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Original Research Article

Effect of a Phytogenic Feed Additive Supplemented Diet on Economic Efficiency and Cost of Production of Broiler Chickens

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A B S T R A C T

The aim of this work was to compare the efficacy of a phytogenic feed additive (PFA) on the economic efficiency and cost of production of broiler chickens. Two hundred fifty Vencobb 400Y day old chicks were distributed equally into five groups of 50 chicks each, which were further divided into five replicate of ten chicks each. The chicks were placed on one of five dietary treatments i.e. basal diet without any supplement (NCON) or with antibiotic (PCON) and NARGROPHYT at 1.0% (NGP-1.0), 1.5% (NGP-1.5) and 2.0% (NGP-2.0). The effect of these supplements on economic efficiency and cost of production was assessed in a six week study. Feed productivity were significantly ($P<0.05$) higher in NGP-1.5, NGP-2.0 and PCON than NCON group. The cost productivity of phytogenic treated birds similar to NCON group, however significantly ($P<0.05$) lower than PCON group birds. The feed price ratio and feed productivity of NGP-1.5 and NGP-2.0 had significantly ($P<0.05$) higher value than NCON but similar to PCON group. Benefit: cost ratio of herbal treated groups was similar to NCON, however significantly ($P<0.05$) lower than PCON group birds. The feed cost per kg body weight gain was significantly ($P<0.05$) higher in NCON followed by NGP-1.0, NGP-1.5 and NGP-2.0. Feed cost per kg body weight gain of NGP-2.0 was similar to PCON group. Economic efficiency index (EEI) was highest in PCON which was similar to NGP-2.0. NGP-1.0 and NGP-1.5 posses significantly ($P<0.05$) higher EEI than NCON. Cost index (CI) in NGP-2.0 and PCON was also similar. The return on feed was similar in NGP-1.5 NGP-2.0 and PCON group and significantly ($P<0.05$) higher in comparison to NCON. Gross return of herbal treated groups was similar to PCON; but significantly ($P<0.05$) higher than NCON group. Return on investment of herbal treated groups were similar to NCON but significantly ($P<0.05$) lower than PCON group. Profitability, profitability index (PI) and return on investment of PFAs supplemented groups was similar to NCON, however significantly ($P<0.05$) lower than PCON group. The break even output values of Phytogenic mixture supplemented groups were similar to NCON, however significantly ($P<0.05$) higher than PCON group. The EE, REE-NC and REE-PC of herbal supplemented groups were similar to NCON group. However, the values were significantly ($P<0.05$) lower than PCON group. So it can be concluded that 2.0% phytogenic feed additives in broilers feed can be an effective alternative of antibiotic growth promoters.

Introduction

The industrialization of poultry husbandry and the improvement in feed efficiency have accelerated the introduction of feed additives in broilers diet. Feed is a major input for the broiler rearing and contributes about 70-80% of the total cost of production hence plays a vital role in broilers economy. The main goal of scientists is to increase production by maintaining good health of broilers. Antibiotics were used as a growth promoter to improvement of production parameters and diseases prevention from many years. However repeated utilization of antibiotics has led to the increasing resistance of pathogens to antibiotics and the accumulation of antibiotic residues in animal products and in the environment. These situations force the world to restrict the use of antibiotic growth promoters (AGPs) in animal feed (Alloui *et al*., 2014). The removal of AGPs from broilers feed had negative impacts on their productions performance and foster the resurgence of pathogens causing illness and economic losses in farms. To overcome from these problems, herbs and plant extracts are searched to be incorporated in poultry feed as growth promoters (Alloui *et al*., 2013). Many medicinal plants were tried by various researchers, some of them proved the ability of bioactive compounds of plants (phytobiotics) to prevent disease and promote the growth of broilers at same time. The advantage of phytogenic feed additives over synthetic growth promoters is mainly due to the natural synergistic effect of all agents within the plants. Some traditional medicinal herbs/plants like, turmeric, mangrail, garlic, methi, aloe vera, ashwagandha, punarnawa, bhuiamla, neem and tulsi are alone or in combination proved for their novel property of phytogenic growth promoter. Thus, the present experiment was designed to assess the effectiveness of the range of concentrations of a novel preparation consisting of a blend of natural herbs as dietary feed additives of broiler chickens. The effect of this herbal blends on economic efficiency and cost of rearing were determined.

