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THE EFFECT OF SODIUM-BUTYRATE MICROENCAPSULATED IN BALM FAT ON PERFORMANCE OF *E. COLI* INFECTED BROILER CHICKENS

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ABSTRACT

The objective of the present study was to determine the effect of sodium butyrate microencapsulated in balm fat (NaB) on *E. coli* infected broiler chicken performance variables. One day-old Cobb chickens (n = 90) allotted into 3 equal groups (1-3) with 3 replicates of 10 birds each were used in this study for 35 days and these birds fed on mash diet. Birds of group1 fed on NaB in the following dietary levels; starter ration: 1 kg/ton, grower ration: 0.5 kg/ton and finisher ration: 0.25 kg/ton. Chickens of groups 2 and 3 fed on plain ration. Experimented chickens of groups 1 and 2 were individually infected with *E. coli* serogroup O78 in phosphate buffered saline for 2 successive days via crop gavages with 6×10^{8} CFU/ml/bird. Birds of group 3 were kept without infection and served as blank control group. Referring to our results, NaB supplementation to *E. coli* infected broiler chickens lead to a significant improvement in FCR especially from the third week of experiment. Additionally, a significant decrease in liver wt. % and a significant increase in thymus wt. % were observed indicating the positive impact of supplementation in combating the induced coli septicemia. Conclusively, NaB can be safely used as a potent antimicrobial alternative in broiler chickens in EGYPT.

Key words:

Sodium butyrate microencapsulated in balm fat, chicken performance, colisepticaemia, *E. coli* infection, related organ weight.

INTRODUCTION

Avian collibacillosis is a complex syndrome characterized by multiple organ lesions that is a major cause of morbidity, mortality, and condemnation of carcasses in the poultry industry **(Allan *et al.,* 1993).** To overcome the infection and losses, mostly antibiotics are being incorporated in feed. Antibiotic growth promoters (AGP) have been used for decades to improve poultry performance with low cost of implementation and ease adding to feed and water **(Fernandez-Rubio *et al.,* 2009)**. These antibiotics had possible lead to the emergence and dissemination of multiple antibiotic resistant pathogens **(Lerbech *et al.,* 2014**; **Deepa *et al.,* 2018)** that became a widely distributed problem in human and veterinary field **(Habrun *et al.,* 2010).** Moreover, currently concern about possible antibiotic residues and resistance has been arising the restrictions of antibiotics use in poultry **(Jan *et al.,* 2007; Saberfar *et al.,* 2008).** Antibiotic growth promoters (AGP) have been used for decades to improve poultry performance with low cost of implementation and ease adding to feed and water **(Fernandez-Rubio *et al.,* 2009).** However, currently concern about possible antibiotic residues and resistance has been arisen restrictions of antibiotics use in poultry **(Jan *et al.,* 2007; Saberfar *et al.,* 2008).** As the issue of controlling poultry enteropathogens without the use of antibiotic growth promoters (AGP) is becoming a big challenge; natural alternative concepts based on natural ingredients for gastrointestinal tract (GIT) integrity and antibacterial action became highly commendable **(Awaad *et al.* 2014).** Industry and researchers have had to look for natural alternatives such as oily plant extracts **(Hernandez *et al.,* 2004; Mitsch *et al*., 2004),** yeast cell walls **(Gajewska *et al.,*2012)**,probiotics **(Dankowiakowska *et al.*, 2013; Patterson and Burkholder,2003)** and prebiotics **(Hajati and Rezaei,2010).** Because of their pH-reducing and antimicrobial effects; acidifiers appeared as one of the most feasible and functional alternative to AGP **(Lückstädt, 2003).** Short chain fatty acids (SCFA) are promissory and potentially alternatives to antibiotic growth promoters **(Adil *et al.,* 2011).**

MATERIAL AND METHODS

Sodium butyrate (NaB):

NaB encapsulated in palm fat which is fat coated sodium of alimentary fatty acid (Admix®30) (Produced by NUTRI-AD International, Belgium) was used in this study. Its ingredient is n-Butyric acid sodium salt 30±2%. NaB supplementation in ration was given at a dosages according to the manufacturer's recommendations (Starter diet: 1 kg/ton, grower diet: 0.5 kg/ton, and finisher diet: 0.25 kg/ton).

Ration:

Chickens feed *ad libitum* a crumbed started, grower and finisher diets. Ration used were formulated to meet the nutrient requirements of the broiler chickens during starter, grower, and finisher periods according to the National Research Council. From day 1-16 of age, the birds received a starter diet (23% crude protein; 3000 kcal/Kg ME), from d 17-28 of age a grower diet (21% crude protein; 3100 kcal/Kg ME) and from d 29-35 of age a finisher diet

(19% crude protein; 3150 kcal/ KgME). No antibiotics were administrated in water or feed for the whole experimental period (35 days).

