

EFFECT OF CINNAMON OIL AND COATED SODIUM BUTYRATE SUPPLEMENTATION ON COST EFFECTIVENESS IN BROILER PRODUCTION

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ABSTRACT

A feeding trial was carried out with 216 day-old Vencobb-400 broiler chicks distributed to six experimental groups with six replicates, each replicate containing six chicks, in deep litter for 35 days. The experimental groups were fed with control ration (T₁), ration with oxytetracycline (OTC) at 50 mg/kg (T₂), ration with cinnamon oil (CO) at 250 mg per kg and coated sodium butyrate either at 0.09 (T₃) or 0.18 (T₄) per cent levels and ration with CO at 500 mg per kg and CSB either at 0.09 (T₅) or 0.18 (T₆) per cent levels. The coated sodium butyrate used in this experiment was encapsulated with a vegetable fatty acid containing 30% sodium butyrate. The economics of raising broilers up to 35 days with different levels of CO with CSB supplementation was calculated based on the actual cost of feed per kg live weight gain. The increase in the revenue was Rs. 2.79 per kg live weight in group supplemented with CO at 250 mg per kg and CSB at 0.09 per cent (T₃) when compared to control. Returns were found to be better in group supplemented with CSB @ 0.09 per cent and CO @ 250 mg per kg than the dietary oxytetracycline group. A decrease (Rs.0.43) in the revenue of per kg live weight gain was recorded in T₃ (CO @ 250 mg per kg and CSB @ 0.09%) when compared to antibiotic group (T₂) but this decrease was marginal and not significant. This is an important observation in this study as to the industry's attempts to avoid use of antibiotics in feed.

Key Words: Broiler, Cinnamon Oil, Coated sodium butyrate, Cost effectiveness

INTRODUCTION

In modern-day commercial broiler production, birds are inevitably exposed to physiological stress due to rapid growth, intensive rearing and high stock density resulting in diminishing immune competence and gut health. This paves the way to increased susceptibility of the birds to illness, infection

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and mortality. To overcome these losses, several antibiotics are routinely incorporated in feed. The dietary use of antibiotics has been practiced for decades in animal production especially in commercial poultry production as a growth promoter.

The need for the use of antibiotics to decrease the spread of disease and as a growth enhancer is increasing day by day to sustain the growth of poultry production (Youcef Mehdi *et al.*, 2018). However, pathogenic microbial load suppressing agents like probiotics, prebiotics or organic acids have been included in an attempt to replace antibiotics (Isabel and Santos, 2009). Alternatively, the phytogetic feed additives like essential oils which are derived as a mixture of aromatic oily liquids obtained from plant materials are also found to be effective natural antibiotic growth promoters.

One among the aromatic essential oils, cinnamon oil derived from *Cinnamom verum*, a plant that is a native of Sri Lanka and South India (Petrovic *et al.*, 2010). Cinnamon oil contains cinnamaldehyde and eugenol, been which are known to be bioactive substances with potential health effects (Chao *et al.*, 2005) *viz.* antimicrobial, antifungal and antioxidant properties (Goni *et al.*, 2009) and is also shown to have anticandidial, antiulcer, analgesic, and hypocholesterolemic activities (Lin *et al.*, 2003). Recently, experiment in broilers with coated sodium butyrate at 0.09 and 0.18 per cent as feed additive showed better performance than antibiotic supplemented and control groups (Deepa, 2016). Both the organic acids and essential oils separately have been shown to increase production efficiency in broilers

but no attempts to the best of our knowledge have been made with to study the effect of combination of an essential oil and organic acids. The phytogetic additives and organic acids, in isolation or combination in broiler diets improved nutrient digestibility of the diet and replaced the growth promoting antibiotics and improved broiler performance (Fascina *et al.*, 2012). Based on the above background, an attempt was made to find the efficacy cinnamon oil (CO) and Coated Sodium Butyrate (CSB) on the economics of raising broilers.

