# The Effects of Dietary Energy Sources on Immune Organs of Broilers Exposed to Heat Stress

*M. Prayuwidayati[1,]*, T. Pasaribu[1], R. Palupi[1], K. G. Wiryawan[2], A. Sudarman[2], & R. Mutia[2]*

*[1]Graduate Study Program of Bogor Agricultural University*
*[2]Department of Nutrition and Feed Technology, Faculty of Animal Science, Bogor Agricultural University, Indonesia*
**e-mail: widayub@gmail.com*

## Abstract

*The aim of this experiment was to study the effect of palm oil addition as energy source in the ration on the percentage of limfoid gland, thymus gland and bursa fabricius of broilers exposed to heat stress. The research was conducted in Experimental Station, Faculty of Animal Science, Bogor Agricultural University, in November to December 2011. The experiment was conducted in a Completely Randomized Design (CRD) consisting of two treatment rations with three replications. The treatments were as follow: R1 = ration with 22% crude protein and 3050 kcal Metabolism Energy containing 1% palm oil; R2= ration with 22% crude protein and 3050 kcal Metabolism Energy containing 7% palm oil. The parameter observed were limfoid gland percentage, thymus gland percentage and bursa fabriosis percentage. The result of the experiment showed that the addition of palm oil in the ration until 7% DM basis in broiler'ration did not significantly affect the lymphoid organ percentage, thymus gland percentage, and the bursa fabriosis percentage in broilers exposed to heat stress. It could be concluded that addition of palm oil as energy sources in the ration gives similar effect on broilers exposed to heat stess.*

*Keywords: broiler, heat stress, lymphoid organ, thymus gland, and bursa fabriosis*

## Introduction

Global climate change has significant effects on agriculture production, including poultry production. Heat stress is one of big concern in poultry industry, especially in tropical and sub-tropical countries. It has been well known that heat stress could reduce the productivity and increase the mortality of the chicken, that will in turn affects the performance of poultry industry. High environmental temperature could hamper the average daily gain of the chicken, as results of lower appetite and feed intake.

Broiler chicken is known as a homoeothermic animal. Body temperature regulation of this animal was directly affected by environmental temperature. Therefore, as part of its thermoregulation, broiler chicken should control feed intake to meet the need for maintenance, production, and heat production (Furlan & Macari, 2002). Objective of this experiment was to study the effect of palm oil addition as energy source in the ration on the percentage of limfoid gland, thymus gland and bursa fabricius of broilers exposed to heat stress.

## Materials and Methods

The experiment was conducted in Experimental Station, Faculty of Animal Science, Bogor Agricultural University, from November to December 2011. Twenty four of 1 week old chickens were used in this experiment. The broiler chickens were then divided into two groups and the treatment ration arrangement was presented in Table 1.

Table 1. Dietary treatment formulation

| Ingredients | R1 (%) | R2 (%) |
|---|---|---|
| Corn Gluten meal | 4.96 | 13.16 |
| Corn grain | 60.00 | 44.17 |
| Soybean meal | 25.00 | 24.73 |
| Fish meal | 7.91 | 10.00 |
| Oil | 1.05 | 7.00 |
| Calcium Carbonate | 1.08 | 0.94 |
| Total | 100 | 100 |
| Metabolism Energy (kcal/kg) | 3050 | 3050 |
| Dry Matter, % | 85.12 | 78.49 |
| Crude Protein, % | 22.00 | 22.00 |
| Ca, % | 0.687 | 0.682 |
| P, % | 0.465 | 0.454 |

The experiment was conducted in a Completely Randomized Design consisting of 2 treatment rations with 3 replications. Each experimental unit consists of 4 broiler chickens. The treatments were as follow: R1 = ration with 22% crude protein and 3050 kcal Metabolism Energy containing 1% palm oil; R2= ration with 22% crude protein and 3050 kcal Metabolism Energy containing 7% palm oil. The parameter observed were limfoid gland percentage, thymus gland percentage and bursa fabricius percentage. All data collected were subject to analysis of variance, followed by Duncan's Multiple Range Test (Steel and Torrie, 1995).

## Results and Discussions

Average daily environmental temperature and humidity observed at afternoon during the experiment was 30.38 °C and 80.35% respectively. Whereas, comforts zone poultry production is 25 – 28 °C for temperature and 60% - 70% for humidity. This high environmental temperature condition caused the broiler chickens exposed to heat stress during the experiment. This situation also supported by low average daily feed intake as well as high water intake.

Data on the percentage of thymus gland, percentage of lymph, and percentage of bursa fabricius at the end of the experiment were presented on Table 2. It could be seen from the table that long term heat stress caused broiler chicken difficult to achieve the standard body weight, because significant amount of energy in the diet will be used for heat production and heat dissipation. Heat stress also has deteriorated effects on physiological organs such as lymph, thymus gland, and bursa fabriosis.

Table 2. Percentage of thymus gland, lymph, and bursa fabricius at the end of the experiment

| Dietary treatment | Lymph (%) | Thymus gland (%) | Bursa fabricius (%) |
|---|---|---|---|
| R1 (carbohydrate as energy sources) | 0.22 | 0.71 | 0.14 |
| R1 (palm oil as energy sources) | 0.21 | 0.78 | 0.11 |

The difference of energy sources did not significantly affect ($P>0.05$) the percentage of thymus gland, percentage of lymph, and percentage of bursa fabricius at the end of the experiment. No significantly different in these parameters probably because of no difference in energy content of the dietary treatments during the experiment. Tizard (1998) stated that bursa fabricius is lymphoid organs that function to support growth and differentiation of cells of antibody system. Moreover, Riddell (2004) stated that bursa fabricius which is located in dorsal part of cloacae produce Cell B which is then synthesized the plasma cell and antibody. Therefore, this organ is very important in body immune system.

## Conclusion

Difference energy sources in the diet of broilers exposed to heat stress did not significantly affect the lymphoid organ percentage, thymus gland percentage, and the bursa fabricius percentage.

## References

Furlan RL, Macari M. 2002. Termorregulacao. *In:* Macari M, Furlan RL, Gonzales E, ed. Fisiologia aviaria aplicada a frangos de corte, 2 ed. Jaboticabal: Funep-Unesp. P. 209-230.

Mc Cance K.L and Shelby J. 1994. Stress and Disease. In: Pathophisiology. The Biologic Basis in Adult and Children ( Kathryn L, Mc Cance and Sue E Huether, 2 eds ). Mosby. St Louis, Baltimore, Chicago, London, Madrid, Philadelphia,Sydney, Toronto.

Steel, R.G.D dan J.H. Torrie. 1995. Prinsip dan Prosedur Statistika. PT. Gramedia Pustaka Utama, Jakarta