The Changing of Broilers'Blood Component at Various Environmental Temperatures and Times of Sampling

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ABSTRACT

This study was conducted to evaluate the effects of environmental temperatures and ages (time of sampling) on erythrocyte number (Er), hemoglobin concentration (Hb) and hematocrite value (Hm). Ninety 14-d old broilers were used in 3 x 4 completely randomized design in split plot 3 x 4 reared in three environmental chambers (25.55±1.45; 29.29±1.27 and 31.59±1.05°C as T1, T2 and T3 respectively), and four times of sampling (0, 4, 8 and 16 days after factor of treatment environmental temperature as S0, S4, S8 and S18 respectively). The results showed in general that T2 and T3 significantly increased in Er and Hm. The numbers of erythrocyte and presentation of hematocrite of T3S4 were higher and T1S8 were lower than all. The level of hemoglobin of S0, were higher than the others. It was concluded that a high environmental temperature and time sampling could affects the blood component of broilers.

Key words: temperature, time of sampling, blood component, broilers

INTRODUCTION

The global environmental temperature issue that will increase the environmental temperature is one of major concern for poultry producers. The increasing of environmental temperature will affect on industry of animal husbandry. It causes, besides will affect on hormonal system, digestibility of protein, availibility of antioxidant and the increasing of the free radical, the heat stress will affect the biochemistry and component of blood.

Lu *et al*. (2007) reported that feed consumption and body weight gain of broilers reared at temperature of 21°C (from 5 to 8 weeks of age) were 169.9 g/d, and 61.45 g/d respectively, significantly higher than for those reared at 34°C with feed consumption and body weight gain of 93.6 g/d and 22.29 g/d respecticely. However, feed to gain ratio increased from 2.76 at low temperature to 3.92 at high temperature.

Sugito *et al*. (2007) and Kusnadi *et al.* (2009) approved from their experiments that heat stress could reduce growth rate as well as level of the hormone triiodothyronin (T_3) in blood plasma of broiler chicken. As calorigenic factor T_3 has function to increase oxygen consumption for metabolisme through what the increment of growth rate could be gained.

Harlova *et al*. (2002) reported that erithrocyte, leucocyte, hemoglobin and hemotocrite of heat-stressed were significantly lower than control. Similar result was showed by Kusnadi (2008), that blood component of broilers 4 and 6 weeks of age reared at 33.5°C, significantly lower than 28.55°C. Zhang *et al*. (2007) reported that erithrocyte, hematocrit and hemoglobin of broiler reared at low altitude (100 m) were 1770000/mL, 29.73% and 9.49 g/mL, significantly lower than at high altitude (2900 m) of 2860000/mL, 36.49% and 10.45 g/mL respectively. The objective of the present study was to evaluate the effect of environmental temperatures and times of sampling on blood component of broilers.

MATERIALS AND METHODS

Ninety 14-d old broilers with 500 - 600 g of body weight were used as materials. The treatments had two factors, the first factors were three environmental temperatures (25.55±1.45; 29.29±1.27 and 31.59±1.05°C as T1, T2 and T3 respectively) and the second factors were four times of sampling (0, 4, 8 and 16 days after factor of environmental temperature as S0, S4, S8 and S18 respectively). The ration used was commercial feeding from Comfeed Industry. The

ration and dringking water were always available or *ad libitum*.

The measured variables consisted of erythrocyte number, level of hemoglobin and presentation of hematocrite. All those variables were measured with autohematology analyzer used spectrophotometer. The experimental design used was a completely randomized design in split plot 3 x 4 (three environmental temperatures, four times of sampling) with six replications, respectively. Data collected were analysed with analysis of variance (ANOVA) and Duncan multiple range test (DMRT) was further used to test the significant differences (Steel and Torrie, 1993).

RESULTS AND DISCUSSION

Analisis of variance resulted that interactions of environmental temperature x time of sampling affected significantly ($P<0.05$) on erythrocyte and hematocrite, only factor of time of sampling affected significantly ($P< 0.05$) on hemoglobin. The average of erythrocyte, hematocrite and hemoglobin were showed in Table 1.