MATERIALS AND METHODS

Experimental design and dietary treatment

A feeding trial was conducted with day-old Vencobb 400 broiler chicks (n=216). The experiment was conducted at experimental poultry shed of Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal, Tamil Nadu from November to December 2016. The chicks were wing banded, weighed individually and assigned randomly to six experimental groups with six replicates per treatment and each replicate containing six chicks. All the replicates had equal numbers of male and female chicks. The experiment was conducted in a Completely Randomized Design (CRD). The birds were housed in deep litter pens and reared under uniform standard management practices. The chicks were fed with weighed quantity of experimental diets based on Vencobb standard and the birds had free access to water. The chicks were vaccinated against Ranikhet Disease (RDVB1) on seventh and twenty first days and Infectious Bursal Disease on fourteenth day of age. The dietary treatments were presented in Table.1

Table 1. Dietary treatments of birds fed with cinnamon oil and coated sodium butyrate supplementation

Treatment groups	Details
T ₁	Control (without antibiotic and without CO and CSB),
T ₂	Ration with 50 ppm of Oxytetracycline (OTC)
T ₃	Ration with CO @ 250 mg/kg and CSB @ 0.09 %
T ₄	Ration with CO @ 250 mg/kg and CSB @ 0.18 %
T ₅	Ration with CO @ 500 mg/kg and CSB @0.09 %
T ₆	Ration with CO @ 500 mg/kg and CSB @ 0.18 %

Feed composition and formulation of pre starter (1-12days), starter (13-23 days) and finisher (24-35days) diets prepared based on Vencobb standard were presented in Table 2.

Table 2. Ingredients and nutrient composition of experimental broiler pre-starter, starter and finisher diets

Ingredient	Pre-starter diet (0-12 days)	Starter diet (13-24 days)	Finisher diet (25-35 days)
Maize (%)	54.97	56.86	58.84
Soybean meal (%)	38.05	34.40	30.5
Rice bran oil (%)	2.90	4.60	6.30
Calcite (%)	1.35	1.45	1.42
Dicalcium phosphate (%)	1.45	1.35	1.25
Salt (%)	0.40	0.40	0.40
L - Lysine hydrochloride (78 %) (g/100kg)	0.08	0.05	0.03
DL - Methionine (99 %) (g/100kg)	0.250	0.230	0.210
L - Threonine (g/100kg)	0.000	0.010	0.000
Additives and supplements* (g/100kg)	485	510	750
NSP enzyme ¹ (g/100kg)	0	0	100
Choline chloride ² (g/100kg)	100	100	100
Sodium bicarbonate ³ (g/100kg)	0	0	0.100
Nutrients**			
Crude protein (%)	22.50	21.03	20.00
Metabolisable energy (kcal/kg)	2950	3124.5	3150
Digestible lysine (%)	1.30	1.20	1.05
Digestible methionine (%)	0.55	0.50	0.45
Calcium (%)	0.94	0.91	0.87
Available phosphorus (%)	0.45	0.42	0.40

*Additives and supplements of 485g/100 kg, 510g/100 kg and 750 g/100 kg in pre-starter, starter and finisher diets respectively contained Vit AB₂D₃K₄– 60, 60 and 80 g, Vitamin- B complex⁵– 20 g , Coccidiostat⁶ – 50, 50 and 60 g, Toxin binder⁷ – 25, 100 and 100 g, Liver stimulant⁸ – 50, 100 and 150 g , Lysoforte⁹ – 60 g, Endox dry¹⁰ - 20, 20 and 30 g and Trace minerals¹¹ – 150, 150 and 250 g

