

Evaluation of Growth and Carcass Characteristics of Broiler Chickens (Cobb 500) Fed on Different Level of Organic Acids Inclusion in Diet at Parwanipur

Md. H. Azad^{1*}, A.K. Jha², Md.S.N.Ali², P.Alam², N.Sheikh², H.Ali² and K.Ansari²

¹Animal Nutrition Division, Khumaltar, Lalitpur

²Regional Agricultural Research Station, Parwanipur, Bara

*Corresponding author: azardhusneid@hotmail.com

ABSTRACT

An experiment was carried out to evaluate the effect of different level of organic acids on productive traits, carcass yields and body parts (Thigh, Back, Neck, wings and Breast) of broiler chicken. This experiment was conducted at Regional Agricultural Research Station, Parwanipur, Bara for 41 days to test the effect of organic acids inclusion in broiler feed and its effect on growth performance and carcass study. Altogether 225 day old Cobb-500 broiler birds were procured from Shivam Hatchery, Birgung and divided into 5 treatments with 3 replications (15 birds in each replication) by using completely randomized design. Concentrate feed was purchased from Posak Feed industry, Birgung. Control group (T1) was feed without organic acid inclusion and whereas T2, T3, T4 and T5 groups were fed concentrate mixture mixed with different combination of organic acids @ 400ml/ per 100 kg feed, respectively. Experimental birds were provided adlib amount of grower feed (B1) for 21 days and that after finisher feed (B3) for 20 days and had easily access to drinking water. Feed intake was recorded daily and body weight gain was measured in 7 days interval. Experiment revealed that highest weight gain was observed in T2 (2.6 kg) followed by T3 (2.5) where combination of organic acids were formic acid 65% + propionic acid 35% and formic acid 65% and citric acid 35%, respectively, however, it was not significant among diet groups. From every treatment group each birds were selected for carcass and body parts study. The study showed significant difference ($P<0.5$) in carcass quantity and body parts of the birds between the treatment groups. The dressing percentage of T1, T2, T3, T4 and T5 were 68.96%, 67.87%, 70.38%, 69.88% and 69.67% respectively. Experiment suggested that further study should be carried out to precise the appropriate level of organic acids inclusion and higher cost benefit ratio.

Keywords: Broiler, Organic acids feeding, Growth performance

INTRODUCTION

Broiler chickens (*Gallus gallus domesticus*) are specifically raised for meat. They are a hybrid of the egg-laying chicken, both being a subspecies of red jungle fowl (*Gallus gallus*). Typical broilers have white feathers and yellowish skin. Most commercial broilers reach slaughter-weight at between five and seven weeks of age, although slower growing breeds reach slaughter-weight at approximately 14 weeks of age (Kruchten; 2002).

Since last few years in Nepal, there are so many farmers engaged in poultry farming. The poultry population of Nepal is estimated to be 50,195,285 (MoAD, 2016). Certain antibiotics even as residues can cause allergic or hypersensitive reactions in consumers. Tiwari *et.al.*, (2013) reported that utilization of organic acids has been increased as growth promoters in animal which could help in providing protection from adverse human health implications. Organic acid (1% sorbic acid and 0.2% citric acid) supplementation significantly increased the villus width, height and area of the duodenum, jejunum and ileum of broiler chicks at 14 days of age (Kum *et.al.*, 2010). Garcia *et.al.*, (2007) reported that broilers fed diets containing formic acid had the longest villi (1273 and 1250 μm for 0.5 and 1% formic acid, respectively) compared with control (1088 μm). Similarly, crypts of jejunum were deeper in birds fed the formic acid diet (1%) than birds fed the antibiotic diets (266 vs. 186 μm , respectively) in the same experiment. In some studies, organic acid salt also significantly improved villus height in the duodenum, jejunum and ileum. Pelicano *et.al.*, (2005) reported higher villus height in the ileum with the diet based on organic acid salts compared with diet fed without mannan oligosaccharide + Organic acid salt.

