

The Effect of Lighting Duration and Light Intensity on the Level of Triiodothyronin Hormone in Arabic Chicken (*Gallus turcicus*)

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Abstract— This study was to know the temperature, humidity, and the level of triiodothyronin hormone (T3) of the Arabic chicken in the difference of light intensity and lighting duration. The material were 36 layer phase Arabic chicken. This study was an experimental study which used 2x2 completely randomized factorial pattern. The treatment combination were I1L1 (16 hours of 5 watt bulb lamp); I1L2 (18 hours of 5 watt bulb lamp); I2L1 (16 hours of LED lamp); and I2L2 (18 hours of LED lamp). The chicken were caged on battery cage for 9 weeks. The data were analyzed using ANOVA in the assist of 2013 Microsoft Excel. When the result was significantly ($P < 0.05$) or very significantly different ($P < 0.01$), it will continued by Duncan's test. The result showed that triiodothyronin hormone level of Arabic chicken significantly affected by lighting duration but not by light intensity. In general, the average of temperature and humidity in bulb lamp (I1L1 and I1L2) group was 30.89°C and 69.91% and the average of temperature and humidity in LED lamp (I2L1 and I2L2) group was 29.41°C and 76.86%. The conclusion of this study was prolonged lighting duration would effect negatively on Arabic chicken physiology, but different lighting intensity would not affect Arabic chicken triiodothyronin hormone level.

Keywords— Arabic chicken, lighting intensity, lighting duration.

I. INTRODUCTION

Lighting is an important parameter for chicken productivity which can be a strong exogen factor in control a lot of physiological system and behaviour. Lighting can be used in synchronize a lot of essential system such as body temperature and metabolism system that affect eating activity and digestion. Lighting also stimulates some hormone secretion which control growth, maturity, and reproduction [1].

Lighting is the most important environment factor in poultry husbandry, in this study is Arabic chicken. Lighting can be given through natural or artificial lighting. Lamp can be the source of artificial lighting. Lamps can be divided into several kind such as bulb lamp, Halide metal lamp, high pressure sodium lamp and light emitting diode lamp [2].

Lighting is a positive stimulant for hypothalamus. Light carries electromagnetic wave which stimulates chicken hypothalamus [1].

Light, in this case is lamp, is an important factor and a breakthrough efficient lighting system for the development of Arabic chicken husbandry, because Arabic chicken is a potential domestic chicken to be developed [3]. Lamp is also a solution to increase lighting performance an efficiency in Arabic chicken husbandry.

Based on all of those explanation, further scientific study about the effect of lighting duration and light intensity on the level of triiodothyronin hormone in Arabic chicken (*Gallus Turcicus*) is important to be performed.

II. MATERIALS AND METHODS

A. Research Materials

This study was used 36 silver Arabic chicken which were kept since layer period (18 weeks) to 26 weeks old. The lamp used were 5 watt bulb lamp (Chiyoda®) and 5 watt LED lamp (Phillips®). Chicken food used was laying hens complete feed 324 KJ from PT. Charoen Pokphand Indonesia. Feeding was carried out for 9 weeks as much as 100 g/chicken/day. The cages were 36 battery cage for 36 chicken each. In every treatment there was 4 lamp each. Treatment cage was covered so that artificial lighting can be more effective. The blood was taken in week 9 of the study to measure triiodothyronin hormone. The chicken were fasted for two hours before.

B. Research Methods

This study used completely randomized factorial pattern with 9 repetition. The total number of chickens used in this study was 36 Arabic chickens. Factor 1 was a group with 16 hours of lighting duration. Factor 2 was a group with 18 hours of lighting duration. Each factor used light intensity, 5 watt bulb and 5 watt LED lights. So the treatment of the group is as follows:

- I1,L1 : 5 watt bulb lamp in 16h
- I1,L2 : 5 watt bulb lamp in 18h
- I2,L1 : 5 watt LED lamp in 16 h
- I2,L2 : 5 watt LED lamp in 18 h

C. Research Variable

1. Analysis of triiodothyronin (T3) levels

Measurement of triiodothyronine levels was measured using the ECLIA method (electrochemiluminescence immunoassay). Analysis of triiodothyronine levels was carried out in the 9th week of the study.

2. Temperature and humidity

Temperature and humidity measurements were carried out in the morning (at 07.00 a.m), during the day (at 1:00 p.m.), and at night (at 7 p.m.). Temperature and humidity measurements are carried out by a thermohygrometer that was attached to the enclosure. The temperature and humidity data

obtained were then averaged to get an average temperature and weekly humidity.

D. Data Analysis

The data were analyzed using variance test (ANOVA) with 4 treatments and 9 replications through the help of Microsoft Excel 2013 Program. If it was significantly different ($P < 0.05$) or very real ($P < 0.01$), it will be followed by Duncan's test

III. RESULTS AND DISCUSSION

A. The Effect of Treatment on Triiodothyronine Levels

Data on triiodothyronine levels in Arabic chickens due to differences lighting duration and light intensity are shown in table I.