- 1 NSP enzyme each kg contained Cellulase-1,20,00,000; Hemi-cellulase- 54,00,000; Protease-24,00,000; Amylase-24,00,000;- Beta glucanase – 1,06,000 IU .
2. Choline chloride -100g/100kg
3. Sodium bicarbonate – 10 g/100kg
4. Supplied per kg of diet: Vitamin A – 16500 IU, Vitamin B₂ –10 mg, Vitamin D₃ – 3200IU and Vitamin K – 2 mg
5. Supplied per kg of diet: Thiamin – 4 mg, Pyridoxine – 8 mg, Cyanocobalamine – 40mcg, Vitamin E – 40 mg, Niacin-60 mg,
Calcium D pantothanate –40 mg, Folic acid – 4 mg.
6. Coccidiostat containing 25 per cent of 3,5 Di-nitro-ortho- toluamide
7. Toxin binder containing mixture of silicates, cross linked insoluble poly vinyl pyrrolidone homopolymer, mannan oligosaccharides, yeast cell wall extracts, activated charcoal, XMB factors, multiple organic acids and lipotropic factor.
8. Liver stimulant containing tricholine citrate, Vit B₁₂, inositol, Vit E, biotin, selenium, methyl donors, mould inhibitors and toxin binders.
9. Lysoforte containing lysophospholipids and lysophosphatidyl choline
10. Endox dry containing ethoxyquin, BHA, EDTA, phosphoric acid, citric acid, mono-and diglycerides and BHT.
11. Supplied per kg of diet: Manganese –54 g, Zinc – 52 g, Iron – 20 g, Iodine – 2 g, Copper –2 g, Cobalt –1 g.

**Calculated value

The experimental broiler pre-starter, starter and finisher diets were formulated by supplementation of CO at 250 mg per kg and CSB either at 0.09 or 0.18 per cent levels and CO at 500 mg per kg with CSB either at 0.09 or 0.18 per cent levels. The antibiotic used in this study was 10 per cent oxytetracycline (OTC) at 50 mg/kg of feed. The coated SB used in this experiment was encapsulated with

vegetable fatty acid containing 30 per cent SB. The level of coated SB was increased by three times since the active compound (SB) in it was 30 per cent (as per the analysis of test sample). Cinnamon oil available in the market was used for the experiment.

Birds were fed with experimental diets *ad libitum* in mash form. Body weight gain

and feed intake were recorded weekly. FCR was calculated as grams of feed consumed per chick divided by grams of weight gain per chick. The economics of raising broilers up to 35 days with different levels of CO with CSB supplementation was calculated based on the actual cost of feed per kg live weight gain. The mean change in feed cost/kg live weight gain (Rs.) was calculated based on cost of feed (pre-starter, starter and finisher feed) and 0-5 weeks body weight gain of respective treatment of experimental birds. The mean change in feed cost/kg body weight gain over antibiotic group (Rs.) was calculated by subtracting the feed cost/kg live weight gain of respective treatment groups from the antibiotic group (T_2). The data were analyzed statistically as per the standard statistical methods given by Snedecor and Cochran (1994) using the statistical package SPSS software 17.0 version.

RESULTS AND DISCUSSION

Cost effectiveness

The effect of supplementation of CO and CSB (T_3 , T_4 , T_5 and T_6) on cost effectiveness in broiler production is presented in Table 3. The cost of the feed per kg live weight gain was found to be lowest in antibiotic group (T_2 - Rs. 49.37/-) due to its lower feed intake, better body weight gain and feed efficiency. Even though the cost of the feed per kg live weight gain in the group fed low CO and CSB (T_3 -Rs. 49.80) was found to be slightly higher, it was comparable to the production cost of antibiotic group. Supplementation of low level of CO and CSB (T_3) had better economical returns when compared to other CO and CSB groups [T_4 - Rs. 5.18, T_5 - Rs. 5.14 and T_6 - Rs. 19.60 (because of low feed intake due to unpleasant

smelling of CSB at high level of inclusion and high mortality)]. However, the reduction in profitability of group T_3 when compared to group T_2 is less than that of the control. The cost of production per kg live body weight in group T_3 is higher by Rs.0.43 than that of antibiotic group and the reason might be higher level of cost of supplements such as CO and CSB of Rs. 2.79 per bird in T_3 group.

