

## **EFFECT OF DIETARY SUPPLEMENTATION OF ORGANIC ACID MIXTURE AND BACITRACIN METHYLENE DISALICYLATE ON THE PRODUCTION PERFORMANCE AND ILEAL HISTOMORPHOMETRY OF COMMERCIAL BROILERS**

**P. Kanagaraju\***

Assistant Professor, Livestock Farm Complex, Veterinary College and Research Institute,  
Ramaiyanpatty, Tirunelveli, TANUVAS, Chennai, India 627 358.

E-mail: kanraj2007@gmail.com (\*Corresponding author)

**Abstract:** This study was carried out to investigate the effect of organic acid mixture and BMD supplementation on the production performance and gut histomorphometry of broilers. 250 day-old commercial broilers were divided into four groups, each with three replicates of twenty birds each and they were fed with one of the following four experimental diets: basal diet (T1), basal diet + Bacitracin methylene disalicylate (BMD) (T2), basal diet+organic acid mixture at 0.25 % (T3), basal diet+organic acids 0.50 % (T4). The result indicated that organic acid mixture supplementation significantly ( $P<0.01$ ) increased growth rate. Feed consumption was not affected by the different dietary treatments. Feed conversion ratio was significantly ( $P<0.05$ ) improved in BMD and organic acid mixture supplemented groups. Pathogenic organisms counts in duodenal contents was significantly ( $P<0.01$ ) lowered in the organic acid and BMD fed groups. Livability was not affected by the dietary treatments. Ileal villi length and Villi width were significantly ( $P<0.05$ ) increased in organic acid mixture fed birds than that of BMD groups. crypt depth was significantly ( $P<0.01$ ) increased in both organic acid mixture and BMD groups. Based on the results, it is concluded that the dietary supplementation of organic acid mixture at 0.5% level had beneficial effect on broilers growth performance and could replace antibiotic growth factor (BMD) in broiler feed to curtail the development of antibiotic resistance.

**Keywords:** Organic acid mixture, BMD, broilers, growth performance, ileal histomorphometry.

### **Introduction**

Due to potential development of antibiotic resistant bacteria addition of antibiotic growth promoters in the feed of farm animals including poultry has been banned in many of the developing and developed countries (Roe and Pillai, 2003). This situation forced the poultry nutritionist to find out alternatives to antibiotics to promote the growth of the poultry, gut health and would favours environmentally friendly poultry farming practices. The alternatives that commonly used in poultry diets are probiotics, prebiotics, phytobiotics and organic acids. However, least information is available on the dietary supplementation of organic acid on the growth performance of broilers. Hence, the present experiment was

undertaken at Poultry Research Station, Chennai 600051 to investigate the effect of dietary supplementation of organic acid mixture as an alternative to antibiotic growth promoter on the production performance and gut health of commercial broilers.

### **Materials and methods**

Two hundred and forty day old commercial broilers were divided into four groups, each with three replicates of twenty birds each and they were fed with one of the following four experimental diets: basal diet (T1), basal diet + Bacitracin methylene disalicylate (BMD) (T2), basal diet supplemented with organic acid mixture at the rate of 0.25 % (T3), and 0.50 % (T4). The organic acid mixture contains butyric acid, formic acid and propionic acids. The experimental diets were formulated and prepared according to BIS (2007) standard in mash form. The chemical composition of the experimental rations was analyzed as per the procedure of AOAC (1990). Whereas the calcium, total phosphorus, lysine, methionine plus cystine and metabolisable energy content were calculated from the composition of the feed ingredients, according to BIS 2007. Feed and drinking water were provided to birds *ad libitum*. The data on body weight, feed consumption, FCR, livability was recorded bi weekly. The fecal samples of duodenum were collected at 6<sup>th</sup> week of age from two broilers of either sex for counting gut pathogen *Escherichia coli*. The tissue samples about 2 cm from ileum of broilers of either sex were collected as per the method described by Miller carin (2007). The ileum samples were fixed in 10 per cent formalin, embedded in paraffin and tissue sections of 5 µm thick were made. The tissue sections were stained with haematoxylin and eosin stain and examined in an Olympus BX 51 microscope for villi length and crypt depth measurements. The data collected were statistically analysed by statistical Package for Social Science (SPSS, 1999) software (version 20.0). Means were compared by Duncan multiple range comparison test with level of significance at 5 percent level.

### **Results and Discussion**

The results of dietary supplementation of organic acid mixture and BMD in broilers are presented in table.1. It was observed that the supplementation of organic acids at the rate of 0.50 % significantly ( $P < 0.01$ ) increased sixth week body weight when compared to all other treatments. This finding is in agreement with Saikat Samanta et al. (2010) who reported that live weight of the broilers increased linearly ( $P < .01$ ) due to supplementation of either organic acid blend or BMD to the diets. In the present study, the feed consumption was not altered in the broilers fed on diets supplemented with organic acids and BMD are contrary to the findings of Haque *et al.* (2010) and Tanzin *et al.* (2015) who reported increased feed

intake in broilers fed on diets supplemented with organic acids. However, Ramigani *et al.* (2017) observed decreased feed consumption and justified it with decreased palatability.