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 cost of using antibiotics in poultry farm could be reduced by the addition of organic acids in broilers diet. The mixture of organic acid in diet also enhances the growth of poultry with reduced mortality rates. The quality of meat flavor seems to be improved with the addition of organic acid in poultry diets. This type of work has not been carried out in Nepal. Therefore, this study was carried out to evaluate the effect of addition of various levels of organic acids a natural growth promoter on the performance of the broilers.

The marketing of poultry has been greatly diversified with a significant increase in cut-up (parts) and processed products (Le Bihan Duval *et.al.*, 2001). Demand for high quality cut-up (parts) and further processed convenience foods have driven the poultry industry to change its marketing practices (Watts and Kennett, 1995). Breeders of meat-type chickens have become interested in adult body weight and other growth traits, aimed at big-bodied weight at early age in order to attract better price at marketing (Malik *et.al.*, 1997) since the age at which broiler chicken are sold is greatly influenced by consumer preferences (Omage *et.al.*, 2006).

The main goal of broiler rearing is production of quality broiler carcasses that will be acceptable from the consumers. Acceptability depends on the quality and quantity of edible parts of carcasses, and the amount of muscle mass in carcass. Broilers carcasses are evaluated mainly through yield edible parts of which are expressed by dressing percentage (slaughter yields) and the quality of edible parts of carcass. All quality characteristics of carcass are inherent in the hybrids (genotype) and are therefore conditionally hereditary characteristics with precisely defined heritability proposed values (Chen *et.al.*, 1987).

MATERIALS AND METHODS

Experimental Birds: The experiment was carried out on Cobb 500 broiler chickens at Regional Agricultural Research Station, Parwanipur, Bara from 12 February 2018 to 3 April 2018 (074/11/9 to 074/12/20 BS) for 41 days. Two hundred twenty five experimental day old birds were procured from Shivam hatchery, Birgung, Parsa and were allotted into five treatments with five replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine @ one drop /bird against Ranikhet at the first week.

Diet Composition: The Control group (T1) was feed without organic acid inclusion and whereas T2, T3, T4 and T5 groups were fed concentrate mixture mixed with different combination of organic acids @ 500 ml/g per 100 kg feed, respectively.

Chemical Analysis: Representative samples were analyzed for Dry Matter (DM), crude Protein (CP), crude Fibre (CF), organic matter (OM) and ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC, 1980). Crude Ether of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest, 1970).

Experimental Diet: The following experimental diet was provided to the birds (Table 1).

Table 1: Experimental diet

Treatment	Diet
1	Adlib concentrate mixture (without inclusion of organic acid)
2	Adlib concentrate mixture treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)
3	Adlib concentrate mixture treated with 0.5% mixture (formic acid 65%+ citric acid 35%)
4	Adlib concentrate mixture treated with 0.5% mixture (formic acid 65%+ sorbic acid 35%)
5	Adlib concentrate mixture treated with 0.5% mixture (formic acid 65%+ lactic acid 35%)

Feeding Regime: Concentrate mixture was given on group basis and was provided to the experimental birds once a day (morning) in *adlib* amount for both periods (starter–21 days and finisher – 20 days) of the experiment. Drinking water was provided in adequate amount.

Carcass and Body Parts Study: At 41 days of age, all birds were transported to a slaughterhouse. Feed was removed 12 hour before processing. Experimental procedures followed

the principles for care of animals in experimentation [13]. Measurements of carcass, body parts like breast yield and dressing percentage (% of birds) etc were performed.

Data Measurement: The trial period consisted for 41 days (21 days starter and 20 days finisher). Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning. The body weight gain was measured in group basis (replication-wise) in seven days interval in the morning before feeding. The carcass and body parts were also measured after slaughtering the birds.

Data Analysis: Data of feed intake and body weight gain were analyzed by “One way Anova” test for every measurement using statistical package SPSS 2006, released versions 15.0.