TABLE I. The average of triiodothyronine level ($\mu\text{g/ml}$)

Intensity(I)	Lighting duration (L)		Average
	L1	L2	
I1	0.90 ± 0.14	0.55 ± 0.35	0.73 ± 0.30
I2	0.85 ± 0.07	0.25 ± 0.21	0.55 ± 0.37
Average	0.88 ± 0.10^b	0.40 ± 0.29^a	

Based on the results of the data analysis presented in table 2, it was found that the lighting duration of L1 (16 hours) and L2 (18 hours) showed very significant differences ($P < 0.01$). Whereas in light intensity, both I1 (bulb lamp) and I2 (LED light) do not show any significant differences. The triiodotyronin (T3) hormone influences the growth and performance of Arabian chicken production. The influence can not be separated from the difference in light sources and the duration of lighting given, because the difference in light sources and lighting duration will affect the temperature of the cage. The temperature and duration factors of the lighting affect the triiodothyronine level. This can be seen in the average length of exposure of 16 hours (L1) which shows that the results of $0.88 \mu\text{g/ml}$ differ significantly. Triiodotyronine levels of 16-hour exposure were higher than the 18-hour exposure (L2) which showed an average yield of $0.40 \mu\text{g/ml}$ which showed a very significant difference. This shows that L2 (18 hours) lighting duration makes the condition of Arabic chickens uncomfortable, because they have decreased triiodotyronin (T3) levels. According to [7], a decrease in thyroid hormone secretion (T3 / T4) is happened because the T3 / T4 hormone is not stimulated in a uncomfortable condition, which results in a decrease in the hormone. The decrease is due to the stimulation of tyrotropin releasing factor (TRF) to the anterior hypophysis to be reduced so that the thyroid stimulating hormone (TSH) produced by the anterior hypophysis becomes lower, due to the subsequent T3 / T4 hormone produced by the thyroid gland to decrease. Therefore, it can be concluded that, the addition of time to 18 hours (L2) in Arabic chickens causes a decrease in the levels of the triiodotyronine hormone which can be interpreted that Arabic chickens are in uncomfortable conditions.

Based on the lighting intensity of this study, the bulb lamp (I1) shows the average yield of $0.73 \mu\text{g/ml}$. While the LED lights (I2) show an average yield of $0.55 \mu\text{g/ml}$. At both light intensities did not show any significant differences. This

shows that the bulb lights and LED lights have an effect that is not significantly different in stimulating the triiodothyronine hormone in Arabic chickens.

B. Temperature and Humidity

The average temperature and humidity data of Arabic chicken coops due to the treatment of differences in light intensity and lighting duration during the study are shown in table II.

TABLE II. The average temperature ($^{\circ}\text{C}$) and humidity (%)

Intensity (I)	Temperature	Humidity
I1	30.89 ± 2.29	69.91 ± 3.76
I2	29.41 ± 2.52	76.86 ± 4.92
Average	30.15 ± 2.49	73.38 ± 5.57

The average temperature and humidity of the cage during the research on the bulb treatment (I1L1 and I1L2) in general had an average temperature of between 30.89°C with a humidity of 69.91%. while in the treatment of LED lights (I2L1 and I2L2) in general it had an average temperature ranging between 29.41°C with humidity of 76.87%. The ideal temperature for layer laying hens is between $18-23.9^{\circ}\text{C}$ [4]. However, according to [5] in the research conducted, it was explained that domestic chickens and Arabic chickens were classified as chicken species which were tolerant to high temperature maintenance. It is indeed evident that domestic chickens and Arabic chickens in Indonesia continue to breed well in some areas on the island of Java which have an ambient temperature outside the ideal conditions for chickens, namely between $27-35^{\circ}\text{C}$.

Arabic chickens can indeed live and survive when they are at ambient temperatures outside of ideal conditions. When the environmental conditions reach 29°C or when the chicken's body temperature reaches 42°C the chicken starts to do panting. The necessary process is carried out by chickens to balance body temperature with ambient temperature. According to [6] explained that production efficiency will decrease because the metabolic energy needed by the body for growth will be used to maintain the balance of body heat. In the research conducted it can be concluded that the effect of the light bulb and LED lights provided can still be tolerated by Arabic chickens, because Arabic chickens can still live and produce.

IV. CONCLUSION

The conclusion of this study is that the duration of excessive lighting had a negative impact on the response of Arabic chicken physiology. The difference in light intensity does not affect the physiological response to the triiodotyronin hormone. Giving different light intensity does not significantly affect the temperature and humidity in the Arabic chicken research enclosure so that it can be tolerated and Arabic chickens can still live and produce normally.

V. SUGGESTION

Based on the results of this study, it is necessary to do research on the addition or reduction of power (watt) both on the light bulb and LED lights. Then at different lighting

durations, more varied research needs to be done, such as the addition of 12 hours and 14 hours of lighting duration difference. In addition, in terms of economics, further research is also needed

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