EFFECT OF THE DIETARY OREGANO *(ORIGANUM VULGARE L.)* POWDER AND OIL ON THE PERFORMANCE, CARCASS AND ORGANS DEVELOPMENT OF BROILERS REARED UNDER HEAT STRESS (32°C)

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Abstract

An experiment on COBB 500 broiler chicks, reared under heat stress, evaluated the effect of the oregano (Origanum vulgare L.) powder and oil, on broiler performance, carcass and organ development. The study used 80, 1 day-old Cobb 500 chicks, weighed individually and housed in an experimental hall with 32°C constant temperature, humidity 36% and 23 h light regimen. During the starter stage (1-14 days), all chicks received a conventional diet formulation with corn and soybean meal as basic ingredients. During the growth stage (14-42 days), when the actual feeding trial started, the chicks were weighed, assigned to four groups (C, C1, E1, E2). Compared to the conventional diet C (with monensin in the premix for the grower phase), diet formulation C1 didn't include monensin in the premix. The diet formulations for the experimental groups were similar with formulation C1 but differed from it by the addition of 0.01% oregano oil (E1), or 0.005% oregano oil plus 1% oregano powder (E2). The chicks had free access to the water and feed. Throughout the experimental period from 14 to 42 days, body weight gain was recorded weekly and feed intake was recorded daily. At the end of the feeding trial, 5 chicks from each group were slaughtered in order to make measurements of the relative weight of carcass cuts and internal organs of broilers.

Key words: broilers, heat stress, oregano oil and powder, performance, carcass

INTRODUCTION

Heat stress has been associated with decreases on weight gain, feed intake, feed efficiency and digestibility of nutrients of birds [8]. The ideal temperature for poultry is 25-30°C for optimum body weight and 15-27°C for feed efficiency. Different natural agents are used to minimize the harmful effects of heat stress on performance of broilers. For example some vitamins [5,23], minerals [27] and substances with antioxidant character such as tomato powder [27], different essential oils [28] and oil mix (Thymus serpyllum, Laurus nobilis L., Myrtle oil, Foeniculum vulgare, Salvia officinalis) [14]. Oregano *(Origanum vulgare L.)* is one of the many plant that are used at present as supplements in animal's diets. Oregano (*Origanum vulgare* L.) is an aromatic plant with a wide distribution throughout the Mediterranean area and Asia [30]. It contains mainly carvacrol and thymol that constitute about 78 to 82% of the total oil and their precursors, (-terpinene and p-cypene). Oregano possesses intense in vitro antimicrobial [9], antifungal [6] insecticidal [15] and antioxidant [2] properties. These properties make it an appropriate candidate as a replacement for antibiotic growth promoters and also a promising feed additive in order to prevent meat lipid oxidation. The oil obtained from *O. vulgare* subsp. *hirtum* plant by a steam distillation process comprises more than 20 ingredients, most of which are phenolic antioxidants [29]. So far, it has demonstrated some encouraging experimental results in

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broilers [10] and pigs [21]. Furthermore, the combination of the potential effects of the dietary supplementation with oregano oil, beneficial in terms of production and harmful in terms of welfare, suggests that it is important to investigate its potential consequences on the feeding behaviour of farm animals. Oregano oil is generally recognized as safe by the United States Food and Drug Administration and has beneficial effects on the intestinal microflora [12,13] feed utilization [18,19], and digestive enzymes stimulation [11]. However, the effects of oregano oil on growth performance of poultry were inconsistent. Supplementation of oregano oil was shown to improve growth performance of poultry in a few studies [16,24]; in contrast several other studies reported that oregano oil had no significant effect on animal performance [17,13]. The aim of this study was to evaluate the effects of dietary Oregano oil and Oregano powder *(Origanum vulgare L.)* supplementation on the performance, carcass traits and organs development in broilers reared at 32°C.

MATERIAL AND METHOD

The trial was conducted within the experimental halls of the National Research-Development Institute for Animal Biology and Nutrition (IBNA-Balotesti, Romania), according to the provisions of the protocol approved by the Ethics commission of the IBNA-Balotesti. The study used 80 day-old Cobb 500 chicks (1 day), weighed individually and housed in an experimental hall with 32°C constant temperature, humidity 36% and 23h light regimen. The day-old chicks were weighed individually and assigned to 4 groups (C, C1, E1 and E2), homogenous as body weight: 42.39 ± 0.18g (C); 42.616 ± 0.24g (C1); 42.748 ± 0.21g (E1); 42.43 ± 0.20g. The chicken had free access to the feed and water. Diet formulations were calculated using the results of the chemical analysis of the feed ingredients and in agreement with the feeding requirements [22] and with the feeding requirements of Cobb 500 hybrid. In the first phase, starter (14 days), all chicks received a conventional diet. For the other two phases (grower and finisher), the basal formulation of the diets was the same for all four groups (Table 1). Compared to the conventional diet C (with monensin in the premix for the grower phase), diet formulation C1 didn't include monensin in the premix. The diet formulations for the experimental groups were similar with formulation C1 but differed from it by the addition of 0.01% oregano oil (E1), or 0.005% oregano oil plus 1% oregano powder (E2).

