) bird at the age of 40 and 50 days post hatch are summarized in Table 1. A significant difference has been obtained between the control and treated birds at the age of 40 and 50 days. Whereas a comparison between the ages i.e. 40 and 50 days revealed a non-significant difference. The blood profile at 40 days of age showed a highly

significant decrease (Fig. 1) in total red blood cell count from $2.84 \times 10^6 \pm 0.021 (10)/ \text{cu mm}$ in control birds to $2.11 \times 10^6 \pm 0.09 (10)/ \text{cu mm}$, $2.07 \times 10^6 \pm 0.08 (10)/ \text{cu mm}$ and $1.96 \times 10^6 \pm 0.03 (10)$ in treated birds upon injecting 1, 3 and 5 ml of synthetic estrogen respectively. Similar results were obtained at 50 days of age (Fig. 1) i.e. $2.35 \times 10^6 \pm 0.05 (10)/ \text{cu mm}$, $2.28 \times 10^6 \pm 0.06 (10)/ \text{cu mm}$ and $2.23 \times 10^6 \pm 0.07 (10)/ \text{cu mm}$ for 1, 3 and 5 ml respectively. This decrease in total RBC count might be the result of hemodilution, which is in accordance to the findings of Gilbert (1962), Nirmalan and Robinson (1972).

A significant difference was also obtained for the hemoglobin estimation for control and treated birds (Fig. 2) at 40 and 50 days. The hemoglobin reduced from $10.23 \pm 0.11 (10) \text{ gm/dl}$ in control to $8.45 \pm 0.36 (10) \text{ gm/dl}$, $8.08 \pm 0.38 (10) \text{ gm/dl}$ and $7.73 \pm 0.41 (10) \text{ gm/dl}$ at 40 days of age in treated birds upon injecting 1, 3 and 5 ml of synthetic estrogen respectively. At the age of 50 days these results were more pronounced (Fig. 2) and reduced to $8.90 \pm 0.35 (10) \text{ gm/dl}$, $8.60 \pm 0.35 (10) \text{ gm/dl}$ and $7.63 \pm 0.43 (10) \text{ gm/dl}$ of hemoglobin in response to 1, 3 and 5 ml of synthetic estrogen respectively. This decrease in hemoglobin concentration was a result of less number of RBC per ml of blood. Since estrogen is reported to reduce circulating erythrocytes per unit of blood by inducing hemodilution (Gilbert, 1963 and Nirmalan and Robinson, 1972).

Moreover sedimentation rate in 1st hour increased significantly (Fig. 3) from $5.01 \pm 0.07 (10) \text{ mm}$ in control to $17.33 \pm 3.41 (10) \text{ mm}$, $20.70 \pm 4.33 (10) \text{ mm}$ and $25.25 \pm 4.97 (10) \text{ mm}$ in treated birds of 40 days when injected with 1, 3 and 5 ml of synthetic estrogen respectively. Similar results were also obtained for the birds' aged 50 days i.e. $19.18 \pm 4.25 (10) \text{ mm}$, $22.48 \pm 4.56 \text{ mm}$ and $27.25 \pm 5.61 \text{ mm}$, when injected with 1, 3 and 5 ml of estrogen respectively. This increased rate of erythrocyte fall is the result of hyperlipaemia i.e. increased plasma lipoprotein, induced by estrogen. As these lipids gets coated on the surface of RBC there by increasing its rate of fall (Nirmalan and Robinson,

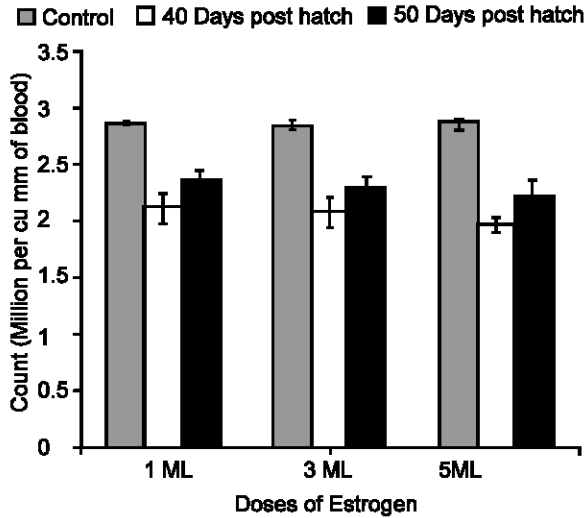


Fig. 1: Effect of different estrogen doses on RBC count at 40 and 50 days post hatch in chickens

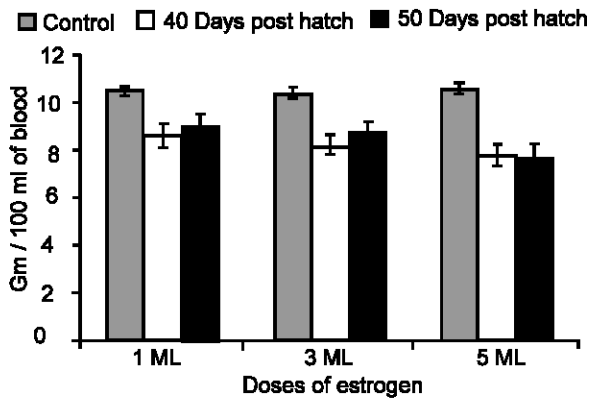


Fig. 2: Effect of different estrogen doses on Hb at 40 and 50 days post hatch in chickens

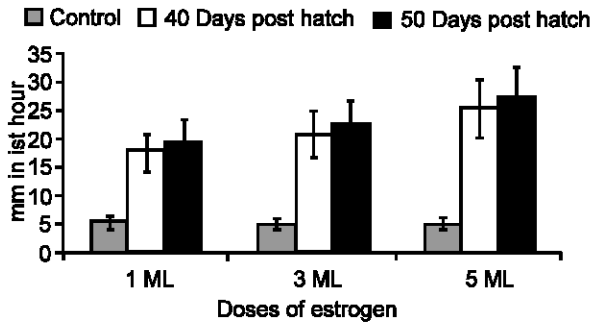


Fig. 3: Effect of different estrogen doses on EST at 40 and 50 days post hatch in chickens

1972). This effect is very much similar to Nicarbazin (Sturkie and Textor, 1960). Moreover a comparison between ages of 40 and 50 days revealed no significant difference. It can be concluded from the results obtained that

estrogen decreased total RBC count, hemoglobin concentration and increases ESR by inducing hemodilution and hyperlipaemia, but it did not appear to affect the blood parameters by altering individual red blood cells.

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