Original Research

Effect of Dietary Supplementation of Cinnamon *(Cinnamomum cassia)* Powder and Synbiotic as Alternative to Antibiotic Growth Promoter on Economic Efficiency of Broiler Chicks

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Abstract

A total of 300 day old Vencobb broiler chicks of either sex were randomly distributed into five dietary treatment groups with three replicates in each group with 20 chicks. The treatments included the T_1 control (basal diet as per BIS 2007); T_2 Basal diet + Bacitracin methylene disalicylate @20 gm/ quintal of feed; T_3 Basal diet + Cinnamon powder @ 250 gm/ quintal of feed; T_4 Basal diet + Synbiotic @ 50 gm /quintal of feed for 7 days and then @ 25 gm/quintal of feed and T_5 Basal diet plus the combination of cinnamon and synbiotic. The cost of production calculated at the end of experiment revealed that net profit per bird and benefit cost ratio was found highest in T_4 (Rs.62.12) and (1.47) followed by T_5, T_3, T_2 as compared to control. Better economic efficiency was recorded in T_4 (203.98 %) as compared to all other treatments and the control respectively. Highest viability was recorded in T_4 and T_5 (100 %). The European Production Efficiency Factor (EPEF) was greater for the T_4 (443.34), T_5 (443.28), T_3 (414.61) and T_2 (326.76) than the control group (300.37). It was concluded that synbiotic was most efficient, effective and economical herbal feed additive and can be used as an alternative to antibiotic growth promoter in broiler industry.

Key words: Broiler, Cinnamon, European Production, Efficiency Factor, Synbiotic, Vencobb Broiler

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Introduction

Costs of production and returns are the two major concerns in poultry sector. The problems of how much the bird costs and how much it gains are becoming the most important formula in poultry economics. So,

poultry enterprises can be made more profitable if critical standard limits for cost of production are determined and given close attention (Romero *et al*., 2010). The efficiency of poultry to convert the feed into meat plays a key role in economics in broiler industry. In fact, only 70% of total cost of production is contributed by feed (Willems *et al*., 2013). Currently, consumers around the world are increasingly more conscious of the nutritional value and safety of their food and its ingredients. In poultry nutrition, it is a solid fact that feeding cost is considered the most expensive item in the whole production process. Therefore, attempts are usually made to reduce feed cost without adversely affecting performance or product safety (Mona *et al*., 2010).

Antibiotic growth promoters have been widely and successfully used to promote growth and protect health of the poultry birds. However, their subclinical application in feed has arisen into a controversial issue worldwide due to appearance of residues and resistant strain of bacteria (Ownes *et al.*, 2008; Toghyani *et al.*, 2011).With increasing the risk of developing resistant bacteria to specific antibiotics and the presence of antibiotic residue in poultry feed led to a prohibition of using antibiotics as growth promoters in animal production in European Union since January 2006 (Cross *et al.*, 2007; Houshmand *et al.*, 2011). Therefore, proper utilization of poultry feed is seeking importance at the present situation with increasing public concerns pertaining to antibiotic resistance. As a result, the demand for alternative products to antibiotics that can be used as prophylactic and growth promoting agents is very high. Many alternative substances obtained from nature and belonging to the groups of prebiotics, probiotics, organic acids, enzymes, silicates, herbs and spices etc. have been vigorously tested and evaluated for their potential to replace antibiotic growth promoters (AGPs) in poultry diets (Panda *et al*., 2006; Khan *et al.*, 2012a, 2012b).

Hence, the present study was carried out to evaluate the efficacy of the, cinnamon and synbiotic as alternative to the antibiotics growth promoter on economic efficiency of broiler chicks.

Materials and Method

Location

The present investigation was conducted from Sept 03, 2017 to October 15, 2017 at Poultry Farm and Department of Livestock Production Management of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan University of Veterinary and Animal Sciences, Bikaner.

