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Effect of utilization organic acid supplement on broiler (ROS-308) feeding at pre-starter and starter period breeding on basic performance parameters

Hasan.A.Mohammed*

Erbil Polytechnic University –Shaqlawa Technical Institute ,Veterinary Department.
***Corresponding author, Dr. Hasan. A. Mohammed,** Head of Veterinary Department in Shaqlawa Technical Institute, E-mail: *mohammedhassan335@gmail.com*, Tel +9647504654962

Abstract

The purpose of this work was to study the role utilization effect different type of organic acid with natural acid in pre-starter and starter of period breeding broiler (Ross-308) on performance parameters. A total number of 200 one day old straight run broiler Ross-308 hybrid chicks were distributed to four dietary treatments each of treatment has 5 replicate each of replicate has 10chicks, the control group without any supplement source of organic acid, treatment 1(T1) received acetic acid treatment 2(T2) received citric acid, treatment 3(T3) received mixing of juice and lemon cortex. Treatments (1, 2, and 3) were supplements source of organic acid by drinking water concentration0.25% from 1 day till 10 days. The average live bodyweight (L.B.W) feed consumption, main and secondary carcass weight, totally and daily weight access, feed conversation ratio (F.C.R) and edible parts weight were analyzed and compared finally. The results showed insignificant effects with addition of organic acid ($p \leq 0.05$) on (T1, T2 and T3) by (L.B.W, total and daily weight access, carcass and heart weight) but significant ($p \leq 0.05$) with in other parameters. Supplement of lemon cortex increases of (F.C.R) but other organic acids affected positive and negative by different local parameters levels in pre-starter and starter of broiler chick feed.

Keywords: chicks, organic acids, neutral acid, carcass parameters.

Introduction

High levels of production and efficient feed conversion are the need of the modern poultry industry, which to a certain extent could be achieved by the use of specific feed additives. Antibiotic feed additives as growth promoters have long been supplemented to poultry feed to stabilize the intestinal microbial flora, improve the general performances and prevent some specific intestinal pathology (Hassan et al. 2010).

Organic acid treatments composed of individual acids and blends of several acids have been found to perform antimicrobial activities similar to those of antibiotics (Wang et al. 2009). The European Union allowed the use of organic acids and their salts in poultry production because these are generally considered safe (Adil et al. 2010). Organic acids have been used for decades in commercial compound feeds, mostly for feed preservation, for which formic and propionic acids are particularly effective (Lückstädt2014). In the European Union, these two organic acids and several others (lactic, citric, fumaric and sorbic acids) and their salts (e.g. calcium formate, calcium propionate) are used under the classification 'feed preservative' (Lückstädt & Mellor 2011). As a group of chemicals, organic acids are considered to be any organic carboxylic acid of the general structure R-COOH (including fatty acids and amino acids).

The short-chain acids (C1–C7) are associated with antimicrobial activity. They are either simple mono-carboxylic acids such as formic, acetic, propionic and butyric acids or carboxylic acids with the hydroxyl group such as lactic, malic, tartaric and citric acids or short-chain carboxylic acids containing double bonds like fumaric and sorbic acids (Shahidi et al. 2014).Organic acids are weak acids and are only partly dissociated. Most organic acids with antimicrobial activity have a pKa (the pH at which the acid is half dissociated) between 3 and 5. A wide range of organic acids with variable physical and chemical properties exists, of which many are used as drinking water supplements or as feed additives (acidifiers). Many are also available as sodium, potassium or calcium salts (and/or partially esterified). The advantage of salts over acids is that they are generally odorless and easier to handle in the feed-manufacturing process owing to their solid and less volatile form. They are also less corrosive and may be more soluble in water (Huyghebaert et al. 2011). The use of organic acids has been reported to protect the young chicks by competitive exclusion (Mansoub et al. 2011), enhancement of nutrient utilization, and growth and feed conversion efficiency (Lückstädt & Mellor 2011). This publication presents recent studies on the effect of organic acids on enteric diseases, gastrointestinal tract, nutrient digestibility, immunity and performance in broiler and laying hens.

The study was conducted in order to evaluate acetic acid and citric acids with natural source acid as lemon juice mixing with cortex in pre-starter and starter period on basic performance parameter of broiler chicks in cage technology.

Materials and Methods

The experiment was conducted by cooperation of one private farm in closed Erbil city with 200one day old straight run broiler chicks (Ross-308)for a period 10 days in pre-starter and starter dietThe chicks were randomly divided into 4 equal treatments groups (C, T1, T2 and T3) each having 50 chicks. Each treatment was subjected to 5 equal replications of 10 chicks each. The diets were formulated with commonly available feed ingredients is shown in Table 1. The dietary treatments were C (control diet) without any additive; T1, T2 and T3 were supplemented with 0.25% acetic acid, 0.25% citric acid and 0.25% mixingjuices with cortex of lemon respectively with drinking water. Dry mash feed was supplied on *adlibitum* basis. Fresh clean drinking water was made at all the times. Adequate sanitary measures were taken during the experimental period. The birds were housed in cages of 120cm×76cm.

