Overcoming Heat Stress with DOSTO® Oregano Oil

DOSTOFARM®

Heat stress during the hot summer season and in tropical regions interferes with the broilers comfort and suppresses productive efficiency. In order to prevent death from heat exhaustion, the birds have to make major thermo-regulatory adaptions. This negatively affects the feed intake and growth, so the full genetic potential is often not achieved (Van der Klis & Vinyeta Punti, 2015) (Butcher, 2015).

An experiment conducted in the experimental barn and diagnostic center of the Faculty of Veterinary Medicine of the Mahanakorn University (Thailand) evaluated the effect of DOSTO® Liquid (with 10% DOSTO® Oregano oil) on the performance, immune response, intestinal morphology and meat quality of broilers in tropical conditions.

The results showed that the essential oil of DOSTO® Oregano with known immunostimulant and antioxidative properties alleviates heat stress in broilers. Growth rate and feed efficiency were effectively improved. Adding DOSTO® Oregano to the drinking water had a positive effect on the immune system. Furthermore, DOSTO® Oregano improved the meat quality, reducing significantly the drip loss and lipid peroxidation.

Experimental setup

For the experiment, 384 one-day-old male broiler chicks, breed Ross 308, were selected and divided into two experimental groups and a control. Thus every group consisted of 8 replicates of 16 birds each. The trial took place during 35 days.

One experimental group received 150 ml DOSTO® Liquid per 1000 liters of water from day 1 to 35 (DOSTO 150 ppm). The second experimental group received 300 ml DOSTO® Liquid per 1000 liters of water from day 1 to 35 (DOSTO 300 ppm). The drinking water of the control group was not supplemented with further additives.

In tropical regions like Thailand it is common to have ambient air temperatures of 30-35 °C and ambient relative humidity of 60 - 80 %. Under these challenging conditions the water intake increases while the feed intake decreases, leading to higher water to feed ratio. In order to assess the heat stress, the water consumption was measured and the water to feed ratio evaluated.

The zootechnical performance parameters were determined on day 21 and 35 by monitoring the weight gain and feed conversion rate. The effect on the immune system and stress level of the birds was recorded by measuring the heterophil - lymphocyte ratio and duodenal IgA of broiler chickens at 21 and 35 days of age. Intestinal morphology was determined by measuring the villus height and crypt depth on 21 and 35 day of age.

The effect of DOSTO® Oregano oil supplementation in drinking water on meat quality of broiler chickens was evaluated by measuring the drip loss and lipid peroxidation (TBAR).

Table 1: Experimental Setup

Parameter	Control	DOSTO 150 ppm	DOSTO 300 ppm
Number of birds (n)	128	128	128
Repetitions (n)	8	8	18
DOSTO Liquid (ml/ 1000 L water)	0	150	300

Results and discussion

Water to Feed Ratio and Zootechnical Performance

At 21 °C, the water to feed ratio varies between 1.6 to 1.8 (depending on the drinker type and environmental conditions) [1]. In the present study the water to feed ratio over the 35 days fattening period was 2.6 in average.

Under these conditions, the group supplemented with 300 ppm of DOSTO® Liquid reached the highest weight gain on day 35, being 62.68 grams heavier than the control. Both experimental groups had better feed conversion rates than the control. The group supplemented with 300 ppm of DOSTO® Liquid showed the lowest FCR (1.57) (Table 2).

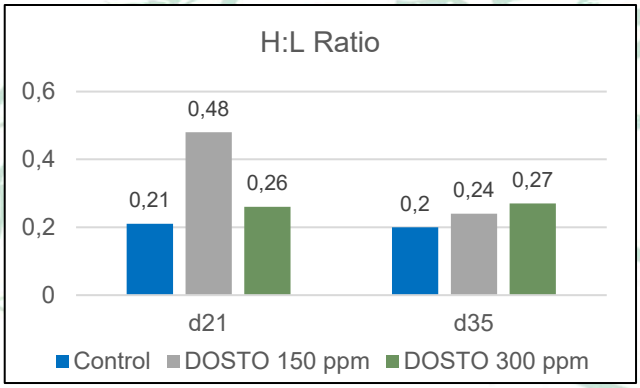
Table 2: Water to feed ratio, weight gain [g] and feed conversion ratio on day 35