Experimental Design

For the present study, 300 day old straight run commercial broiler chicks (Vencobb 400 strain) were procured from the Kewalramani Hatcheries Pvt. Ltd., Ajmer and were equally and randomly divided into 5 treatment groups having 60 broiler chicks in each group was further sub-divided into 3 replicates of 20 chicks each.

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Table 1: Design of the experiment

Dietary Treatment	Composition
T_1	Basal diet (Control) As per BIS (2007)
T_2	Basal diet + Bacitracin methylene disalicylate @20 gm/ quintal of feed
T_3	Basal diet + Cinnamon powder @ 250 gm/ quintal of feed
T_4	Basal diet + Synbiotic @ 50 gm /quintal of feed for 7 days and then @ 25 gm/quintal of feed
T_5	Basal diet + Cinnamon powder @ 250 gm/ quintal of feed + Synbiotic @ 50 gm /quintal of feed for 7 days and then @ 25 gm/quintal of feed

(a) Bacitracin methylene disalicylate = 20 gm/ quintal of feed

(b) Synbiotic = @ 50 gm/ quintal of feed for 7 days and then @ 25 gm/quintal of feed

(c) Cinnamon Powder = 250 gm/ quintal of feed

Cost of Feed Additives

(a) Bacitracin methylene disalicylate = Rs/ 0.43 per gm

(b) Synbiotic = Rs/ 0.30 per gm

(c) Cinnamon Powder = Rs/ 0.45 per gm

Experimental Diets

The chicks were fed with starter ration up to 21 days and finisher ration from 22 to 42 days of age as per BIS (2007) recommendations. The chicks under treatment were provided with dietary supplemented ration from day old to the 42nd day of age. During the period of study (0-6 weeks), all the birds were provided with starter diet (with 3056 kcal of metabolizable energy ME/kg of ration and 22.04% crude protein [CP]) from 0 to 3 weeks of age and finisher diet (with 3163 kcal of ME/kg of ration and 20.08% CP) from 4 to 6 weeks of age.

Experimental Procedure

Deep litter system of housing was adopted for the feeding trial in the present study with an objective to provide maximum comfort to the broilers. The pens were thoroughly cleaned and disinfected before starting of experiment. Fresh and dried wheat straw was used as a bedding material. All the chicks were maintained under standard managemental regimen of brooding and lighting. Proper ventilation and biosecurity measures were ensured throughout the trial. Routine, day old vaccinations for Marek's and Ranikhet (F_1 strain) disease were given to the chicks just after hatching and on 4th day respectively. On 14th day all the chicks were vaccinated against Infectious Bursal Disease. *Ad libitum* clean and fresh *water* was provided throughout the trial.

Observations Recorded

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Body Weight (gm) and Feed Consumption (gm)

The body weights (gm) of individual birds were recorded at weekly interval and average body weight gain was calculated from difference in body weight attained between the two consecutive weeks. Feed consumption (gm) of birds of each replicate was recorded at weekly intervals and feed consumption per bird per week was calculated by dividing the total amount of feed by the number of chicks in the particular pen during the experimental period of six weeks.

Feed Conversion Ratio (FCR)

Feed conversion ratio (kg feed/kg gain) was calculated by dividing the cumulative feed intake by body weight gain of the chicks during the two consecutive periods.

Mortality (%)

Throughout the experiment, the chicks were observed for sign of disease. Mortality record was maintained daily. At necropsy, the dead birds were sent to the Department of Pathology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, RAJUVAS, Bikaner for postmortem examination for any gross pathological lesions and cause of mortality for each chick was recorded as and when it occurred. Total mortality for each group was then converted into percentage for that particular group and due importance was given to mortality while calculating feed consumption and FCR.

Viability (%)

Remaining chicks at the end of period.