Table 1. The ingredients and chemical composition of

control diet Ingredients	**Amount in the diet (%)**
Maize	51.75
Soybean meal	42.00
Soybean oil	4.00
Salt	0.25
Di- Calcium Phosphate	0.50
Calcium premix	1.00
Vitamin-Mineral premix	0.75
DL-Methionine	0.15
Choline Chloride 60%	0.05
Chemical composition	**Amount (%)**
Dry matter	85.00
Crude protein	23.21
Crude fibre	5.88
Ether extract	1.76
Nitrogen free extract	48.41
Ash	6.96
ME(kcal/kg DM)*	3241.22

Calculated according to Wiseman (1987)

Birds' management

Broiler chickens were kept under the Ross recommended procedure. Water and rations distributed ad libitum and uniform light provide 24 hours daily. The temperatures of the house and vaccination programmer applying are basing on broiler live breeding period raisers' recommendations. At the age of day 4 and 8, birds were vaccinated against Infectious Bursal Disease (IBD) using Bursine-2. Chicks were also vaccinated with B.C.R.D.V on 8th day. To evaluate the treatment effect, weight gain, feed conversion ratio, mortality, dressing percentage, economy of broiler production were recorded and calculated. At the end of experiment, two birds from each treatment were selected randomly to record the dressing yield, organs weight and cut up parts. Feed samples were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), nitrogen free extract (NFE), and total ash by following the method of AOAC(1990).

Duplicate samples were analyzed and the average value was taken. Collected and calculated data were analyzed for analysis of variance (ANOVA). Procedures appropriate for a completely randomized design and the significance of differences between the means estimated using Duncan test (Duncan's new multiple range test). Probability level of P<0.05 was considered for Significance in all comparisons. All statistical analyses were performed using the software SPSS 17.5 for Windows® (SPSS Inc., Chicago, IL).

Results and Discussion

Body weight gain

Effect of organic acids inclusion in broiler ration on live weight gain is presented in Table 2. Significant (P<0.05) difference compared with C group in body weight of birds among the groups were observed at 10 days ages. Birds on T3 showed lower (P<0.05) (L.B.W), total weight gain, daily weight access and feed intake than control group (C) same treatment showed the best (1.35) (P<0.05) (F.C.R). All Treatments showed unimproved growth when administration of citric acid, and acetic acid and mixing cortex with lemon juices in water drinking was done. The growth retardation in treatment C seemed to be a consequence of a depressed water intake induced by application of acetic acid in water. The result is in agreement with Schuhmacher et al. (2006), who found lower weight gain. Highest weight gain on 0.5% citric acid agreed with previous findings of Shen-HuiFang et al. (2005); Denil et al. (2003) and Stipkovits et al. (1992) where improved weight gain was observed with administration of citric acid in diets at 0.3, 0.5 and 0.7%, respectively. The results contradict with the findings of previous researchers Pinchasov et al. (2000) where depressed weight gain was observed with application of acetic acids in diets.

Table 2. Live weight gains Feed consumption and F.C.R from 1-10 days breeding in different treatments

Attributes/gram	Groups (Mean ±S.D)			
	C	T1	T2	T3
live body weight at 1st day	54.40±1.14	58.4±4.92	53.40 ±4.61	54.4±1.81
live body weight at 10th day	316.40±4.98a	292.60±4.51b	292.40±1.82b	286.40±10.21b
Total w access	262.0±6.04a	234.20±8.17b	239.0±5.52b	232±11.90b
Daily w access	26.20±0.60a	23.42±0.82b	23.90±0.55b	23.20±1.18b
Feed consumption	69.18±4.30a	53.48±7.15b	62.77±4.08a	31.31±4.23c
F.C.R	2.64±0.15a	2.28±0.25b	2.63±0.19a	1.35±0.19c

a,b means with different superscript within row are significantly different (P< 0.05) and values will increase from (a) to (c)value. Values mean ±S.D. Standard Deviation of 200 birds. C= CONTROL DIET; T1 ACETIC ACID,T2CITRIC ACID and T3 and mixing cortex with lemon juices in water drinking; ±= Standard deviation; SD= Standard deviation Mean; Figure having different superscript in the same row differ significantly (P<0.05); *= 5% level of significance.

The average feed intake of birds fed on different diets is shown in Table 2. It is evident that average feed intake was lower in T3 and higher in C group and differed statistically (P<0.05) only at 1st and 2nd treatmentsof 10 days age. These results contradict with the finding of previous researchers (Darko et al., 1991; Frigg et al., 1983 and Stipkovits etal., 1992) where depressed feed intake was observed. During (0-10days) of age feed intake was the highest in C group (69.18g) and the lowest in T3 (31.31g) at same age but difference (T1, T2, and T3) was insignificant (P>0.05) accompanied by retarded growth to be the consequence of depressed water.

