

## Relative weight of small intestine and lymphoid organ of finisher period broiler chicken at different rearing temperatures

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### ABSTRAK

Sebagai negara tropis, Indonesia memiliki rentang suhu udara yang beragam, bahkan dapat mencapai lebih dari 34 °C pada siang hari. Suhu tersebut tidak sesuai untuk pemeliharaan ayam broiler sehingga dapat menyebabkan ayam broiler mengalami stres panas. Stres panas dapat menyebabkan menurunnya daya tahan tubuh ayam broiler, munculnya berbagai macam penyakit, laju pertumbuhan dan produksi menurun serta menjadi tidak ekonomis. Stres panas dapat menghambat penyerapan nutrisi di dalam saluran pencernaan yang dapat berpengaruh terhadap bobot relatif organ pencernaan dan berpengaruh terhadap bobot relatif organ limfoid ayam broiler. Penelitian ini dilaksanakan di kandang A Laboratorium Produksi Ternak Unggas, Fakultas Peternakan dan Pertanian, Universitas Diponegoro, Semarang tanggal 08-23 Maret 2018, bertujuan untuk mengkaji bobot relatif usus halus dan organ limfoid ayam broiler periode finisher yang dipelihara pada suhu berbeda. Materi yang digunakan pada penelitian ini adalah ayam broiler strain CP 707 jantan periode finisher (umur 21 hari) sebanyak 20 ekor dengan bobot badan rata-rata 1.167 g. Penelitian menggunakan uji-t dengan 2 perlakuan dan 10 ulangan. Perlakuan yang diterapkan adalah T1 : suhu panas dan T2 : suhu nyaman. Parameter yang diamati adalah bobot relatif usus halus (duodenum, jejunum, ileum) dan organ limfoid (bursa fabrisius, timus, limpa). Hasil penelitian menunjukkan bahwa bobot relatif usus halus yang terdiri dari duodenum, jejunum dan ileum pada suhu pemeliharaan panas dan nyaman berturut-turut yaitu sebesar 0,25%; 0,66%; 0,55% dan 0,34%; 0,79%; 0,71%, serta bobot relatif organ limfoid yang terdiri dari bursa fabrisius, timus dan limpa pada suhu pemeliharaan panas dan nyaman yaitu sebesar 0,07%; 0,23%; 0,11% dan 0,09%; 0,28%; 0,16%. Suhu pemeliharaan berbeda nyata terhadap bobot relatif usus halus dan organ limfoid ayam broiler periode finisher ( $P < 0,05$ ). Simpulan dari penelitian ini adalah ayam broiler periode finisher yang dipelihara pada suhu nyaman memiliki bobot relatif usus halus dan organ limfoid yang lebih tinggi dibandingkan dengan ayam broiler periode finisher yang dipelihara pada suhu panas.

*Kata kunci : bobot relatif, usus halus, organ limfoid, ayam broiler, suhu pemeliharaan*

### ABSTRACT

As a tropical country, Indonesia has a diverse air temperature range, reaching more than 34 °C during the day. This temperature is not suitable for rearing of broiler chickens because it induces heat stress. Heat stress can reduce the broilers immune system, it can also cause various diseases, the decrease in growth rate and production and making it uneconomical. Heat stress can inhibit the absorption of nutrients in the digestive tract which can affect the weight of the digestive organs and affect the relative weights of lymphoid organs of broiler chicken. The research was conducted at Poultry Production Laboratory, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang on 08-23 March 2018. This study aims to examine the relative weights of the small intestine and the relative weight of lymphoid organs of finisher period broiler chicken which are reared in different temperatures. The material used in this research is broiler chicken strain CP 707 male finisher period (age 21 days) as many as 20 chicken with an average body weight of 1167 g. The research used the t-test with 2 treatments of 10 replications. The treatment

applied is T1: heat temperature and T2: comfortable temperature. The parameters observed were relative weights of the small intestine (duodenum, jejunum, ileum) and lymphoid organs (bursa fabricius, thymus, spleen). The results of the study showed that the relative weight of the small intestine consisting of the duodenum, jejunum and ileum at heat and comfortable rearing temperatures was respectively 0.25%; 0.66%; 0.55% and 0.34%; 0.79%; 0.71%, as well as the relative weight of lymphoid organs consisting of bursa fabricius, thymus and spleen exchanges at heat and comfortable rearing temperatures of 0.07%; 0.23%; 0.11% and 0.09%; 0.28%; 0.16%. The rearing temperature is significantly different with the relative weight of the small intestine and lymphoid organs of finisher period broiler ( $P < 0.05$ ). The conclusion of the research was that finisher period broiler chicken reared at a comfortable temperature have a higher relative weight of small intestine and lymphoid organs compared to broiler finisher period which are maintained at hot temperatures.