Economic Efficiency Measurement

Net cost of production per bird was considered in order to evaluate the profitability of the feed additives inclusion on a net profit of bird sales. The economic efficiency was calculated as follows-

Net profit = Total revenue per bird - Net cost of production per bird

Benefit Cost Ratio = Gross return/ total cost of production

Economical Efficiency (EE*)*

EE= Net profit / Net cost of production per bird

Relative Economical Efficiency (REE)

REE= (E.E*100) / Control EE; where: control treatment group REE=100%

Whereas European Production Efficiency Factors (EPEF) was calculated according to Marcu *et al*. (2013) by following formula-

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$$EPEF = \frac{Viability\,\% \times BW(kg) \times 100}{Age\ (days) \times FCR\ (kg\ feed/kg\ gain}$$

Result and Discussion

Mortality

The mortality rate was lower for all the dietary treated groups in comparison with control group Percent mortality recorded has been presented in Table 2. Throughout the experimental period 5 birds died out of a total of 300 birds. Mortality recorded in T_1, T_2, T_3, T_4 and T_5 was 3, 1, 1, 0 and 0 respectively. The lowest mortality was found in synbiotic (T_4) and synbiotic plus cinnamon (T_5) group as they help in reducing bacterial infection and maintaining good health of gut (Munj *et al.*, 2010). These results are in agreement with Popovic *et al.* (2016) who noticed lowest mortality in synbiotic fed group. Furthermore, Al-Sultan *et al.* (2016) noticed numerically lower mortality percentage in probiotic and synbiotic supplemented group (0 %). It may be asserted that both of feed additives (synbiotic and cinnamon) had beneficial effect on the livability of broilers as compared to control broilers.

Table 2: Effect of different feed additives on per cent mortality of broiler chicks

Treatment	No. in beginning (0 day)	Age in weeks						Total Mortality	Per cent mortality	Viability
		I	II	III	IV	V	VI			
T_1	60	-	-	1	-	1	1	3	5	95
T_2	60	-	-	-	-	-	1	1	1.66	98.34
T_3	60	-	-	-	-	1	-	1	1.66	98.34
T_4	60	-	-	-	-	-	-	0	0	100
T_5	60	-	-	-	-	-	-	0	0	100
Total	300	0	0	1	0	2	2	5	1.66	98.34

Economic Efficiency

The cost of production of broilers, considering the cost of chicks, feed consumed and miscellaneous cost up to six weeks of age, reared under different treatments is presented in Table 3. The cost of feed per kg live weight gain was lowest in T_4 followed T_5, T_3, T_2 and T_1. These results were in agreement with Abdel-Hafeez *et al.* (2017). While Sarangi *et al.* (2016) reported high cost of feed per kg live weight gain in synbiotic supplemented group as compared to control group. Net profit per bird shown in Fig.1 and benefit cost ratio was found highest in synbiotic group (T_4) results agreed with Kamel and Mohamed (2016).

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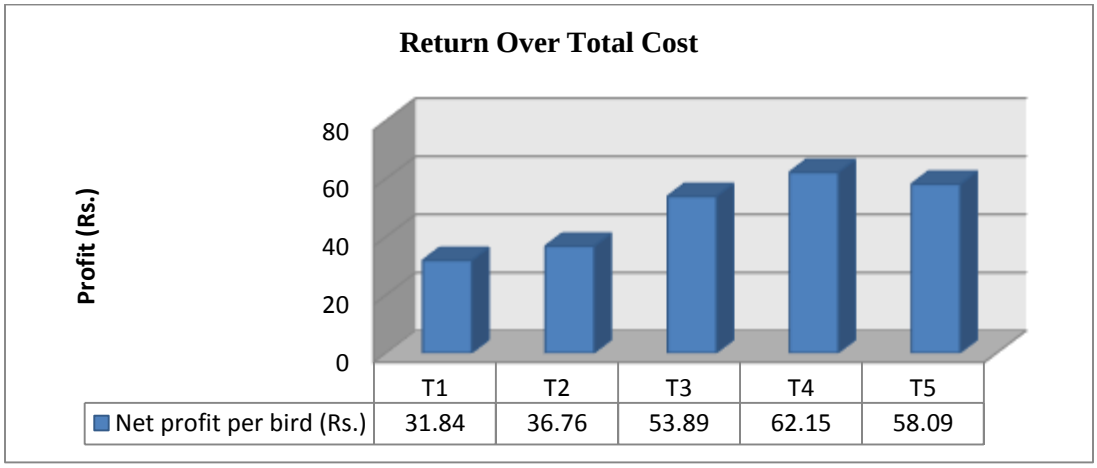

