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LEVELS OF HORMONES TRIIODOTHYRONINE AND PLASMA BLOOD GLUCOSE BROILER STARTER DUE TO HEAT STRESS AND PRELIMINARY DIFFERENCE FEEDING TIME

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Abstract

The study was conducted to know blood glucose and triiodothyronine levels of broiler starter due to heat stress and different initial-time feeding. The material used in this study was 64 male DOC broilers of Lohmann strain with the average initial weight of 47.98 ± 2.24 g. The experiment was designed based on randomized block design with a 2x2 factorial and four replications. The treatment combinations as follow: S1W1 = low temperature, feeding 12 hours post-hatching; S1W2 = low temperature, feeding 24 hours post-hatching; S2W1 = high temperature, feeding 12 hours post-hatching; S2W2 = high temperature, feeding 24 hours post-hatching. The Data were Analyzed by using ANOVA. If there was a significant effect (P <0.05) or very significant effect (P <0.01) in Followed by Duncan's test. The result Showed that heat stress treatment significantly affected (P <0.05) to the triiodothyronine level, while initial feeding treatment had no significant effect. Also, blood glucose levels had no significant effect due to the treatments. It concluded that heat stress negatively affected by the blood glucose and triiodothyronine levels of broiler starter. The initial-time feeding has no effect on the blood glucose and triiodothyronine levels. Interactions between treatment and different temperature-time initial feeding have no effect. Nevertheless, the low temperature treatment and initial feeding of 12 hours post-hatching shows the best results with blood glucose 246.25 ± 9.91 mg / dl and triiodothyronine of 2.05 ± 0.14 ng / ml.

Keywords: Heat Stress; Initial Feeding; Blood Glucose; Triiodothyronine.

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1. Introduction

One of the main problems faced by broiler farm in tropical regions that high ambient temperature comfortably above the temperature of chicken. Broiler comfortable temperature is 18-22^{0}C (Charles, 2004). In tropical areas (eg Indonesia), the ambient temperature during the day can reach 34°C (Kusnadi and Rahim, 2009). It is triggered hot. A stressful condition stress is compounded by the initial management of post-hatching feeding time is wrong that broiler growth period starter becomes maximal (Tamzil *et al*., 2013).

A few days after hatching is a critical time period or in the growth and development of the commercial broiler body (Wahju, 2004). The error management during this period can lead to disruption of growth in the next period. In connection with this, the feed intake should not be delayed so that the energy and protein needs are met immediately. According to Bhanja *et al*.,(2009), in the presence of food or nutrients that meet the needs of broiler cause digestive tract will grow and the digestive enzymes can rapidly secrete.

Research Sugito *et al*., (2007) proved that the hormones triiodothyronine (T3) plasma of broiler chickens on day 5 of treatment of heat stress decreased from 1.53 to 1.04 pg/ml. This situation is likely to accelerate the decline in production because the hormones T3was instrumental in the growth through increased oxygen consumption and metabolic systems (Geraert *et al*.,1996; Decuypere and Buyse, 2005).

Stress conditions will reduce or inhibit the production of thyroid stimulating hormone(TSH) from the anterior hifofisis so that the production of T3/ T4by the thyroid gland becomes low (Hafez, 1968). The fall in production followed by the low content of hormones T3plasma in broiler chickens evidenced also by Kusnadi and Rahim (2009). The fall in production in conditions of heat stress, other than because of the low content of hormones T3plasma, also reinforced with reduced nitrogen retention, which can decrease the digestibility of protein and amino acids (Geraert *et al*., 1996; Tabiri *et al*.,2000; Virden *et al*., 2007), but increased plasma levels of the hormone corticosterone (Yunianto *et al*.,1999).

Thyroid hormones are also able to increase the speed of blood glucose and galactose absorption through the gut. Thyroid hormones also increase the intake of glucose and its use in the cells of the body (Djojosoebagio, 1990). Mumma *et al*.,(2006) reported that heat stress can lower blood glucose levels. Based on the description above, an examination for hormone know the levels of triiodothyronine and plasma blood glucose broiler starter due to heat stress and differences early post-hatch feeding time.

2. Materials and Methods

The research material used is 64 tail DOC broiler strain Lohmann (CP 707) which is produced by PT. Charoen Pokphand Jaya Farm, with the criteria of the average male and standard body weight of 47.98 ± 2.24 g.

The research method is experimental in vivo study using a randomized block design (RAK) factorial (2x2) with four replications. The first factor is the treatment temperature stress (S) and the second factor is the start time of feeding (W). Combination treatment as follows: S1W1 =

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low temperature, fed 12 hours after hatching; S1W2 = low temperature, fed 24 hours after hatching; S2W1 = high temperature, fed 12 hours after hatching; S2W2 = high temperature, fed 24 hours after hatching. Treatment temperature settings as follows: Low temperature = Week I (31-33^{0}C), the second week (28-30^{0}C), the third week (26-280C). High temperature = Week I (34-360C), the second week (31-33 ^{0}C), the third week (29-31^{0}C).