RESULT AND DISCUSSION

Chemical Composition of Concentrate Mixture: The chemical composition of treated and non-treated concentrate mixture is given in Table 2.

Table 2: Chemical composition of the compound feed (on DM basis)

Concentrate mixture	DM	TA	OM	CP	CF
Feed (Starter)					
Control feed	90.47	6.15	93.85	22.16	3.69
Feed treated with treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.29	4.72	96.28	21.84	4.33
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.44	6.08	93.92	22.05	4.45
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.49	5.90	94.10	22.15	4.35
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.32	5.82	94.18	20.98	4.21
Feed (Finisher)					
Control feed	88.60	4.58	95.42	19.37	4.28
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.59	6.09	93.91	17.70	3.46
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	89.38	5.98	94.02	18.44	4.14
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.43	4.33	95.67	20.20	3.70
Feed treated with 0.5% mixture (formic acid 65%+ propionic acid 35%)	88.26	4.99	95.01	19.12	4.65

Body Weight Gain: The body weight gain trend of experimental birds is given in Table 3.

Table 3: Body weight gain trend of experimental birds, g (Mean± SD)

TRT	Days							Total weight gain (g)	Daily weight gain (g)	FCR, Kg
	0	7	14	21	28	35	41			
1	48.55±1.5	184.33±5.8	476.0±2.2	968.7±5.6	1436±9.7	1824.6±2.5	2498.0±1.4	2449.45±0.1	59.74±0.1	1.58
2	48.2±0.19	185.89±6.5	488.22±1.5	1005.7±2.2	1476.3±5.9	1904.6±1.4	2658.0±5.5	2609.8±3.6	63.65±0.3	1.48
3	48.8±1.3	175.67±1.7	456.33±6.8	928.22±1.3	1366.6±1.3	1835.4±3.6	2608.7±2.7	2559.9±1.4	62.4±0.1	1.50
4	48.3±0.5	181.78±1.0	512.00±1.5	988.00±3.8	1463.4±8.4	1866.7±1.9	2485 ±1.1	2436.7±0.6	59.04±0.2	1.57
5	48.9±0.5	183.56±6.8	484.11±2.2	993.67±4.7	1458.7±4.3	2031.1±5.2	2569±1.4	2520.1±0.9	61.4±0.1	1.52
Mean	48.5±0.79	182.24±4.36	483.33±3.5	976.87±4.8	1440.2±5.92	1892.5±3.32	2563.74±4.94	2515.24±1.32	58.42±0.5	1.53
P-value	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05

Average mean body weight of experimental birds was 48.5 gm at the beginning which reached 2563.74 gm by the end of experiment. At the 7 days of experiment, highest body weight gain was noted for T2 (185.89 gm) followed by T1 (184.33 gm). During 14 days of experiment, higher body weight gain was found in T4 (512 gm) followed by T2 (488.22gm). Similarly, at 21 days of experiment, higher body weight gain was found in T2 (1005.7gm) followed by T5 (993.67 gm). At the 28 days of experiment, higher body weight gain was observed in T2 group (1476.3 gm) followed by T4 (1463.4 gm), T5 (1458.7 gm), T1 (1436 gm) and T3 (1366.6 gm). During 35 days of experiment, higher body weight gain was observed in T5 group (2031.1 gm) followed by T2 (1904.6 gm), T4 (1866.7 gm), T3 (1835.4 gm) and T1 (1824.6 gm). Finally at 41 days of experiment, higher body weight gain was observed in T2 group (2658 gm) followed by T3 (2608.7 gm), T5 (2569 gm), T1 (2498 gm) and T4 (2485 gm). Experiment revealed that highest weight gain was observed in T2 (2.60 kg) followed by T3 (2.55 kg) where combination of organic acids were formic acid 65% + propionic acid 35% and formic acid 65% + citric acid 35% respectively. Similarly, highest FCR was recorded for T1 group (1.58) followed by T4 (1.57), T5 (1.52), T3 (1.50 kg) and T2 (1.48) respectively. There was non significant effect of different level of organic acid inclusion in diet on body weight gain and FCR.