Fig. 1: The return over total cost for various treatment groups

Table 3: Effect of dietary supplementation of Cinnamon *(Cinnamomum cassia)* powder and Synbiotic on economic efficiency of broiler chicks

S. No.	Parameters	Treatments				
		T1	T2	T3	T4	T5
1	Chick cost (Rs.)	32	32	32	32	32
2	Feed intake (kg)					
	Starter	1.189	1.16	1.092	1.083	1.065
	Finisher	2.474	2.431	2.353	2.341	2.314
3	Feed price per kg (Rs.)					
	Starter	26.4	26.486	27.525	26.485	27.61
	Finisher	26	26.086	27.125	26.075	27.2
4	Feed cost per bird (Rs.)					
	Starter	31.39	30.72	30.06	28.68	29.4
	Finisher	64.32	63.42	63.83	61.04	62.94
5	Total feed cost per bird (Rs.)	95.71	94.14	93.88	89.72	92.35
6	Feed cost per kg live weight gain (Rs.)	42.9	41.39	37.6	35.18	36.48
7	Miscellaneous cost per bird (Rs.)	10	10	10	10	10
8	Net cost of production per bird (Rs.)	137.71	136.14	135.88	131.72	134.35
9	Cost of production per kg live weight (Rs.)	61.73	59.84	54.42	51.64	53.06
10	Body weight at the end of 6th week (kg)	2.231	2.275	2.497	2.551	2.532
11	Return on sale @ 76 per kg body weight	169.56	172.9	189.77	193.88	192.43
12	Net profit per bird (Rs.)	31.84	36.76	53.89	62.15	58.09
13	Net profit per kg (Rs.)	14.27	16.16	21.58	24.36	22.94
14	Economical efficiency % (EE)	23.12	27	39.65	47.18	43.23
15	Relative Economical efficiency % (REE)	100	116.78	171.51	204.05	186.99
16	Benefit Cost Ratio	1.23	1.26	1.39	1.47	1.43

Though they observed lower value as compared to present findings, but trend was same. Economical efficiency % values of different treatments were 47.18 being the best for broilers of T_4 and 23.12 for control

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T_1. According to input- output analysis, the highest value of Relative Economical Efficiency (REE) was recorded in T_4 followed T_5, T_3, T_2 and T_1 shown in Fig. 2. Similar results were found by El-Kaiaty *et al.* (2015) though they observed lower values of EE and REE as compared to present findings.