Table 1 showed that the average of erythrocyte of T3S4 was 2763000 pieces/ mm^3. It was significantly higher than T2S4 and T1S4 (2193000 pieces/ mm^3 and 1987000 pieces/ mm^3 respectively). On 8 days of sampling, all of erythrocyte number decreased but the erythrocyte of T1S8 was still the lowest than the others. However on S16, all of that erytrhocyte increased especially in T1S16 (2330000 pieces/mm^3) higher significantly than T2S16 (2093000 pieces/mm^3) and T3S16 (2103000 pieces/mm^3).

The increasing of erythrocyte of T3S4 (Table 1), may be related to reduced blood oxygen saturation. This result was agreed with research of Olanrewaju *et al*. (2007). The oxygen was needed to increase the metabolic activity to meet the energy demands for both maintenance and growth under relatively extreme stressfull condition (Luger *et al*., 2003). In others sampling, the erythrocyte of T2 and T3 especially at 16 days of sampling (T2S16 and T3S16) were lower than of T1S16. This was caused, the birds had adapted with environmental temperatures and in turn decreased in erythrocyte number and their productivity (Harlova *et al*., 2002; Kusnadi, 2008).

Furthermore, Table 1 showed that the presentation of hematocrite of T3S4 and T2S4, significantly higher than T1S4 and presentation of hematocrite of T3S8 and T3S8, significantly higher than T1S8. This result is equal with result of erythrocyte. The increasing of hematocrite in T2 and T3, may be related to the increased muscle activity and the concomitant movement of water from plasma to muscle, leading to an increase in erythropoiesis as a compensatory reaction to the lack of sufficient oxygen in the tissue, possibly because of impaired oxygen-carrying capacity in the blood. The increasing of hematocrite in T2 and T3, may be due to many factors, such as enchanced erythropoiesis because of high levels of corticosterone (CS) or diminished plasma volume (Maxwell *at al*., 1990; Yahav *et al*., 1997; Luger *et al*., 2003; Olkowski *et al*., 2005).

Table 1. Average of erythrocyte, hematocrite and hemoglobin of broilers at various environmental temperature and times of sampling

Environmental Temperature	Time of sampling (days)				
	S0	S4	S8	S16	average
	erythrocyte (piece/mm^3)				
T1	1980000^{b}	1986667^{b}	1756667^{a}	2330000^{c}	2013333
T2	2000000^{b}	2193333^{b}	2063333^{b}	2093333^{b}	2087500
T3	2019000^{b}	2763333^{d}	2050000^{b}	2103333^{b}	2233917
Average	1999667	2314444	1956667	2175556	
	hematocrite (% of blood)				
T1	28.33333^{c}	26.33333^{b}	23.33333^{a}	30^{cd}	27
T2	28^{c}	29^{cd}	27.33333^{b}	27.33333^{b}	27.91667
T3	27.58^{b}	30.33333^{cd}	26.33333^{b}	26.66667^{b}	27.72833
Average	27.97111	28.55556	25.66667	28	
	hemoglobin (mg/dL)				
T1	11.86667	10.56667	9.033333	11.5	10.74167
T2	11.567	11,5	10.6	10.86667	11.13342
T3	11.99	11.86667	10.5	10.53333	11.2225
Average	11.80789^{c}	11.31111^{bc}	10.04444^{a}	10.96667^{b}	

Note: mean with different suppercripts within a row/column differ ($P< 0.05$).

In this study, concentration of hemoglobin S8 were lowest than others. This result is equal with decreasing in erythrocyte and hematocrite. The increasing of hematocrite in S16, may be caused the bird of S16 had adapted with environmental temperatures (Harlova *et al*., 2002; Kusnadi, 2008).

CONCLUSIONS

The numbers of erythrocyte and presentation of hemathocryte of T3 at 4 days sampling (T3S4) were higher than all treatments; however it was the lowest at 8 days sampling of T1 (T1S8). The level of hemoglobin of S0, were higher than the others.

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