The non-edible carcass weight of experimental birds is given in Table 4.

Table 4: Non-edible carcass weight of experimental birds, g (Mean± SD)

Treatment	Head wt	Feet Wt	Giblet* Wt	Croup, Intestines Wt	Live Wt	Skin wt	Abdominal Fat	Blood
1	50	102	132	126	2120	136	28	85
2	46	78	115	152	2310	172	44	80
3	50	88	122	168	2600	204	52	90
4	65	103	140	198	2650	210	52	85
5	52	126	150	162	2770	206	71	75
Mean	54.6	99.2	131.8	161.2	2490	185.6	43.2	83
Standard Deviation	8.3	18.0	13.9	26.0	0.26	31.6	9.9	5.7
P-value	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05

* Giblet includes heart, gizzard, liver etc.

Average mean head weight of experimental birds was 54.6 gm, highest head weight was noted for T4 (65 g) followed by T3 and T1 (50 gm). The average feet weight of broiler was 99.2 gm, highest feet weight gain was noted for T5 (126 gm) followed by T4 (103 gm). Similarly, the average giblet weight was 131.8 gm, highest giblet weight gain was noted for T5 (150 gm) followed by T4 (140) gm. The average croup, intestines weight was 161.2 gm, highest croup, intestine was noted for T4 (198 gm) followed by T3 (168 gm). The average skin weight of experimental birds were 185.6 gm, highest skin weight was noted for T4 (210 followed by T5 (206 gm). The average abdominal fat of broiler was 43.2 gm, highest abdominal fat weight gain was noted for T5 (71 gm) followed by T3, T4 (52 gm). Finally, the average blood collected during slaughtering of broiler was 83 gm, highest blood collection was noted for T3 (90 gm) followed by T1, T4 (85 gm). A Non- significant difference was observed in carcass among the treatment groups.

Table 5: Cut parts weight of experimental birds, g (Mean± SD)

Treatment	Thigh wt	Back Wt	Neck Wt	Wings Wt	Breast Wt
1	372	200	60	110	472
2	412	256	52	140	648
3	466	362	72	156	650
4	436	336	74	152	714
5	480	380	66	164	692
Mean	433.2	306.8	64.8	144.4	635.2
Standard Deviation	43.2	76.23	9.0	21.0	95.4
P-value	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05

Average mean thigh weight of experimental birds was 433.2 gm, highest thigh weight was noted for T5 (480 gm) followed by T3 (466 gm) (Table 5). Average mean back weight of experimental birds was 306.8 gm, highest back weight was noted for T5 (380 gm) followed by T3 (362 gm). Average mean neck weight of experimental birds was 64.8 gm, highest neck weight was noted for T4 (74 gm) followed by T3 (72 gm). Average mean wings weight of experimental birds was 144.4 gm, highest wing weight was noted for T5 (164 gm) followed by T3 (156 gm). Average mean breast weight of experimental birds was 635.2 gm, highest breast weight was noted for T4 (714 gm) followed by T5 (692 gm). A significant difference was observed in cut parts of birds among the treatment groups.

Table 6: Dressing % of experimental birds, g (Mean± SD)

Treatment	Dressing %
1	68.96
2	67.87
3	70.38
4	69.88
5	69.67
Mean	69.35

The mean dressing percentage of experimental birds was noted 69.35 gm, highest dressing % was noted in T3 (70.38 gm) followed by T4 (69.88 gm). The dressing percentage of T1, T2, T3, T4 and T5 were 68.96%, 67.87%, 70.38%, 69.88% and 69.67 % respectively (Table 6).

