

## **EFFECT OF DIETARY SUNFLOWER OIL ON PHYSIOLOGICAL PARAMETERS OF BROILER CHICKENS EXPOSED TO ELEVATED TEMPERATURES \***

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### **Introduction**

During the summer heat-wave, poultry breeders find it difficult to maintain appropriate temperatures in poultry facilities, which often exposes the birds to heat stress. Many studies have shown that a change in ambient temperature has a tremendous effect on a number of physiological processes. Elevated air temperatures were found to increase rectal temperature (Acikgöz et al., 2003), change cholesterol levels (Siegel, 1968; Puvadolpirod and Thaxton, 2000 a, b, c) and affect the humoral and cellular immune response (Siegel et al., 1983; Murray et al., 1987 a, b; Puvadolpirod and Thaxton, 2000 a, b, c).

Cook et al. (1993) and Miller et al. (1994) report that unsaturated fatty acids stimulate the body's physiological processes during stress. Whitehead (2000) holds that by stimulating the immune system through modified feeding, it is possible to offset the negative effects of reduced immunity resulting from stress.

The aim of the present study was to determine the effect of supplementing feed with sunflower oil on the physiological processes of broiler chickens exposed to thermal stress.

### **Material and methods**

A total of 720 day-old broiler chicks were weighed, tagged and allotted to 4 groups, each having 12 replicates, at a stocking density of 15 birds/m<sup>2</sup>: I – control, in which chickens were reared under standard microclimate and fed standard diets; II – experimental, in which chickens were reared under standard microclimate and fed a starter diet containing 6% sunflower oil from 1 to 21 days of rearing and a standard diet from 22 days of rearing; III – experimental, in which chickens were exposed to a 5-day period of elevated air temperature (32°C) at 4 weeks of rearing and were fed a standard diet throughout the rearing period; IV – experimental, in which chickens were exposed to a 5-day period of elevated air temperature

(32°C) at 4 weeks of rearing and were fed a starter diet with 6% sunflower oil from 1 to 21 days of rearing and a standard diet from 22 days of rearing.

During the experiment, rectal temperature was measured before and after the treatment factor was applied and on the last day of rearing. Before and after the treatment factor was applied and on the last day of the experiment, the blood plasma was assayed in 10 randomly chosen birds from each group for the levels of cholesterol, triglycerides and IgG, using the Lowry method as modified by Slebodzinski et al. (1982).

The results were analysed statistically using variance analysis and significant differences were estimated using Duncan's test.

## **Results**

Table 1 gives the measurements of rectal temperature of broiler chickens. Highly significant differences were found after the treatment factor was applied between groups I and II vs. III and IV. At 42 days of rearing, rectal temperature in all the groups remained similar, as evidenced by the lack of significant differences between the groups.

The lowest IgG level after applying the treatment factor was found in group III (11.7g/l) and it was highly significantly lower than in the other two experimental groups (Table 2). On day 42 of rearing, a statistically significant difference was only found between the control group and group II. Significant differences in cholesterol level were only found on day 42 of rearing (Table 2). The highest cholesterol was observed in group III and the lowest in group IV ( $p \leq 0.05$ ). The lowest triglyceride level on day 22 of rearing was also observed in group IV. There were highly significant differences between group IV vs. groups III and I and between groups II and I (Table 2). On day 28 of rearing, after the treatment factor was applied, no statistically significant differences were observed between the groups, while on the last day of rearing a highly significant difference occurred between groups III and IV, and a significant difference between groups I and IV.

## **Discussion**

The heat stress applied in group III caused an increase in rectal temperature in relation to the groups reared under standard thermal conditions, which conforms with the studies of Altan et al. (2000). Sosnowka-Czajka and Herbut (2004) report that a dietary supplement of sunflower oil increases the adaptability of chickens exposed to heat stress. This is not supported by the present study, because after elevated air temperature was applied in group IV, a highly significantly higher rectal temperature was observed in relation to the control

group and group II despite the fact that sunflower oil was supplemented to the diet. On day 28 of rearing, a higher IgG level was observed in the groups supplemented with sunflower oil, especially when compared to group III. This conforms with the studies of Craig-Smith et al. (1987), who showed a positive effect of feeding PUFA on the immune response of birds. Puvadolpirod and Thaxton (2000 a) report that stress increases serum cholesterol and triglyceride levels in chickens. In our study, the highest cholesterol and triglyceride levels were found in chickens from group III on day 42 of rearing, and the lowest in chickens from the group exposed to elevated temperature and fed with a sunflower oil supplement at  $p \leq 0.05$  and  $p \leq 0.01$ . A tendency towards the lower level of cholesterol and triglycerides was also observed in group II compared with the groups receiving a standard diet without sunflower oil. This is consistent with Wiseman and Salvador (1989), who found that vegetable oils supplemented to the diet alter fat metabolism within 1.5-3 weeks of diet supplementation.

## Conclusion

It is concluded that birds exposed to heat stress, despite being fed a diet enriched with sunflower oil, were unable to maintain high rectal temperatures unchanged. The dietary sunflower oil supplement had a beneficial effect on the physiological parameters of broiler chickens exposed to thermal stress.

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Tab. 1. Rectal temperature (°C)

A – before heating  
B – after the treatment factor was applied  
C – last day of rearing  
\* – heated groups

Day of rearing		Group				SE
		I	II	III*	IV*	
22	A	41.62	41.36	<b>41.54</b>	<b>41.64</b>	0.11
28	B	<b>41.59 A</b>	<b>41.53 A</b>	<b>42.06 B</b>	<b>42.16 B</b>	
42	C	42.15	41.93	42.19	41.96	

A,B – values marked with different letters differ highly significantly ( $p \leq 0.01$ )

Tab. 2. Biochemical parameters of blood serum in broiler chickens

A – before heating  
B – after the treatment factor was applied  
C – last day of rearing  
\* – heated groups

Item	Day of rearing		Group				SE
			I	II	III*	IV*	
IgG (g/l)	22	A	<b>10.4</b>	<b>11.1</b>	10.7	<b>11.5</b>	4.20
	28	B	<b>12.8</b>	<b>13.7 B</b>	<b>11.7 A</b>	<b>13.6 B</b>	
	42	C	11.5 a	12.8 b	12.1	12.3	
Cholesterol (mmol/l)	22	A	3.10	2.81	3.20	3.01	0.16
	28	B	3.35	<b>3.05</b>	<b>3.15</b>	<b>3.07</b>	
	42	C	3.62	3.51	3.76 a	3.31 b	
Triglycerides (mmol/l)	22	A	<b>0.93 Ba</b>	<b>0.78 AC</b>	<b>0.89 BCb</b>	<b>0.72 A</b>	0.039
	28	B	0.91	0.82	0.88	0.80	
	42	C	1.03 a	0.96	<b>1.06 B</b>	<b>0.90Ab</b>	

a,b – values marked with different letters differ significantly ( $p \leq 0.05$ )

A,B – values marked with different letters differ highly significantly ( $p \leq 0.01$ )