Livestock is kept for 14 days and is divided into 16 units' experimental cages each measuring 1x1x1 m and is equipped with a feed, drink thermometer, thermostat and a heating lamp of 60 watts. Heat stress treatments using a heat source form help helpless 60-watt bulbs. Each block is equipped with a thermostat and the temperature of the thermometer to set the temperature to remain stable under conditions appropriate treatment of heat stress. Cage covered with a white plastic curtain as an effort so that the temperature remains stable. At noon, the side curtain is opened so that the ammonia in the cage out and does not accumulate inside. In the afternoon until noon curtains closed.

Temperature and humidity measurement is done in the morning (06.30 GMT), noon (12:30 pm) and afternoon (17:30 pm). Temperature and humidity measurements were done with the help thermohydrometer installed on the side of the cage. Temperature and humidity data obtained in the morning, afternoon and evening then averaged to obtain the average weekly temperature and humidity.

Blood plasma was taken on the 14th day of the wings by using a disposable syringe.The blood sample is then transferred into a vacuum tube anti-coagulant *Ethylene diamine tetraacetic acid* (EDTA) to analyze blood glucose levels and triiodothyronine. Plasma triiodothyronine hormone levels were tested and blood glucose. Blood glucose levels were analyzed using the GOD-PAP method, appropriate work instructions KIT catalog number 676 543 (Mannheim, 1998) measured by a spectrophotometer. While triiodothyronine levels were measured using ECLIA (*electrochemiluminescence immunoassay*). The data obtained were analyzed using analysis of variance (ANOVA) with the help of Microsoft Excel 2016. If the program is significantly different ($P < 0.05$) or highly significant ($P < 0.01$) followed by Duncan's test.

3. Results and Discussion

3.1. Effect of Treatment of Levels of Triiodothyronine (T3)

Growth is influenced by many factors. In addition to the feed consumption and the temperature of the enclosure, the growth is also influenced by other factors, namely the hormonal system, one of which is the hormone triiodothyronine (T3). Berdasarkan Table 1 temperature factors influence treatment effect ($P < 0,01$) to triiodothyronine hormone levels broiler at the age of 2 weeks while the initial factor feeding time did not give significantly different effect. At the temperature factor is seen that at low temperatures, the average levels of the hormone T3 higher than the levels of the hormone T3 at high temperatures respectively of 2.06 ± 0.16 ng / mL and 1.65 ± 0.07 ng / mL, this proves that heat stress has a negative impact on levels that are lower triiodothyronine levels.

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The results are consistent with research Sinuratetal., (1987); Yahav and McMurtry (2001); Kusnadi and Rahim (2009) reported that along with the increase in temperature will lead to further fall plasma levels of hormones triiodothyronine broiler. Sugito *et al*., (2007) also proved that the hormones T3 broiler on day 5 of treatment of heat stress decreased from the previous 1.53 to 1.04 ng / mL. This situation, according to Geraertetal., (1996) and Decuypere and Buyse (2005) will accelerate the decline in production performance. This is because of the hormones triiodothyronine active role in supporting growth through increased oxygen consumption and metabolic systems streamline.

Table 1: Mean triiodothyronine levels (ng/ml) Day to-Temperature(S) The start time of feeding (W) Mean

Day to-	Temperature (S)	Early feeding time (W)		Average
		W1	W2	
14	S1	2,05 ± 0,14	2,07 ± 0,20	2,06 ± 0,16 b
	S2	1,61 ± 0,04	1,69 ± 0,08	1,65 ± 0,07 a
	Average	1,83 ± 0,25	1,88 ± 0,25	

Description: different superscript letters in the same column (a, b) shows highly significant (P <0.01). S1 = Low temperature; S2 = High temperature; W1 = Initial feeding time 12 hours; W2 = Early feeding time 24 hours.

Low levels of the hormone T3 on the condition of high environmental temperature or the state of heat stress (S2W1 and S2W2) compared to treatment of low temperature (S1W1 and S1W2) in this study, according to Decuypere and Buyse (2005) due to T3 is a hormone that is classified kalorgenik, so as to reduce the effects of heat stress from high temperatures the secretion of T3 will decrease. Research Lin *et al*., (2008) reported that the decrease in levels of the hormone T3 in the broiler by methimazole (anti-thyroid compounds) also followed by increasing levels of the hormone corticosterone. Shibata *et al*., (2007) explains that corticosterone hormones needed to maintain blood glucose levels through the process of gluconeogenesis that comes from the breakdown of protein. This is why the growth is reduced. Thormone3 in the body has a function for growth including the synthesis of proteins through increased feed intake and oxygen required in the process of metabolism.

Decuypere and Buyse (2005) explain that the secretion of thyroid hormones (T3/ T4) were decreased in hot temperatures begins with the arrival of warmer temperatures on the hypothalamus so that the production of TRF (TyrotropinReleasingHormone) by the anterior pituitary is reduced. The TRF Decrease impact the anterior pituitary TSH production will be lower. A decrease in TSH will be followed by a decrease in the production of hormones T3/ T4 produced. In contrast, hormone T3/ T4 will be stimulated at comfortable temperature conditions that will lead to increased growth.