DISCUSSION

This experiment was initiated with aim to increase productivity of broiler with the reduction of their mortality rates. The mean FCR was noted 1.53 and was highest in T1 (1.58 kg) lowest in T2 (1.48). Likewise, mean total weight gain was 2515.24 g and it was higher for T2 (26,098 gm) and lowest in T4 (2,436.7 gm). The body weight gain was non-significant ($P>0.05$) in 7 days that after it was non-significant up to 41 days of experiment. Dietary organic acids did not significantly affect weight gain.

Islam *et al.* (2008) reported 3118.6 g and 3101.9 g cumulative feed intake of bird at 5 weeks of age fed with 0.5% citric acid and 0.5% citric + 0.5% acetic acid included group, respectively which was non-significant between groups. Moreover, they noted that better FCR was in 0.5% citric acid included group and lower in 0.5% acetic acid included group during the 5 weeks of experiment. Furthermore, significant ($P<0.05$) difference in body weight of birds among the

groups were observed at all ages. Adil *et al.* (2012) and Boiling *et al.* (2000) also reported improved FCR with supplementation of organic acids. Birds on treatment (0.5% acetic acid) showed lower ($P<0.05$) weight gain than control group and treatment (0.5% citric acid) showed the highest ($P<0.05$) weight gain. Improved weight gain was observed when administration of both citric acid in diets and acetic acid in water was done together. Highest weight gain on 0.5% citric acid agreed with previous findings of Fang *et al.* (2005); Denli *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.

In a study, Celik *et al.* (2003) observed better FCR of turkey chicks supplemented with organic acids (propionic acid, formic acid, acetic acid) as compared to un-supplemented group. Propionic acid increases feed intake by improving palatability of feed and may increase permeability of mucosal cell of the intestine which increases the rate of utilization of nutrients and results better feed conversion.

Average mean thigh, back, neck, wing and breast weights were 433.2 gm, 306.8 gm, 64.8 gm, 144.4 gm and 635.2 g respectively. Average mean head, feet, gible, and croup, intestines weights were 54.6 gm, 99.2 gm, 131.8 gm and 161.2 g respectively. The average abdominal fat of broiler was 43.2 gm, highest abdominal fat weight gain was noted for T5 (71 gm) followed by T3, T4 (52 gm). Finally, the average blood collected during slaughtering of broiler was 83 gm, highest blood collection was noted for T3 (90 gm) followed by T1, T4 (85 gm). At the 6th week of carcass assessment, live weight, carcass weight, thigh weight and back weight values obtained were not agreed with the work of Makram *et al.*, (2010) and Olawumi *et al.*, (2010). These authors reported lower values for live weight, carcass weight and thigh weight for three different strains of broilers respectively. However, dressing, breast and back weight values in this study were consistent with the range of values reported by Makram *et al.*, (2010) for four commercial broiler strain chickens under summer season in Egypt. Meanwhile, the superior carcass and dressing weight values noted were disagreed with the reports of Olawumi and Fagbenro, (2010); Ekeocha and Afolabi (2012). These authors documented lower values for Marshall, Hubbard and Arbor Acre respectively. The breast weight and back weight values obtained in this present study were not compatible with the results of Olawumi *et al.*, (2012) who noted lower values for these variables for Marshall, Hubbard and Arbor Acre birds.

CONCLUSION

Organic acids can be used in poultry diet as a growth promoter. It has resulted better body parts and growth performance with reduced bird mortality. However, further study should be conducted to ascertain the optimum level of inclusion and duration of experiment to get more benefit from broiler production. The expensive antibiotics cost could be reduced by the addition of organic acids in the poultry diets.

ACKNOWLEDGEMENT

The authors would like to express their most sincere gratitude and appreciation to NARC for funding to this research. Similarly, supportive role of Director (MrTufelAftar) of Agricultural Regional Research Station deserves high appreciation without that conduction of experiment was impossible. Mr. Basanta Kumar Shrestha (Technical Officer) and his teams, Animal Nutrition Division, Khumaltar also deserve appreciation for their dedicated work in chemical analysis of feed ingredients.

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