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The Effects of an Organic Acids and Etheric Oils Mixture on Fattening Performance, Carcass Quality and Some Blood Parameters of Broilers

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Abstract: This experiment was conducted to investigate the effects of an organic acids and etheric oils mixture (BIACID™) on fattening performance, carcass quality and some blood parameters of broilers. Therefore, a total of 160 days-old Ross 308 broiler chicks were assigned to 2 groups with 4 replicates each containing 20 chicks. The groups were employed: Control group (C) without additive, Group (A), which supplemented with 1 kg ton^{-1} organic acid mixture containing etheric oils. Experimental period lasted 42 days. There was no statistical difference in the cases of live weight, live weight gain, feed consumption, feed conversion ratio, hot and cold carcass yield, liver, gizzerd, heart, abdominal fat pad weight and their ratios to hot carcass weight, the mean intestinal content pH and total intestinal weight scores, serum total protein, triglyceride and cholesterol levels of groups C and A. Only the jejenum length scores were statistically longer of group A than group C. As a result, the values obtained by the addition of organic acid mixtures containing etheric oils to broiler ratios are generally in an acceptable level.

Key words: Broiler, etheric oils, organic acids, fattening performance

INTRODUCTION

Organic acids detrimental effects on bacterias are based on penetration to their cell walls and damaging their physiology (Gauthier, 2002). After penetration, non ionized organic acids decompose to H (H^+) ions and anions (A^-). By the time the decrease of intracellular pH activates a specific mechanism (H^+-ATP ase pump). Due to important amount of energy is consumed by the activation of this mechanism, bacterial proliferation endures or can not survive. The decrease of internal pH also may inhibit glicolysis, active transport and stimulus transmission (Lambert and Statford, 1999).

Contrary to antibiotics, organic acids have a common effect mechanism despite their different chemical structures. Their antimicrobial effect increases with the environmental pH decrease (Lambert and Statford, 1999).

More than 2600 different etheric oil kinds have been defined. It is known that some of the organic acids, etheric oils and phenolic compounds have antimicrobial effects. The most prevalent mechanism is impairing the permeability of cell wall and inactivation of enzymatic systhem. It is claimed that these products have positive effects on animal health and especially on immun systhem. But there is no satisfying amount of study about their effects on digestive systhem microflora and performance parameters (Eren, 2001).

Biologic factors (variety of plant, region, harvesting conditions), production factors (extraction/distillation, stabilisation), storing conditions (light, temperature, oxygen, duration) may change these products contents. Because of these reasons their presentations are not accepted as antibiotics. But some researchers claim that these feed additives effectiveness may be near to antibiotics (McCartney, 2002).

There has been a tendence that organic acid and etheric oil mixtures would be more effective than their solely addition to diets. In this study, the effects of addition of a commercial product containing mixture of organic acids and etheric oils to broiler diets on live weight, live weight gain, feed consumption, feed conversion ratio, hot carcass weight and yield, cold carcass weight and yield, liver, gizzard, heart, abdominal fat pad weights and their ratios to hot carcass weight, intestinal content pH, duedonum, jejenum, ileum, colon and cecum lengths, total intestinal weight, serum total protein, triglyceride and cholesterol levels are investigated.

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MATERIALS AND METHODS

This study was performed, on a number of 160 day old Ross 308 broiler chicks, which were purchased from a commercial supplier. Birds were divided randomly into 1 control and 1 experimental groups each containing 80 chicks. All the groups were divided into 4 subgroups, which were containing 13 male and 7 female chicks.

A diet containing 22% Crude Protein (CP) and 3000 kcal kg^{-1} Metabolic Energy (ME) for the first 3 weeks chick period and 20% CP and 3200 kcal kg^{-1} ME containing diet for pullet period was used for the last 3 weeks. No feed additive was added to the control group (C) diets. The experimental groups diet was added 1 kg ton^{-1} of mixture of organic acids and etheric oils (A).

The live weights were obtained at the beginning and at the end of the 1-6 weeks of the study. The live weight gain scores were calculated from the difference.