**Table. 1: Effect of organic acid mixture and BMD supplementation on Mean  $\pm$  S.E growth performance, ileal villi height, width and crypt depth of broilers on 6<sup>th</sup> week of age**

Parameter Studied	Basal diet Control	Basal diet + BMD	Basal diet + 0.25 % Organic acid mixture	Basal diet + 0.50 % Organic acid mixture
	(T1)	(T2)	(T3)	(T4)
Body weight (g)**	2073.12 <sup>c</sup> $\pm$ 36.73	2134.23 <sup>b</sup> $\pm$ 40.21	2145.50 <sup>ab</sup> $\pm$ 33.27	2185.28 <sup>a</sup> $\pm$ 32.34
Feed consumption (g) <sup>NS</sup>	3690.15 $\pm$ 47.23	3670.86 $\pm$ 31.34	3660.81 $\pm$ 37.23	3671.27 $\pm$ 38.24
Feed conversion ratio*	1.78 <sup>a</sup> $\pm$ 0.03	1.72 <sup>b</sup> $\pm$ 0.08	1.71 <sup>b</sup> $\pm$ 0.11	1.68 <sup>b</sup> $\pm$ 0.02
Livability (%) <sup>NS</sup>	96.66	98.33	98.33	98.33
<i>Escherichia coli</i> ** (log CFU/g of duodenal content)	8.32 <sup>a</sup> $\pm$ 0.10	7.23 <sup>b</sup> $\pm$ 0.12	6.91 <sup>b</sup> $\pm$ 0.14	5.84 <sup>c</sup> $\pm$ 0.11
Ileal villi height ( $\mu$ m)*	812.32 <sup>b</sup> $\pm$ 11.20	845.13 <sup>b</sup> $\pm$ 10.12	912.20 <sup>a</sup> $\pm$ 11.20	924.12 <sup>a</sup> $\pm$ 10.21
Ileal villi width ( $\mu$ m)**	82.14 <sup>b</sup> $\pm$ 1.21	86.12 <sup>b</sup> $\pm$ 2.15	95.76 <sup>a</sup> $\pm$ 2.14	98.45 <sup>a</sup> $\pm$ 2.13
Ileal crypt depth( $\mu$ m)**	94.12 <sup>b</sup> $\pm$ 2.10	108.12 <sup>a</sup> $\pm$ 3.10	111.20 <sup>a</sup> $\pm$ 2.85	110.78 <sup>a</sup> $\pm$ 2.91

Means with at least one common superscript in the same row do not differ significantly \* (P<0.05), \*\* (P<0.01)

Significantly superior feed conversion ratio was observed in BMD and organic acid supplemented groups when compared with control. Similar findings were reported by Ramigani *et al.* (2017) and Ahmed *et al.* (2019). In contrast, Naveenkumar *et al.* (2017) reported non-significant effect on FCR. The improved FCR could be due to increased digestibility of nutrients, increased permeability of intestinal mucosal wall followed by increased rate of absorption of nutrients resulting in improved feed efficiency

*Escherichia coli* (log CFU/g digesta) counts in duodenal contents was significantly (P<0.01) lowered in the organic acid and BMD fed groups compared with control. Conversely, Saikat Samanta *et al.* (2010) reported that dietary supplementation of organic acid blend and BMD did not affect *E. coli* in the small intestine of broiler chicken but, supplementation of organic acid blend selectively promoted growth of lactobacilli in the small intestine of broilers.

Though the livability was not significantly affected by the treatments, there was numerical improvement in livability among organic acids and BMD received groups. The present findings were in accordance with Acikgoz *et al.* (2011) who recorded numerically lower mortality in organic acid treatment groups. Sultan *et al.* (2015) recorded increased livability and opined that the higher livability might be due to suppression of pathogenic bacteria by organic acids which led to healthy condition of birds throughout the experiment period.

Intestinal villi length and villi width were significantly ( $P < 0.05$ ) increased in ileum of broilers subjected to organic acid mixture than that of BMD and control birds. Whereas crypt depth was significantly ( $P < 0.05$ ) increased in both organic acid mixture and BMD groups than that of control birds. Similar findings were reported by Saikat Samanta *et al.* (2010) who observed that organic acid blend increased the height of villi which accounted for better utilization of nutrients to a greater extent than that occurred in the BMD supplemented birds.

### **Conclusion**

From this present study, we can conclude that the supplementation of 0.5% organic acids mixture per tonne of feed have positive effect on the growth performance in commercial broilers and it can be considered one of the alternative to the antibiotic growth promoter in commercial broilers to curtail development of antibiotic resistance.

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### **Conflict of interest statement**

The author expresses no conflict of interest with regard to the information discussed in the manuscript.

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