*Keywords : relative weight, small intestine, lymphoid organ, broiler chicken, rearing temperature*

## INTRODUCTION

Broiler chickens are one of the main poultry harvested for their meat. Broiler chickens have undergone genetic improvement and can grow quickly in a short time if supported by appropriate environmental factors (Marom *et al.*, 2017). Along with global population growth each year, the demand for animal protein will increase, especially chicken meat. Broiler chickens have poor adaptability especially after the age of three weeks. Broiler chickens need comfortable temperatures ranging from 19 - 26 ° C (Bikrisima *et al.*, 2013). As a tropical country, Indonesia has a wide air temperature range, reaching more than 34 ° C during the day (Kusnadi and Rahim, 2009). This temperature is not suitable for maintenance of broiler chickens so that it can cause broiler chickens to experience heat stress. Heat stress can reduce the broilers immune system, it can also cause various diseases, the decrease in growth rate and production and making it uneconomical (Tamzil, 2014). In addition, heat stress can inhibit the absorption of nutrients in the digestive tract which can affect the weight of the digestive organs of broiler chickens.

The digestive organs supply nutrients for physiological processes and the growth of broiler chickens. The small intestine functions as a place for digestion which is assisted by enzymes to break down carbohydrates, proteins and fats and absorption of digestive products. The more the small intestine works hard in digestion, the more its size increases (Sari and Ginting, 2012).

Immune system plays a key role in supporting the health and productivity of broiler chickens. Organs related to the immune system of broiler chickens are lymphoid organs (bursa fabricius, thymus, spleen) because they function in producing antibodies (Bikrisima *et al.*, 2013). The harder the lymphoid organs work to form antibodies, the more it affects the relative weight of these lymphoid organs. Therefore, the use of different rearing temperatures (hot and comfortable)

is needed to assess the effect on the development of the small intestine and lymphoid organs of broilers so that they are optimal to support the health and productivity of broiler chickens raised in tropical countries such as Indonesia.

The purpose of this study is to examine the relative weights of the small intestine and lymphoid organs of finisher period broiler chicken which are reared at different temperatures. The benefit of this study is to provide information about the relative weights of the small intestine and lymphoid organs of finisher period broiler chicken reared at different temperatures.

The hypothesis of this study is the relative weight of small intestine and lymphoid organs of finisher period broiler chicken reared at comfortable temperatures are higher than the relative weight of the small intestine and lymphoid organ finisher period broiler chickens reared at hot temperatures.

## MATERIALS AND METHODS

The research was conducted at Poultry Production Laboratory, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang on 08-23 March 2018.

### Material

Material used in this study is broiler chicken strain CP 707 male finisher period (age 21 days) as many as 20 chicken with an average body weight of 1,167 grams. The equipment used are thermohygrometer, AC, thermostat, heater with 6 (60 watt) incandescent lamps, 2 LED lights, blower, plywood board, feedlot, drinking water, C-tech Portable Electronic Scale® scales, SF-digital scales 400®, stationery and newspapers. The equipment used for data collection includes Digital Scaledigital scales®, cast plastic, trays, knives, scissors and trashbags. The ingredients used are S12G commercial feed ingredients, disinfectant drinking water, detergents, husks and chalk.

## Method

### Experimental Design

Research was conducted by turning on incandescent lights at 5:00 in the morning so that the temperature rises gradually reaching 35-36 °C at 7:00 a.m., then the treatment temperature will be set automatically at 36 °C using the thermostat, when it reaches 36 °C incandescent light will turn off and if the temperature drops to less than 36 °C, the incandescent lamp will remain on. The use of a blower will help air circulation. The comfortable temperature treatment set up by turning on the AC first with the lowest temperature (16 °C) then gradually increasing it to reach 23 - 24 °C at 07.00 in the morning.

Two treatments are done with 10 replications as follows:

T1: Hot temperature (35 - 36 °C)

T2: Comfortable temperature (23-24 °C)

### Research Procedure

Research began with weighing broiler chicken body weight in the close house and choosing the male sex. The rearing of the broiler chickens is done for 2 weeks. Feed and drinking water are given in ad libitum. Husk and bedding material is replaced every day. Treatment is given from 07.00 a.m. to 19.00 a.m., then the heater and AC will be turned off. Temperature and humidity control in both rooms and in the enclosure environment are recorded at 7:00 a.m., 1:00 p.m. and 19:00 p.m.

