

SUMMARY

Heat Stress (HS) is defined as biological response of living creatures to high ambient temperature (Lara and Rostagno, 2013). Provided that Earth's surface temperature has been increasing with regards to global warming, HS becomes an urgent issue in livestock industry. Broiler chickens are particularly prone to experience HS due to their high metabolism rate. Many researches have been done on the subject but few observed the impact on chicken's cecum. HS has been found to be detrimental to intestinal microstructure. The cecum of chicken is majorly colonized with abundant and diverse microorganisms in its lumen (Frei *et al.*, 2017). This implies that if any damage occurred in cecal mucosa, the impact would be fatal.

Hypothalamic-pituitary-adrenal (HPA) axis activation, intestinal ischemia, oxidative stress, and microbial disequilibrium are some of HS pathogenesis in the intestine. All of them result in damage of mucosal integrity. Although it should be noted that colon is more resistant to HS than other segments, chronic HS may be able to overcome it. El-Daly *et al.* (2014) provided an example of this in reduced sizes of crypts of Lieberkühn and villus in Japanese Quails. Sohail *et al.* (2013) also found that a 21-day cyclic HS could reduce cecum relative weight in broiler chickens which was correlated with hypoplasia.

Current experiment was done to discover the impact of chronic heat stress on ceca in broiler chickens by observing the histopathological alterations: villus height (VH), villus width (VW), crypt depth (CD), villus surface area (VSA), and villus height to crypt depth (VH:CD) ratio. Using Completely Randomized

Design, 20 Cobb broiler chickens (*Gallus gallus*) at the age of 22 days were divided into two treatment groups (10 replicates each). The control group (C) was reared at 24-28°C and 40-55% RH, while the heat-stressed group (T) was reared at 36-40°C and 45-65% RH. Both treatments lasted for 21 days. After that all chickens were slaughtered and the ceca were made into histological preparations stained with H&E.

Analysis of results with Independent-Samples t Test showed that CD was significantly ($p<0.05$) lower in T group than C group. However, the other dependent variables (VH, VW, VSA, and VH:CD ratio) did not differ much between the two groups.

The crypt of Lieberkühn is the center for enterocyte proliferation. It is therefore the first part of intestine to be affected by HS (Yamauchi *et al.* in Burkholder *et al.*, 2008). In that manner, it could be assumed that the cecal villus-crypt morphology of T group was in the early stage of damage despite the long period of HS. The possible explanations were cecum's segment-specific resistance and/or adaptive capacity of Cobb broiler chickens. The development of either villi anatomical modification or villus fusion in response to HS was also another probability.

It can be inferred that histopathological alterations were present in the ceca in broiler chickens (*Gallus gallus*) exposed to chronic heat stress when compared to those not exposed to heat stress. Some suggestions for research improvement stemming from this study include analysis of epithelial turnover time, number of villi per unit area, and villus anatomical modification.

**HISTOPATHOLOGICAL ALTERATIONS OF CECA
IN BROILER CHICKENS (*Gallus gallus*)
EXPOSED TO CHRONIC
HEAT STRESS**

Antonia Vania Adji

ABSTRACT

HS has been found to cause adverse effects on small intestinal microstructure, but little is known about its impact on chicken's cecum. In this research, the histopathological alterations of broiler chicken's cecum following chronic heat stress were evaluated. 20 broiler chickens were randomly divided into C group and T group each containing 10 replicates. Both groups were reared under standard conditions until 21d of age. At d22 until d42, the C group was kept at 24-28°C and 40-55% RH, while the T group was exposed to 36-40°C and 45-65% RH for eight hours per day. At the end of the period, proximal part of each chicken's cecum was collected and made into histopathological slides (H&E). Villus height (VH), villus width (VW), crypt depth (CD), villus surface area (VSA), and villus height to crypt depth (VH:CD) ratio were examined from 10 villi per replicate. Results analysis showed that chronic heat stress profoundly reduced CD ($p < 0.05$). Insignificant changes of villus despite the long heat exposure might imply that the damage is at its early phase. The conclusion is chronic heat stress can produce morphological alterations in the ceca of broiler chickens, though requiring longer duration due to cecum's durability.

Key words: heat stress, broiler chicken, cecum, intestinal morphology