Experimental birds:

One-day-old male Arbor Acres Plus broiler chickens (n=90) were used in this experiment. They were assigned at random into 3 equal experimental groups (1-3) of 30 birds each that were allotted into 3 replicates on deep litter pens (2*1 m) with 10 birds per replicate. The birds were vaccinated against different diseases according to the vaccination programs usually adopted in Egyptian chicken broiler farms. Semduramicin® was added to all rations at a concentration of 25 ppm as a coccidiostat.

Experimental design:

Birds of group 1 was supplemented with diet contained NaB, while those of groups 2 and 3 fed on plain ration. At day 14 and 15 of age; chickens of groups 1 and 2 were inoculated by crop gavages with 6×10^8 CFU/ml/bird of *E. coli* serogroup O78 in phosphate buffered saline (PBS) for 2 successive days. Broilers of group 3 were kept without infection and served as blank controls.

Measured parameters:

***Productive performance*:**

Chicken performance response variables were determined according to **North (1984);** weekly individual body weight (Wt) was measured on all birds. Weekly feed consumption (g/d/bird), feed conversion ratio (FCR) (g feed/g live body Wt gain), and mortality rate were measured for each replicate. Dead birds were weighed to include their weights in the feed conversion estimates.

Related organ weight:

At the end of experiment, 6 birds from each group (2 birds per replicate) were slaughtered then the internal organs (liver, heart, gizzard, intestine, thymus, spleen and bursa of fabricius) were separated and weighed. The related organ weights were calculated by the following formula: Related organ weight = organ weight (g) * 100 ÷ Live body weight (g).

Statistical analysis:

One-way analysis of variance adopted using SAS software general liner models procedure **(SAS Institute, 2000).** The main factor was NaB supplementation as a mean effect. Mean values assessed for significance using Duncan's multiple range tests. Statements of statistical significance are based upon $P \leq 0.05$.

RESULTS AND DISCUSSION

The present results pointed out the negative effect of NaB supplementation on Body weight (BWt), body weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) of chickens in the first two weeks of age. This could be attributed to the functionality of intestines of newly hatched chicks and their digestive enzymes activity that is not sufficiently developed **(Ravindran, 2003**), so fat coating is not emulsified completely **(Noy and Sklan, 1994;LeesonandSummers,2001)** and fat-coated NaB did not release completely.

Consequently; the digestion of feed and absorption of nutrients were not completely accomplished which results in lowering performance variables during the starter period of chicken growth in response to fat-coated NaB and the carry-over effects might affect overall performance of birds **(Ahsan *et al.,* 2016)**. Our obtained results are compatible with those reported by other investigators **(Leeson *et al.,*2005; Hu and Guo, 2007;Antongiovanni *et al*., 2007; Liu, 2009; Mahdavi and Torki, 2009;andAghazadeh *et al.,*2012)** who recorded that NaB supplementation in starter phase did not affect weight gain, feed intake and feed conversion ratio. On the other hand; from the 3rd week until the end of experiment numerical reduction in feed intake and FCR were recorded with significant reduction in overall FCR vs. untreated positive controls at 5th week ($P\leq 0.05$) (Table 1). Parallel results were obtained bymany investigators in studying the efficacy of NaB encapsulated in palm fat in chickens under stress (challenged with *E. coli* or *Clostridium perfringens)* **(Taherpour *et al.,* 2009; Panda *et al.,* 2009; Smulikowska *et al.,* 2009**; **Zhang *et al*., 2011; Eshak *et al.,* 2016). Gauthier (2002)** concluded that organic acids could be a powerful tool in maintaining the health of poultry GIT, thus improving their production performances. The positive effect of NaB encapsulated in palm fat on performance variables could be used alternatively to AGP which confirms the results of **Awaad *et al.* (2011)** who reported that usage of protected organic acids, in poultry nutrition, could be an efficacious tool to replace antibiotic growth promoters (AGP) and showed that their use is considered a novel and effective alternative to antibiotics in broiler chickens. Organ body weight ratio revealed no significant difference in all organs of treated group except a significant increase in thymus % and a significant decrease in liver in NaB treated birds also a numerical increase in BF%, Spleen% and intestine% vs. untreated positive control could be observed (Table 2). Obtained results might be attributed to the fact that organic acids have properties of lowering the intestinal pH, enhancing protein digestion, influencing intestinal cell morphology stimulating pancreatic secretions and acting as a substrate for the intermediary metabolism **(Gauthier, 2002).** Beside it play a role in improving the retention of many nutrients (e.g. chelating minerals), increase intestinal integrity, as well as influencing the electrolyte balance in the feed and intestine and they could be a powerful tool in maintaining the health of poultry GIT, thus improving their production performances **(Zhang *et al.,* 2011).**

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