Parameter	Control	DOSTO 150 ppm	DOSTO 300 ppm
Water to feed ratio	2.67	2.57	2.6
Weight gain [g]	1,678.16	1,648.56	1,740.84
FCR	1.64	1.6	1.57

Immune Response to Stress

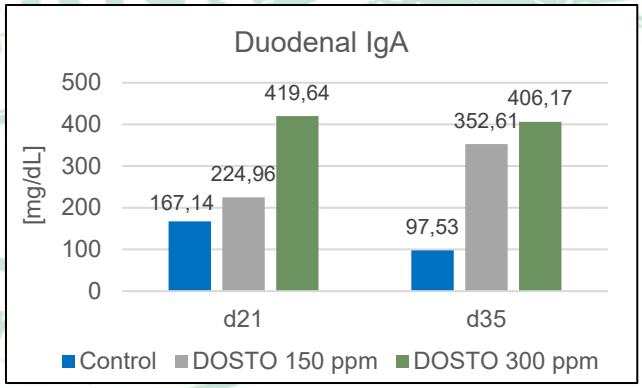
Measuring the ratio of heterophils and lymphocytes (H/L) in response to different stressors is a standard tool for assessing long-term stress. As shown in the Graphic 1, the H/L ratio did not differ between groups of the on day 35.

Graphic 1: Effect of DOSTO® Oregano oil in drinking water on H/L Ratio on day 21 and 35



The duodenal IgA of the treatment groups were not different (P>0.05) from control group. However, the duodenal IgA of 300 ppm of DOSTO® Liquid tended to be higher (P = 0.18) than 150 ppm and control group, respectively (Graphic 2).

Graphic 2: Effect of DOSTO® Oregano oil in drinking water on duodenal IgA on day 21 and 35

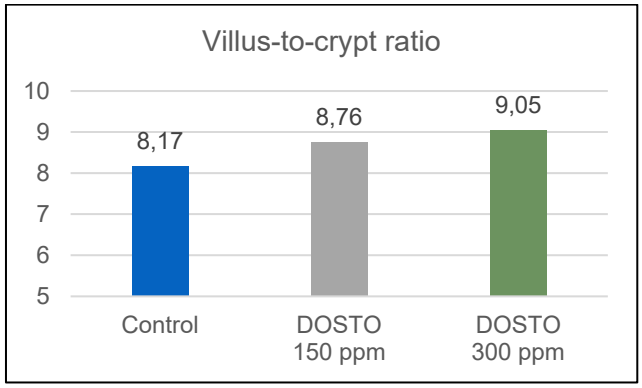


Intestinal Morphology

The crypt-villus is the main functional unit of absorption in the small intestine. An increase in villus height to crypt depth ratio is correlated with an improvement in the digestion and absorption of nutrients [2].

As shown on the Graphic 3, both experimental groups had better villus to crypt ratio than the control. The group supplemented with 300 ppm DOSTO® Liquid had the greater villus to crypt ratio (9.05) (Table 2).

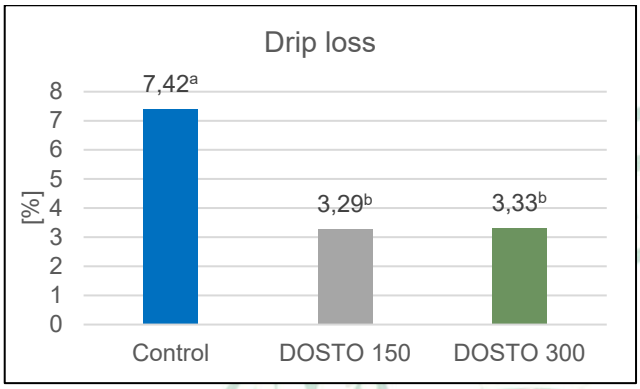
Graphic 3: Effect of DOSTO® Oregano oil in drinking water on intestinal morphology on day 35



Meat Quality

Water-holding capacity is one of the most important quality attributes of meat, in particular with regard to its processing suitability [3]. The drip loss of the experimental groups was significantly lower (P<0.01) than the control group (Graphic 4).