Table 1 Diet formulations

Ingredients	Grower phase (14 – 35 days)				Finisher phase (35 – 42 days)			
	C	C1	E1	E2	C	C1	E1	E2
Corn, %	62	62	62	61	60.45	60.45	60.45	59.45
Soybean meal, %	26.58	26.58	26.58	26.58	25.54	25.54	25.54	25.54
Oil %	2.5	2.5	2.5	2.5	3.72	3.72	3.72	3.72
Oregano Oil, %	-	-	*0.01*	*0.005*	-	-	*0.01*	*0.005*
Oregano Powder, %	-	-	-	*1*	-	-	-	*1*
Gluten %	4	4	4	4	6	6	6	6
Methionine, %	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25
Lysine, %	0.48	0.48	0.48	0.48	0.2	0.2	0.2	0.2
Carbonate, %	1.4	1.4	1.4	1.4	1.33	1.33	1.33	1.32
Monocalcium phosphate, %	1.36	1.36	1.36	1.36	1.13	1.13	1.13	1.13
Salt, %	0.37	0.37	0.37	0.37	0.33	0.33	0.33	0.33
Choline, %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Premix A6 *, %	1	-	-	-	-	-	-	-
Premix A6 with no coccidiostat, %	-	1	1	1	1	1	1	1
Total	100	100	100	100	100	100	100	100

*1kg premix (A6) contains: = 1.350.000 IU/kg vit. A; 300.000 IU/kg vit. D3; 2700 IU/kg vit. E; 200 mg/kg Vit. K; 200 mg/kg Vit. B1; 480 mg/kg Vit. B2; 1485 mg/kg pantothenic acid; 2700 mg/kg nicotinic acid; 300 mg/kg Vit. B6; 4 mg/kg Vit. B7; 100 mg/kg Vit. B9; 1.8 mg/kg Vit. B12; 2500 mg/kg Vit. C; 7190 mg/kg manganese; 6000 mg/kg iron; 600 mg/kg copper; 6000 mg/kg zinc; 50 mg/kg cobalt; 114 mg/kg iodine; 18 mg/kg selenium; 50 g sodium monensin /kg.

One experimental batch/group/phase was manufactured; compound feed samples were collected and assayed for the basic chemical composition. Standardized methods (according to CE Regulation 152/2009) were used to determine nutrients (dry matter, protein, fat, fibre, ash, calcium and phosphorus) concentration. At 42 day, broilers were slaughtered by sectioning the jugular vein and carotid artery, after which they were bled for 2 min, scalded in hot water and manually defeathered. The broilers were weighed both before and after slaughter; broiler carcass, gizzard, liver, spleen, heart, bile and full intestine were also weighed. The length of the intestine, the length and width of the breast and the length of the caecum were also measured. Kerm scales (0.001% precision) were used to measure the weight of the carcass and organs (gizzard, liver, spleen, heart, bile and full intestine). The pH value was determined with a Mettler Toledo pH meter. The productive variables of the broilers: initial weight (g), final weight (g), total gain (kg) average daily weight gain (g/ chick/ day), average daily fed intake (g feed/broiler/day), feed conversion ratio (kg feed consumption/kg gain) were analysed using variance analysis (ANOVA) with STATVIEW for Windows (SAS, version 6.0). The experimental results were expressed as mean values ± standard deviation, the differences being considered statistically significant for $P < 0.001$.

RESULTS AND DISCUSSION

The results of the chemical analysis of the compound feeds (Table 2) showed that the compound feeds for both the growing and finishing stages were balanced as energy and protein content.

Table 2 Chemical composition of the compound feeds

Ingredient	Grower (14–35 days)				Finisher (35–42 days)			
	C	C1	E1	E2	C	C1	E1	E2
	%							
Basic chemical composition								
Dry matter (DM), %	87.70	88.79	87.92	88.81	89.60	89.71	90.53	90.04
Organic matter (OM), %	82.17	83.46	82.86	83.18	84.81	84.88	85.50	84.09
Crude protein (CP), %	20.51	20.71	21.77	21.44	19.40	19.84	19.07	20.18
Ether extractives (EE), %	4.13	3.98	4.30	4.27	5.59	5.45	5.65	5.69
Fibre (CF), %	3.49	3.45	3.81	3.90	3.53	3.37	3.98	3.44
Ash (Ash), %	5.53	5.34	5.06	5.63	4.79	4.83	5.03	5.95
Nitrogen-free extractives (NFE), %	54.04	55.31	52.98	53.57	56.29	56.23	56.80	54.78
Calcium (Ca), mg/kg DM	0.84	0.85	0.85	0.86	0.85	0.84	0.84	0.84
Phosphorus (P), mg/kg DM	0.84	0.67	0.75	0.89	0.85	0.82	0.88	0.73