Again at the ends of the 1-6 weeks of the study feed consumption scores were determined by the difference of the feed lasted than the amount of we put in the feedboxes. By this way, these scores were divided to bird number and the mean scores of subgroups and groups were determined.

The feed conversion ratios were obtained from dividing the mean feed consumption scores to mean live weight gain scores.

After the weighing procedure of all birds individually at the end of the 6 week of the study 3 birds (2 male 1 female) from all the subgroups were slaughtered and hot carcass weights were deermined. To determine the cold carcass weight the carcass were stored in +4°C for 18 h and after weighed. After all of these hot and cold carcass weight scores were divided to live weight score before slaughtering to define the hot and cold carcass yield rates.

All the slaughtered birds fat pads on internal organs (liver, heart, gizzard), bottom of intestines and on the periton were collected and weighed as abdominal fat pad. After this procedure liver, heart, gizzard and abdominal fat pad weight scores were divided to hot carcass weight and in this way, their rates to carcass were determined.

After slaughtering the intestines were tied carefully and extriped. The contents flowed out in a cup and their pH were determined by a pH meter (Orion 420A). Than the duodenum, jejenum, ileum, cecum and colon lengths separately and total intestinal weights were determined.

The slaughtered birds bloods were collected and centrifuged serums were seperated. By the special kits; cholesterol (36033HW00), total protein (38035HW00) and triglyceride levels were determined with an otoanalyser (ABBOTT AEROSET; ABBOTT Laboratories, ABBOTT Park, Illions, USA).

Live weight, live weight gain, feed consumption and feed conversion ratio, hot and cold carcass yields, liver, heart, gizzard weights and their ratios to hot carcass weights, intestinal content pH level, duodenum, jejenum, ileum, cecum lengths, total intestinal weight, serum total protein, triglyceride, cholesterol scores statistical analaysis and the significancy of differences of the mean values of the groups were determined by variance analysis method, the significancy of the differences between the groups were determined by Duncan test. Statistical analyis were performed by SPSS 10.0 software.

RESULTS AND DISCUSSION

The ingredients of the diets are shown in Table 1. The diets nutritional values and their metabolic energy levels used in the study are shown in Table 2.

The mean live weight scores of the groups are shown in Table 3. The mean live weight gain scores of the groups are shown in Table 4.

Table 1: The ingredients of the diets, (%)

Feed ingredient	Chick period	Pullet period
Corn	54.25	57.00
Soy bean meal	27.00	19.00
Full fat soy bean	12.50	16.00
Meat-bone meal	2.00	2.00
Oil	1.00	3.00
Limestone	1.50	1.25
DCP	1.00	1.00
Salt	0.25	0.25
Vitamin+mineral mixture	0.25	0.25
Methionin	0.25	0.25

Table 2: Diets nutritional values (%) and their metabolisable energy levels (kcal kg^{-1})

	Chick diet	Pullet diet
Dry matter	89.60	89.30
Crude protein	22.05	20.04
Extracted oil	6.20	8.30
Crude cellulose	3.70	4.25
Ash	5.80	5.55
Metabolic energy	3005.00	3205.00

Table 3: The mean live weight scores of the groups (g)

	C	A	
Weeks	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
0	42.02±3.24	41.65±3.50	0.215
1	135.85±20.26a	129.89±17.13b	100.1270***
2	338.30±57.96	328.75±53.80	183.050
3	636.30±101.70	645.40±104.80	273.550
4	1130.40±170.19	1169.68±170.70	165.700
5	1601.20±221.19	1638.86±235.38	95.700
6	1990.07±270.49	2054.76±272.24	57.450

***($p<0.001$)

Table 4: The mean live weight gain scores of the groups (g)

	C	A	
Weeks	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
1	92.59±3.07	88.22±5.65	52.860
2	203.69±4.30	198.88±9.77	230.190
3	300.50±14.58	316.58±15.08	120.860
4	493.90±14.54	524.53±26.50	24.360
5	470.80±25.72	472.88±45.27	0.059
6	401.38±13.88	411.80±45.00	0.176
1-6	1962.87±38.79	2012.92±56.44	45.500

Table 5: The mean feed consumption levels of the groups (g)