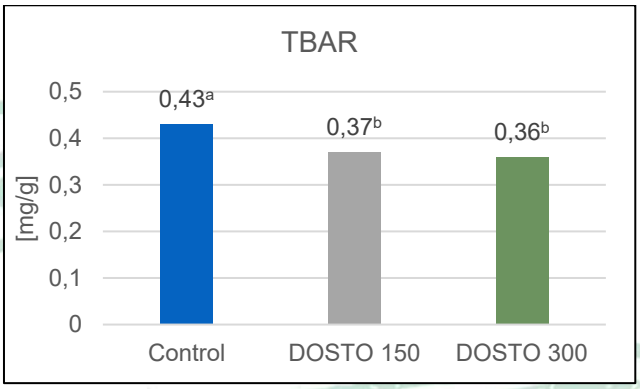
Graphic 4: Effect of DOSTO® Oregano oil in drinking water on drip loss on day 35



*a,b within the same row, means with different superscripts are significantly different (P < 0.01)

In the same way, the TBARS values of the groups supplemented with 150 ppm and 300 ppm of DOSTO® Liquid were significantly lower (P<0.01) than the control group. This mean that the oregano oil had an effect on the reduction of the oxidation process (Graphic 5).

Graphic 5: Effect of DOSTO® Oregano oil in drinking water on TBARS on day 35



*a,b within the same row, means with different superscripts are significantly different (P < 0.01)

Conclusions

The present results confirm the positive effect of DOSTO® Oregano oil on the zootechnical performance, immune system, intestinal morphology and meat quality on broilers under heat stress.

One of the limitations of this study was the low stocking density, unlike in industrial conditions, so no significant differences could be demonstrated. However, the weight gain of the experimental group supplemented with 300 ml of DOSTO® Liquid per 1000 liters of water was higher than the control group. The feed conversion rates (FCR) of both experimental groups were better than the control group. Again, the group supplemented with 300 ml of DOSTO® Liquid per 1000 liters of water had the best FCR on day 35.

The supplementation with oregano oil seemed to have no effect on the Heterophil/Lymphocyte ratio (H/L ratio). This disagrees with [4] who showed lower H/L ratio in broilers fed a thymol- and carvacrol-added diets. In the present study, the higher H/L ratio may be caused by stress factors such as ventilation and hot weather.

The broiler chickens receiving DOSTO® Oregano showed higher duodenal IgA values than the control group. The group supplemented with 300 ml of DOSTO Liquid per 1000 liters of water had higher duodenal IgA levels than 150 ml and the control group, respectively. The increased mucosal IgA indicates an inflammatory response in the digestive tract, helping to protect the intestinal mucosa against pathogens.

The villi high : crypt dept ratio tended to be higher on broiler supplemented with DOSTO® Oregano oil. This may increase performance by improving nutrient absorption. Further tests with larger number of replications are necessary to demonstrate this difference statistically.

Finally, this study demonstrated a significant decrease in drip loss and thiobarbituric reactive substances (TBARS) in the chickens that received DOSTO® Oregano oil. The decreased drip loss indicates that the protein remains in the cells and the water is stored in the muscle fibers. TBARS is a substance produced by lipid oxidation processes. In this study, the TBARS values of the experimental groups were lower than control group. This means that the oregano oil had an effect on the reduction of oxidation process. The oregano oil has an inhibitory effect on oxidation reaction which is the reaction that accelerates the destruction of cell membranes and results in the release of free radicals. This can help to extend the shelf life of the chicken meat and reduce the protein deterioration.

References available under request

Recommended Inclusion Rate for Broilers

Product and Application	Improve Meat Quality	Alleviate Heat Stress
DOSTO® Liquid (water to feed ratio 2.6)	150 ml/ 1000 L water	300 ml/ 1000 L water
DOSTO® Liquid (water to feed ratio 1.6 - 1.8)	250 ml/ 1000 L water	500 ml/ 1000 L water
DOSTO® Powder	500 g/ t of complete feed	1000 g/ t of complete feed
DOSTO® Concentrate 500	75 g/ t of complete feed	150 g/ t of complete feed