The average body weight and the feed conversion ratio of the treatments are presented in Table 3. During phase II (14-35 days), significant differences ($P<0.001$) of the average daily weight gain and average daily feed intake were noticed between groups C and C1. Also in Phase II the average daily consumption of the C1 group was significant ($P<0.001$) lower than in group C, but in Phase III and during the experiment (14-42 days) this difference did not appeared. During phase III (35-42 days) significant differences ($P<0.001$) of the final broiler weight were recorded between groups E1 and E2. The total gain and the average daily weight gain were significantly ($P<0.001$) higher in group E1 compared to group C.

Throughout the experimental period (14-42 days) differences ($P<0.001$) were also noticed in the average daily weight gain (g) between groups E1 and E2. Our results are in contradiction with other reports on the use of oregano in chicken diets [1,20] in that they found no difference on the average body weight and feed conversion. Also, [31] stated that slaughter weight was lower in the oregano group, but feed intake was not, while others[10] reported that growth performance

of broilers was improved. The observation of positive effects of the dietary inclusion of essential oils on the performance of broiler chicks is attributed to their well-known in vitro antimicrobial properties and the appetizing effect that they seem to have.

As reported by [20], they studied the effect of the dietary oregano oil extract on broiler growth, showing that this treatment increased broiler body weight compared to the untreated, control group. In the present study, supplementation with oregano oil improved body weight gain for overall period at E1. On a contrary, [4] reported that dietary inclusion of 1 g/kg oregano oil in broilers' diet could not affect these performance parameters. They suggested that the lack of growth promoting action of oregano oil was related to the absence of thymol and carvacrol in the essential oil used in their study. Inconsistent with this study, other author [19] reported that performance of growing broilers was not affected by using an oregano-based supplement.

Table 3 Broiler performance (average values/group)

Specification	C	C1	E1	E2	SEM	P
	Phase II, grower (14 – 35 days)					
Initial weight (g)	294.88	318.96	301.18	305.84	5.989	0.544
Final weight (g)	1197.00	1107.75	1151.50	1131.00	19.045	0.401
Total gain (g)	902.13	788.79	850.32	825.16	18.900	0.190
Average daily weight gain (g/ broiler/day)	56.38 ^{b}	49.30 ^{a}	53.15	51.57	1.181	0.191
Average daily fed intake (g feed/broiler/day)	84.7 ^{b}	81.11 ^{a}	82.29	82.91	1.419	0.869
Feed conversion ratio (kg feed consumption/kg gain)	1.33	1.47	1.53	1.41	0.059	0.704
	Phase III, finisher (35 – 42 days)					
Initial weight (g)	1197.00	1107.75	1151.50	1131.00	19.045	0.401
Final weight (g)	1917.6	1873.21	2128.46^{d}	1811.92^{c}	5.161	0.167
Total gain (g)	702.00^{c}	771.79	948.46^{a}	713.46	41.551	0.139
Average daily weight gain (g/ broiler/day)	50.14^{c}	55.13	67.74^{a}	50.96	2.966	0.139
Average daily fed intake (g feed/broiler/day)	82.78	79	94.78	74.42	4.622	0.485
Feed conversion ratio (kg feed consumption/kg gain)	2.35	2.09	2.29	2.34	0.094	0.775
	Overall broiler performance - 14-42 days (grower - finisher)					
Initial weight (g)	294.88	318.96	301.18	305.84	5.989	0.544
Final weight (g)	1917.6	1873.21	2128.46	1811.92	5.161	0.167
Total gain (g)	1620.05	1556.36	1823.77	1505.29	50.496	0.139
Average daily weight gain (g)	54.00	51.88	60.79^{d}	50.18^{c}	1.683	0.139
Average daily fed intake (g CF/broiler/day)	83.61	80.05	88.54	78.67	2.804	0.650
Feed conversion ratio (kg CF/kg gain)	2.03	2.18	2.33	2.40	0.122	0.759

*Where a,b,c,d = significant differences (P≤0.05) compared to C, C1, E1, E2;
SEM: standard error of the mean;

No differences in carcass development were noticed in the end of the feeding trial (table 4). Other reports [2,1,7,19,20] showed that the dietary oregano powder and oil failed to promote growth performance in broilers.