The group fed diet with antibiotic oxytetracycline (OTC) had better returns, which is likely to be achieved in the commercial conditions where antibiotic growth promoters are reported to be used in large scale, at-least in pre starter and starter stages to overcome constant pathogen threat. With emerging antimicrobial resistance reported in human beings, use of antibiotics in poultry is to be discontinued with alternates.

Deepa (2016) observed that supplementation of uncoated sodium butyrate (UCSB) gave better economic returns when compared to the respective levels of CSB and the increase in the revenue was to the tune of Rs. 1.30, 1.45 and 2.66 per kg of live weight gain in 0.18 per cent CSB, 0.03 and 0.06 per cent UCSB, respectively, when compared to control with antibiotic fed group. In our study, only CSB was examined, where the supplementation of cinnamon oil @ 250mg/kg and coated sodium butyrate (0.09%) in combination (T_3) was found to be causing better economic returns due to the better body weight gain with optimal feed intake and perform almost equally to antibiotic group in terms of cost benefit. When compared to control group, this combination

Table 3. Effect of cinnamon oil and coated sodium butyrate supplementation at different levels on cost effectiveness of broiler production

Treatment	Cost of feed (Rs./kg)					
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
Pre-starter	30.35	30.50	31.40	31.85	32.00	32.45
Starter	30.26	30.42	31.31	31.76	31.91	32.36
Finisher	34.46	34.61	35.51	35.96	36.11	36.56
Feed intake (g) / bird						
Pre-starter	336.8	331.7	314.2	359.3	334.8	255.5
Starter	988.3	1017	999.3	976.8	961.8	805.0
Finisher	1316.6	1332.1	1353.6	1314.6	1304.8	1269.8
Cost of feed (Rs.)						
Pre-starter	10.22 ^b ± 0.22	10.12 ^b ± 0.37	9.87 ^b ± 0.47	11.45 ^c ± 0.28	10.72 ^{bc} ± 0.11	8.29 ^a ± 0.35
Starter	29.91 ^b ± 0.23	31.02 ^b ± 0.32	31.29 ^b ± 0.43	31.03 ^b ± 0.59	30.69 ^b ± 0.48	26.05 ^a ± 1.01
Finisher	45.37 ± 0.72	46.11 ± 0.68	47.47 ± 1.17	47.27 ± 0.53	47.12 ± 1.11	45.81 ± 0.38
0-5 weeks body weight gain	1634.0	1757.1	1743.3	1659.5	1647.8	1178.7
Mean change in feed cost/kg live weight gain* (Rs.)	52.59 ^b ± 0.60	49.37 ^a ± 0.51	49.80 ^a ± 0.40	54.55 ^c ± 0.65	54.51 ^c ± 0.60	68.98 ^d ± 0.86
Mean change in feed cost/kg body weight gain over antibiotic group* (Rs.)	+ 3.22 ^b ± 0.90	0	+ 0.433 ^c ± 0.78	+ 5.18 ^b ± 0.79	+ 5.14 ^b ± 0.92	+ 19.60 ^b ± 1.23
Net revenue (in Rs.) per kg body weight gain over control group	0	0.41	2.79	5.56	4.29	4.88

Mean ± SE of six observations;

Means having different superscript in a row differ significantly* (P<0.05).

Cost of cinnamon oil – Rs. 2400/kg, Cost of Coated SB –Rs. 500/kg ; Cost of oxytetracycline - Rs. 309/kg

(T₃) also had a net revenue of Rs. 2.79 per kg live weight.

A decrease (Rs. 0.43) in the revenue per kg live weight gain was recorded in T₃ when compared to antibiotic group (T₂) but this decrease was marginal and not significant and was an important observation in this study as to the industry's attempts to avoid use of antibiotics in feed.

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