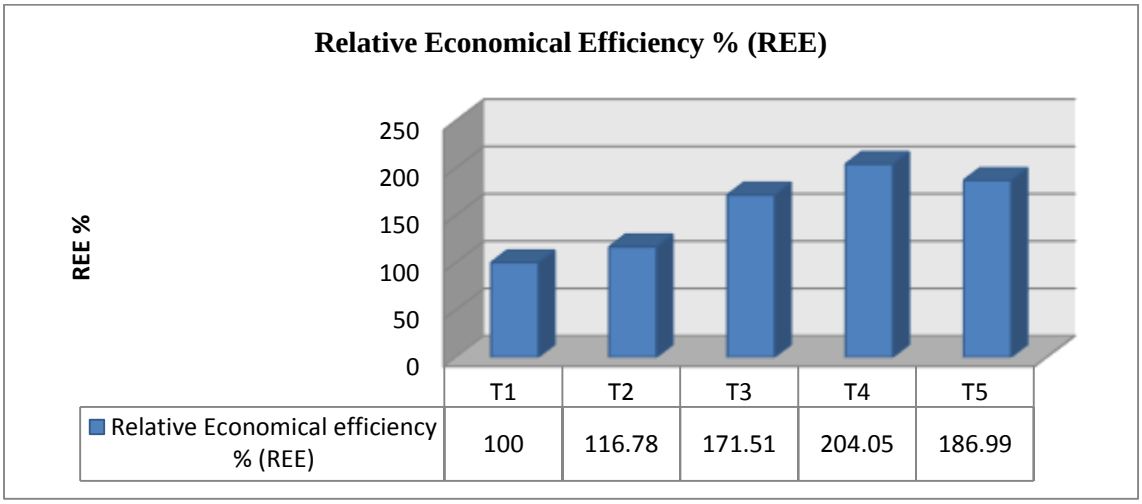

Fig. 2: The Relative Economical efficiency % (REE) for various treatment groups

EPEF

The EPEF for performance of broiler chicks is given in Table 4 and Fig. 3. The EPEF value was higher in T_4 (443.34) followed T_5 (443.27), T_3 (414.60), T_2 (326.36) and T_1 (300). These values show the performance obtained in all supplemented groups was better than the control.The economic efficiency assessment on EPEF was positively influenced by the body weight, feed conversion ratio, and good livability in stipulated number of days thus gives overall economics of the birds considering various important traits. The present study was in accordance with Awad *et al*. (2009) though they observed lower values of EPEF as compared to present findings.

Table 4: The EPEF value of different dietary treatments

S. No.	Particulars	Treatments				
		T1	T2	T3	T4	T5
1	Body weight (Kg.)	2.231	2.275	2.497	2.551	2.532
2	Viability (%)	95	98.33	98.33	100	100
3	FCR (kg feed/kg gain)	1.68	1.63	1.41	1.37	1.36
4	Age (days)	42	42	42	42	42
5	EPEF	300	326.36	414.6	443.34	443.27

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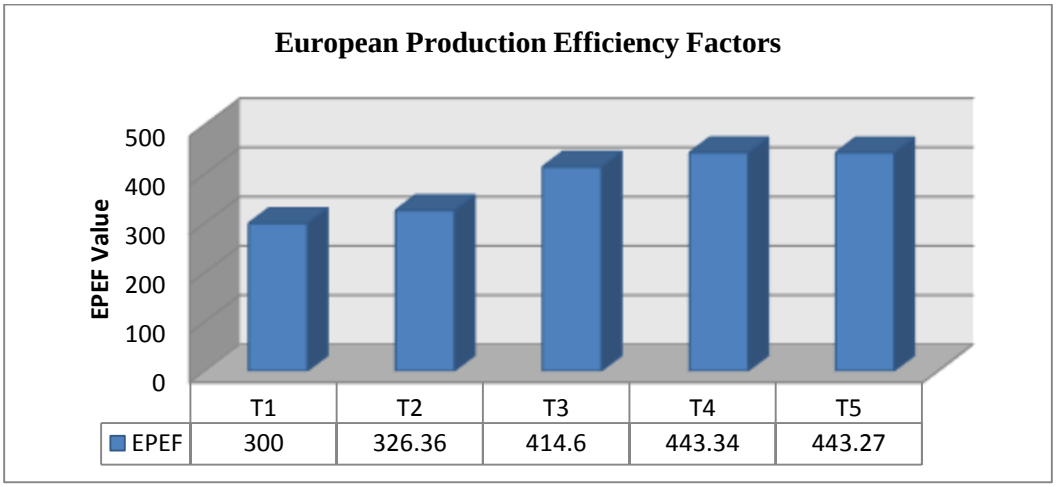

Fig. 3: European Production Efficiency Factors (EPEF) for various treatment groups

Conclusion

The economic efficiency assessment on EPEF was positively influenced by the body weight, feed conversion ratio, and good livability. So it was concluded that synbiotic was most efficient, effective and economical herbal feed additive and can be used as an alternative to antibiotic growth promoter in broiler industry.

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Conflict of Interest

We certify that there is no kind of conflict of interest regarding the material discussed in the manuscript.

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