The effect of organic acid supplementation on feed conversion is presented in Table 2. It is evident that FCR differ significantly (P<0.05) among treatments at all 10 days of age. Better feed conversion was found in (T3) and lower in C group during breeding period. The highest feed conversion on the administration of 0.25% mixing juices with cortex of lemon was in agreement mostly with the findings of Afsharmanesh et al. (2005) who found higher feed conversion with the administration of organic acid in poultry.

Carcass characteristics

Organs weight

It is evident from the Table 3 that weight carcass for treatment C, T1, were respectively insignificant (P>0.05)while they were significant (p≤0.05) withT2, T3 which they also differ significantly (p≤0.05) between them. The results are in well agreement with the previous findings (Kahraman et al., 1997) where no significant effect was observed. The highest dressing percentage (81.1%) value for carcass yield was found in T1 and the lowest (69.14%) value was found in T2.In dietary T1 the dressing yield was improved by about 5.25 % when compared with the control group. This result did not agree with previous findings of Garcia et al. (2000) who found decrease carcass yield. The increased dressing yield on dietary T1 might be due to increasing live weight on 0.25% acetic acid. The result partially agreed with Sapra and Mehta (1990), who found increased edible meat yield with increasing body weight. Percent thigh weight was affected little bit by dietary treatments, while improved by T1 treat with acetic acid. On one hand C group and T3 for percentage breast, head and shank insignificant (p≤0.05) but on other hand T1 and T2 insignificant (p≤0.05) between them while they differ with C and T3. The wings at 10 das observed improved in T3 high value percentage (15.17%) and the lowest value in T1 (11.28%). Skin, feather, blood non edible were Increased bleeding in T2 but decrease in T1.Latest parameter agreed with research Islam et al. (2008).

Table 3. Effect of organic acids on carcass characteristics of broiler chickens

Attributes/gram		Groups (Mean ±S.D)			
		c	T1	T2	T3
carcass weight		239.94±5.54a	237.27±0.66a	202.26±1.29 c	214.99±0.71b
dressing carcass	%	75.84±1.63b	81.11±1.36 a	69.14±0.43c	74.11±3.72b
Thigh	%	22.51±0.49ab	23.11±0.42 a	22.23±0.36 b	22.26±0.64 b
Breast	%	12.55±0.28 a	10.61±0.30 b	12.46±0.19 a	9.92±1.24 b
Back	%	22.88±0.37 b	27.76±0.87 a	22.08±0.23 b	22.69±0.53 b
Wing	%	12.96±0.38 c	11.28±0.35 d	14.16±0.18 b	15.17±0.70 a
Head	%	7.29±0.36 b	6.42±0.07 c	8.54±0.07 a	7.64±0.50 b
Shank	%	11.63±0.93 a	10.44±.24 b	11.13±0.20ab	11.61±0.38 a
Skin, feather, blood & non edible	%	31.90±2.83 b	23.32±2.08 c	44.63±0.91 a	35.20±6.74 b

a,b means with different superscript within row are significantly different (P< 0.05) and values will increase from (a)to (d)value. Values mean ±S.D. Standard Deviation of 200 birds.

Edible parts

Table 4 observed that insignificant differ (P>0.05) related with percentage heart and liver parts among C group, T1and T3 versus T2, on other side for liver percentage insignificant C group with T2 at same time. This can be attributing for differs PH number n digestive system effect on metabolism nutrient especially at pre- starter and starter period (Islam et al.(2008).For gizzard improved percentage in T2 high percentage (44.63) versus lowest number percentage in T1(23.32)while insignificant differ(P>0.05) between C group and T3 this is also attribute for number of PH increase by using citric acid in gizzard, this results agree with results of Patten, and Waldroup (1988).

Table 4. Effect of organic acids on edible parts of carcass characteristics of broiler chickens

Attributes/gram	Groups (Mean ±S.D)			
	c	T1	T2	T3
heart	4.69±0.20a	4.81±0.18a	4.10±0.05b	4.90±0.32a
liver	4.16±0.47ab	4.35±0.09a	3.78±0.17b	4.41±0.24a
gizzard	31.90±2.83b	23.32±2.08c	44.63±0.91a	35.20±6.74b

a,b means with different superscript within row are significantly different (P< 0.05) and values will increase from (a) to (c)value. Values mean ±S.D. Standard Deviation of 200 birds.

Conclusion

Performance of Citric acid and acetic acid of broilers. It may be concluded that supplementation of 0.25% citric acid in the diet showed negative effect on live weight, feed intake and feed conversion efficiency with no detrimental effect on carcass characteristics. Especially ate 10 days for pre-starter and starter period not as many study positive effect but at 42 days breeding. Further that lipase enzyme at this period is not developer this may effect of pH number in digestive system and utilization of industrial acid also effect on microbe in intestine to help for metabolism.

Recommendation

We recommend to

1. Make more experiment on natural source of acid supplement in broiler diet.
2. Utilization of mixing many source acids till end of breeding.
3. Make test of meat to exam which of acids makes best taste for tendons.

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