The data on the bodyweight of the broilers from groups E1 and E2 are not in agreement with the data reported by [3] who used oregano powder in experimental broiler diets.

Table 4 The randament effects of oregano oil and oregano powder inclusion to diets on relative weight of carcass cuts of broilers (42 d of age), (% BW)

Item	C	C1	E1	E2	SEM	P
Greutate pui viu (g)	1735	1758	1767	1745	55.630	0.9977
Carcasa (g)	1436	1448	1455	1430	44.888	0.9978
Randament (%)	82.78	82.32	82.70	82.01	3.223	0.9595

*Where SEM: standard error of the mean;

Figure 1 shows that, compared to group C, the experimental compound feeds formulations (E1 and E2) influence liver and gizzard development in the groups treated with oregano oil (E1) and oregano oil and oregano powder (E2).

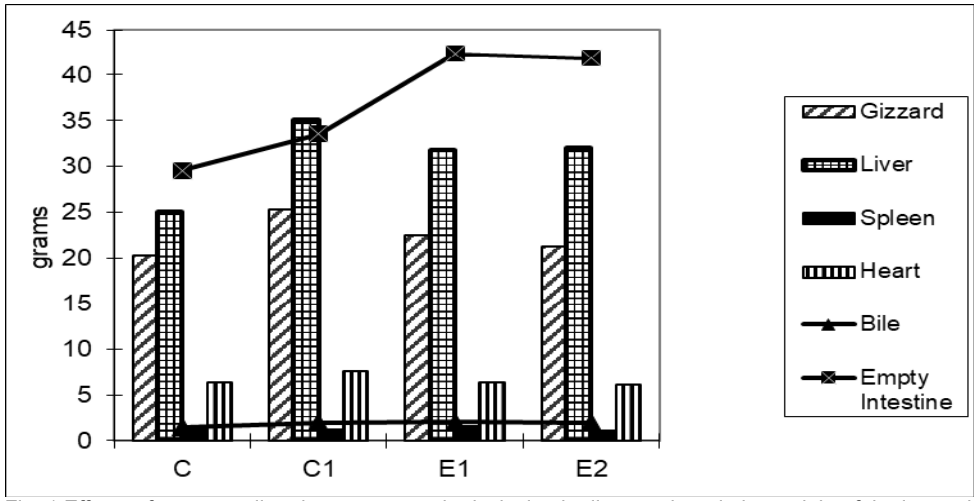

Fig. 1 Effects of oregano oil and oregano powder inclusion in diets on the relative weight of the internal organs of broilers (42 d of age), (g, BW)

The physical measurements performed at the end of the 42 experimental days showed no significant differences between the 4 groups.

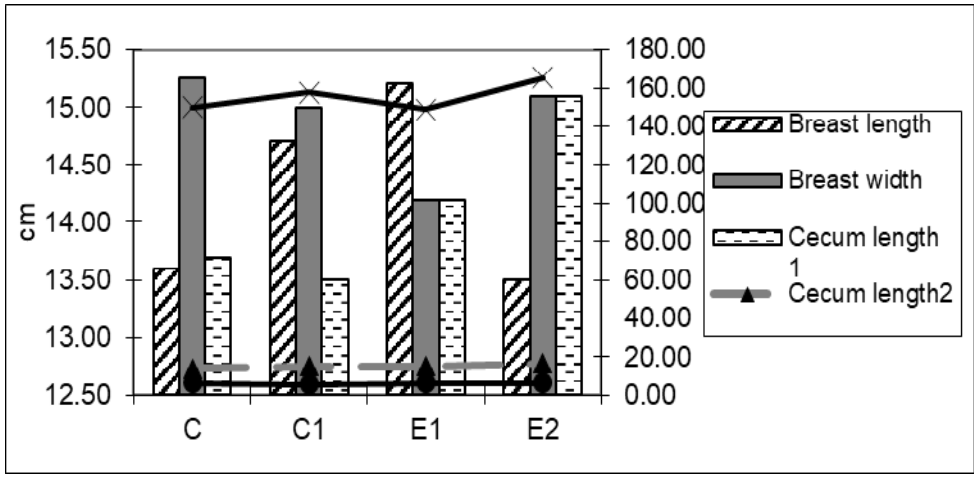

Fig 2 Physical measurements performed upon slaughter (42 days)

CONCLUSIONS

✓ Dietary supplementation with oregano oil had significant effect on growth performance of broilers. The final weight and the average daily weight gain of the broilers from group E1, treated with 0.01% oregano oil was different ($P<0.001$) from that of group E2, treated with 0.005% oregano oil and 1% oregano powder.

✓ The results of the present study indicate that future research is needed to identify the optimum inclusion levels of oregano (oil or oil and powder) in the diets of broilers, and the possible interactions with rearing conditions and/or diets.

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