At the age of 2 weeks, the low temperature treatment had higher levels of hormones T3 average is 2.05 ± 0.14 ng / mL (S1W1) and 2.07 ± 0.20 ng / mL (S1W2) higher than the high temperature treatment or the temperature of heat stress which only amounted to 1.61 ± 0.04 ng / mL (S2W1) and 1.69 ± 0.08 ng / mL (S2W2). High levels of the hormone T3 at a low-temperature treatment (S1) than the high-temperature treatment (S2) at 2 weeks of age broiler based on Table 5 shows that growth at a low-temperature treatment faster than the temperature high treatment.It can be

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concluded that the low-temperature treatment is the broiler maintenance method is recommended. Yunianto Research (1998) reported that T4 and T3 in the plasma plasma decreased very real, with increasing ambient temperature. Differences early post-hatch feeding time in this study showed no significant differences (P> 0.05). This is probably caused by a precursor of T3 was not affected by the initial feeding time significantly. Precursor T3 more influenced by temperature stress, as evidenced by the significant differences in the factor of temperature treatment.

3.2. Effect of the Treatment of Blood Glucose in the Blood Glucose Level

Data broiler starter period due to heat stress treatment and the initial difference feeding time is shown in Table 2.Hasil showed that the treatment temperature and the heat stress early time different feeding on blood glucose levels at each treatment showed no significant difference in mean values ranged from 231.00 to 246.25 mg /dL. This value is still within normal limits. According to Sulistyoningsihetal.,(2014), the blood glucose levels in broiler chickens based on the research results which ranged from 230-370 mg / dL while according Djojosoebagio (1990), broiler blood glucose levels ranged 200-250 mg / 100ml.

Feeding 12 hours and 24 hours post-hatch does not give a significantly different effect on blood glucose levels (P> 0.05). Blood glucose levels broilerperiod starter were not significant in this study was supported by research and Sklan Noy (2001) which states that the glucose levels in chicks aged 2, 4 and 7 days fasted and fed showed significantly different results. The research report of Turner *et al*., (1999) and Sklan Noy (2001) indicated that the birds can regulate plasma glucose concentrations after hatching, except when fed a high carbohydrate. This explains why the research on the initial different feeding time does not give significant results as shown in Table 2.

Table 2: Mean blood glucose levels (mg/dl) Day to-Temperature(S) The start time of feeding (W) Mean

Day to-	Temperature (S)	Early feeding time (W)		Average
		W1	W2	
14	S1	246,25 ± 9,91	242,50 ± 17,37	244,38 ± 13,24
	S2	243,75 ± 4,19	231,00 ± 0,82	237,38 ± 7,37
	Average	245,00 ± 7,17	236,75 ± 12,94	

Description: there is no significant difference (P> 0.05). S1 = Low temperature; S2 = High temperature; W1 = Initial feeding time 12 hours; W2 = Early feeding time 24 hours.

The treatment temperature stress and differences early post-hatch feeding time which does not lower the blood glucose levels of plasma broilerperiod starter in this study due to the strong possibility of egg yolk still remains in the body of broilers of each treatment. The result is the energy reserves in the form of glucose from egg yolk and feeds given because blood glucose levels broilerperiod starter did not experience deterioration. It is also the reason why blood glucose levels in this study showed no significant differences (P> 0.05).

Research Yunianto (1998) shows the catecholamines plasma that epinephrine was significantly higher in the chickens are kept at a temperature of 16^0C compared with those maintained at a

temperature of 25oC and 34oC, while there is no difference between the temperature of 25^0C and 34^0C. These results are in accordance with the stated Lin and Strurkie (1986) in 1998 Yuniantoa), the chickens after 12 weeks of trial, in cold environments epinephrine increased compared to the hot temperatures. Epinephrine compensates for insulin that suppresses blood glucose levels in a way to initiate the breakdown of glycogen, both liver, and muscle, increase blood glucose levels (Frandson, 1992). So the lower the ambient temperature the higher the blood glucose levels. This study also provides such results, though statistically significant blood glucose levels were not significantly different. This is understandable due to low temperatures in this study (at 26^0C-28^0C) is not as low as in research Yunianto (1998) which provides significant results at a temperature of 16^0C while the temperature of 25^0C and 34^0C was not significantly different.

4. Conclusion

Heat stress negatively affects hormone levels and blood glucose plasma triiodothyronine broiler starter period. Differences early post-hatch feeding time does not affect hormone levels and blood glucose plasma triiodothyronine broiler starter period. Interaction treatment temperature and the difference early post-hatch feeding time does not affect hormone levels and blood glucose plasma triiodothyronine broiler starter period. Low-temperature treatment and early feeding 12 hours after hatching show the best results with your blood glucose levels 246.25 ± 9.91 mg/dl and triiodotironin2, 05 ± 0.14 ng/ml.

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