	C	A	
Weeks	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
1	132.85±1.68	127.73±3.27	2.189
2	251.53±7.72	242.23±10.47	24.446
3	499.20±0.80	497.83±2.18	51.381
4	799.05±7.30	817.13±21.01	31.984
5	915.43±19.95	919.15±13.10	10.036
6	936.35±12.96	951.35±23.78	4.674
1-6	3534.40±33.39	3555.40±40.56	35.316

The mean feed consumption levels of the groups are shown in Table 5. The mean feed conversion ratios of the groups are shown in Table 6. The mean carcass weights, hot and cold carcass yield ratios of the groups are shown in Table 7.

The mean liver, gizzard, heart, abdominal fat pad weights and their ratios to hot carcass weights of the groups are shown in Table 8. The mean intestinal content pH, length and total intestinal weight scores of the groups are shown in Table 9. The mean serum total protein, triglyceride and cholesterol levels are shown in Table 10.

Statistical difference was not determined between the groups in the case of live weight and live weight gain scores in general and at the end of the study. Only at the end of 1 week there was an important difference determined between the groups ($p<0.001$) in the case of live weight and was not observed again. The results of Skinner *et al.* (1991) and Kirkpinar *et al.* (1999) who added fumaric acid and organic acid mixture sequentally are not harmonical with this study. The use of only fumaric acid or the addition of high level of organic acid mixture may be the reason. The results of the studies (Botsoglou *et al.*, 2002, 2004; Alcicek *et al.*, 2003), in which etheric oil extracted from one herb (Origanum Vulgare) or mixture of etheric oils were added in different levels to diets of broilers do not confirm our results. The study of Alcicek *et al.* (2004) the group, which diet was added of 24 mg kg^{-1} etheric oil mixture confirms our studies. Different mixtures and addition levels may be the reason.

Table 6: The mean feed conversion ratios of the groups (kg feed kg^{-1} live weight gain)

	C	A	
Weeks	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
1	1.41±0.027	1.44±0.052	51.360
2	1.24±0.094	1.22±0.100	2.600
3	1.60±0.095	1.57±0.087	77.300
4	1.61±0.069	1.57±0.500	5.120
5	1.94±0.059	1.97±0.120	16.300
6	2.33±0.090	2.35±0.190	0.942
1-6	1.69±0.076	1.69±0.080	1.282

Table 7: The mean carcass weights (g), hot and cold carcass yield ratios (%)

	C	A	
Weeks	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
Live weight	2018.50±36.86	2045.08±37.32	22.480
Hot carcass weight	1491.58±86.98	1524.58±92.42	29.894
Hot carcass yield	73.92±1.15	74.57±1.21	9.220
Cold carcass weight	1472.42±90.28	1499.33±94.14	30.240
Cold carcass yield	72.96±1.16	73.32±1.11	11.710

No difference was determined between the group C and group A in the aspect of feed consumption and feed conversion rate scores like Yalcin *et al.* (1997), Kirkpinar *et al.* (1999), Alcicek *et al.* (2003) and Botsoglou *et al.* (2004). Skinner *et al.* (1991) study results do not overlap with our results, in which they added broiler diets of 0.125 and 0.250% fumaric acid and found enhanced feed conversion rates of experimental groups than the control group. Reason may be connected with the only use of fumaric acid. Also, the study of Alcicek *et al.* (2004), in which the addition of 36 and 48 mg kg^{-1} etheric oil mixture enhanced feed consumption rates ($p<0.05$), this can be related with the differences in mixture contents and levels.

At the end of the study there was no statistcal significancy between the groups C and A in the case of hot and cold carcass yield rates. This data does not confirm to Alcicek *et al.* (2003), who presented that etheric oils increase the carcass yields. On the other hand other studies, in which organic acids Yalcin *et al.* (1997) and Kirkpinar *et al.* (1999) were added to broiler diets support our results.