### Data Collection

Data collection is done at the age of 35 days. The weighing of the chicken's weight is carried out before being slaughtered. Surgery is done by dissecting the contents of the chicken's stomach with scissors and the knife is then placed on a tray, separating each of the small intestine and lymphoid organs and then removing the remaining feed and excreta and weighing and recording the results. The relative weight of the small intestine and lymphoid organs is calculated using the following formula:

- Relative weight of small intestine (%)  
$$= \frac{\text{weight of the small intestine (g)}}{\text{weight life (g)}} \times 100\%$$
- Relative weight of lymphoid organs (%)  
$$= \frac{\text{weight of the lymphoid organs (g)}}{\text{weight life (g)}} \times 100\%$$

The data were analyzed using t-test or average different test (Mas and Prastiwi, 2016). Formula used :

$$t\text{-test} = \frac{(X_1 - X_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

## RESULTS AND DISCUSSION

### Relative Weight of Small Intestine

The results of the t-test showed that the rearing temperature was significantly different ( $P < 0,05$ ) on the relative weights of the duodenum, jejunum and ileum. The relative weight of the duodenum, tissue and ileum in treatments T1 and T2 are below normal size. The research of Jamilah *et al.* (2014) showed that the relative weights of the small intestine consisting of the duodenum, tissue and ileum are respectively 0.78%, 1.33% and 1.09%.

The relative weight of small intestine at T1 treatment was lower than that of T2 treatment and is suspected to be caused by several factors, one of which was high air temperature. High temperatures can cause the emergence of free radicals that can interfere with the absorption of nutrients in the digestive tract of broiler chickens by inhibiting the growth of intestinal villi. The intestinal villi will shorten so that the absorption of nutrients is not optimal and the growth of the small intestine is inhibited. This is in accordance with the opinion of Sugito *et al.* (2007) which states that free radicals can interfere with the absorption of nutrients in the digestive tract by inhibiting the growth of intestinal villi. Permana *et al.* (2016) added that the absorption of disturbed nutrients was due to intestinal villi that shortened and the surface area was reduced so that the ability to absorb it was also reduced.

Broiler chicken feed consumption at T1 treatment was lower than T2 treatment. Broiler chicken feed consumption in the treatment of T1 and T2 was less than the standard, which are 1049.7 g/head and 1602.25 g/head, respectively. Kusanadi (2004) states that the total feed consumption of broiler chickens at the age of 2-5 weeks reared at 32 °C, is 1484 g/head, and those reared at 22 °C, is 2462 g/head.

Different environmental temperatures are thought to cause broiler chickens at T2 treatment to have better health, better development of villi intestine so that duodenal weight increases. Weight of the jejunum and ileum T2 treatment is higher, the villi and microvilli of the intestine are increasing so that the field of absorption is also more extensive causing better absorption of nutrients. This is in line with the opinion of Landung *et al.* (2013) stated that chickens that are not heat-stressed can be assumed to have better health so that the development of the intestinal villi gets better and the duodenal weight will increase. Ibrahim (2008) states that the size of the small intestine can affect the capacity and digestive function of the small intestine.

### Relative Weight of Lymphoid Organs

The results of the t-test showed that the rearing temperature was significantly different ( $P < 0,05$ ) on the relative weights of the bursa fabricius, thymus, spleen exchanges. The relative weights of the bursa fabricius, thymus and spleen exchanges in treatments T1 and T2 are below normal. The research of Bikrisima *et al.* (2013) showed that the relative weights of lymphoid organs were 0.083%, 0.5% and 0.27% respectively.

The relative weight of lymphoid organs in T1 treatment is lower than T2 treatment allegedly caused by several factors including the age of broiler chickens and air temperature. Heat stress due to temperature and high humidity can cause the weight of lymphoid organs to decrease. This is in accordance with the opinion of Kusnadi (2009) which states that high air temperatures can cause the weight of lymphoid organs consisting of bursa fabricius, thymus and spleen exchanges to decrease and the lymphocytes that produces antibodies also decrease.

The size of the lymphoid organs indicates how hard it works in forming antibodies. Bursa fabricius and thymus can shrink because they work too hard to form antibodies to rear the body's resistance, while the spleen will enlarge if it works too hard to form antibodies and if the broiler is affected by the disease. Tizard (1988) states that the harder bursa fabricius work in forming antibodies, depletion will occur and its relative weight decreases, while the thymus will experience rapid atrophy so that its decreases in size. Landung *et al.* (2013) reported that the size of the spleen will enlarge as the weight of the work in forming antibodies increases.

Observations and calculations of the relative weight of lymphoid organs were carried out when broilers were 5 weeks old, where the weight of lymphoid organs could be determined based on their age. Riddel (1987) states that the bursa fabricius develop rapidly when chickens are 4 - 12 weeks old. Schalm *et al.* (2000) reported that during the embryonic period until before adulthood, the thymus will grow and develop rapidly. In the opinion of McFerran and Smith (2000), the development of the spleen depends on the activity and health conditions of the chicken, the that in sick chickens, the spleen tend to weigh lower.

### CONCLUSION

The finisher period broiler chickens reared at a comfortable temperature have a higher relative weight of small intestines and lymphoid organs

compared to finisher period broilers reared at hot temperatures.

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