There was no statistical difference observed between the groups C and A in the cases of liver, gizzard, hearth and abdominal fat pad weights and their ratios to hot carcass weight. This result is supported by the study, in which organic acid mixture Kirkpinar *et al.* (1999) and Alcicek *et al.* (2004) was added to diets and presented that these procedures do not statistically effect these parameters.The intestinal content pH scores of goups C and A were not statistically different. The other studies, in which ascorbic acid and citric acid (Brown and Southern, 1985), organic acid mixture Kirkpinar *et al.* (1999) was added to broiler diets presented that

Table 8: The mean liver, gizzard, heart, abdominal fat pad weight scores (g) and their ratios to hot carcass weight (%)

	C	A	
	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
Liver weight	36.83±3.79	38.25±4.97	1.97
Ratio of liver weight to hot carcass weight	2.47±0.05	2.50±0.08	5.36
Gizzard weight	34.25±3.31	32.50±3.87	2.55
Ratio of gizzard weight to hot carcass weight	2.30±0.06	2.13±0.05	4.43
Heart weight	11.67±2.01	11.25±1.76	1.33
Ratio of heart weight to hot carcass weight	0.78±0.03	0.74±0.03	2.39
Abdominal fat pad weight	22.83±2.31	21.25±1.57	0.70
Ratio of abdominal fat pad weight to hot carcass weight	1.55±0.17	1.39±0.10	0.94

Table 9: The mean intestinal content pH, length (cm) and total intestinal weight (g) scores of the groups

	C	A	
	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
pH	6.50±0.27	6.51±0.82	3.85
Duodenum length	38.75±5.83	37.25±4.02	9.13
Jejenum length	51.33±10.13a	61.33±10.66b	5.99**
Ileum length	66.67±14.29	67.50±10.36	0.062
Colon length	9.42±2.39	8.33±1.67	0.744
Cecum length	34.92±0.65	36.25±5.29	3.26
Total intestinal weight	73.67±5.58	73.42±9.47	2.17

**($p<0.05$)

Table 10: The mean serum total protein (g/100 mL), triglyceride (mg/100 mL) and cholesterol levels (mg/100 mL)of the groups

	C	A	
	$\bar{x} \pm S\bar{x}$	$\bar{x} \pm S\bar{x}$	F
Total protein	2.96±0.50	3.10±2.96	0.50
Triglyceride	28.00±4.75	26.08±28.00	4.75
Cholesterol	117.42±16.00	117.92±117.42	16.00

experimental groups levels were not determined different from the control group and support our results.

There was no statistical difference between the groups in the case of duodenum, ileum, colon and cecum lengths and total intetinal weght. Only jejenum length of the group C was shorter than the group A ($p<0.01$). This may be related with digestion or absorbtion functions. The other studies, in which ascorbic acid and citric acid (Brown and Southern, 1985), organic acid mixture Kirkpinar *et al.* (1999) was added to broiler diets presented that experimental groups intestinal content pH levels were not determined different from the control group and support our results.

Serum total protein, triglyceride and cholesterole levels were not different among the groups ($p>0.05$). Yalcin *et al.* (1997) emphasized that the level of serum cholesterole and total protein levels increased with the increase of lactic acid in diets, but the triglyceride level was not effected. The serum total proein level difference was significant between the control and 4-5% lactic acid added experimental group ($p<0.01$). On the other hand, there was significant difference between the 3 and 5% lactic acid added groups in the case of cholesterole level ($p<0.05$). Our study supported the results of Yalcin *et al.* (1997) in the aspect of serum triglieride level, but not the total protein and cholesterole.

CONCLUSION

The European Union banned antibiotics to be used as feed additives except ionophores as anticoccidials. In the light of these data, it is observed that natural, harmless to human and animal health feed additives, which enhance optimal intestinal microflora and could be alternatives of antibiotics have been investigated intensively.

Adding feeds 1 kg ton^{-1} mixture of organic acids and etheric oils doesnt effect the fattening performance parameters, hot and cold carcass yields, liver, heart, gizzard weights and their ratios to hot carcass weights, intestinal content pH level, duodenum, jejenum, ileum, cecum lengths, total intestinal weight, serum total protein, triglyceride, cholesterol levels. Therefore the addition of this feed additive in this level can be acceptable. The usage in place of antibiotics should be investigated intensively.

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