Materials and Methods

Day-old commercial Vencobb-400Y broiler chicks (n=250) were distributed in a completely randomized design into five groups, each group contains 50 chicks in each and it further subdivided into five replicates of ten birds in each. The chicks were placed on one of the five dietary treatments i.e. either a basal diet (NCON) or that supplemented with antibiotic (PCON), a phytogenic feed additive NARGROPHYT at level of 1% (NGP-1.0), 1.5% (NGP-1.5) and 2% (NGP-2.0). NARGROPHYT was a blend of turmeric rhizome, mangrail seed, methi seed, neem leaf, tulsi leaf, aloe vera leaf, garlic bulb, punarnava root, ashwagandha root and bhuiamala root powder. The experimental diets were formulated for pre-starter (1-7 days), starter (8-21 days) and finisher phase (22-42 days) separately as per BIS (2007) requirements and the composition is presented in Table 1. The chicks were kept hygienically on floor litter system in separate pens. All the birds were reared adopting uniform management conditions. Individual BW of chicks was recorded at 0 d and weekly intervals upto 42d. Beside this, replicate-wise total feed consumed during the experimental period was also recorded weekly to find out the commercial viability of this phytogenic product in terms of economic efficiency and cost of production. Data were subjected to statistical analysis under completely randomized design employing one way analysis of variance (Snedecor and Cochran, 1989). The means of different treatments were compared with Duncan Multiple range test (Duncan, 1955). Significance was

considered at P<0.05 level.

Results and Discussion

The data related to cost of production of broilers was presented in Table 2. The values of feed productivity were significantly (P<0.05) higher in NGP-1.5, NGP-2.0 and PCON than NCON group and shows no significant varriation between them. The value was lowest in NGP-1.0 amongst the herbal treatments which was similar to NCON group birds. The cost productivity data revealed that phytogenic treated birds showed no significant variation among groups and similar to NCON group, however significantly (P<0.05) lower than PCON group birds. The feed price ratio value follow the trend similar to feed productivity and it was observed that NGP-1.5 and NGP-2.0 had significantly (P<0.05) higher value than NCON but similar to PCON group.

The data related to economic efficiency of broiler rearing fed with a phytogenic feed additive supplemented diet was presented in Table 3. On scanning the data of benefit-cost ratio it was found that, all herbal treated group birds benefit: cost ratio did not showed any variation among groups and it was similar to NCON, however significantly (P<0.05) lower than PCON group birds. The feed cost per kg body weight gain was significantly (P<0.05) higher in NCON followed by NGP-1.0, NGP-1.5 and NGP-2.0. Two percent phytogenic mixture supplemented group feed cost per kg body weight gain was similar to PCON group. Whereas the economic efficiency index (EEI) was highest in PCON which was similar to NGP-2.0. NGP-1.0 and NGP-1.5 posses significantly (P<0.05) lower EEI than PCON but significantly (P<0.05) higher than NCON. Similarly the value of cost index (CI) in NGP-2.0 and PCON was also similar and significantly (P<0.05) lower than NCON group. The CI of NCON was significantly (P<0.05) higher than all other groups. Data shows that the return on feed was similar in NGP-1.5 NGP-2.0 and PCON group and significantly (P<0.05) higher in comparison to NCON. The value was lowest in NGP-1.0 which was similar to NCON group birds. On investigation of gross return it was observed that herbal treated groups showed no variation and similar to PCON; which were significantly (P<0.05) higher than NCON group. While return on investment of herbal treated groups were similar to NCON and significantly (P<0.05) lower than PCON group. On screening the data of profitability and profitability index (PI), both parameters follow the trends similar to return on investment i.e. Phytogenic feed additive supplemented groups showed no variation in profitability and PI values and similar to NCON, however significantly (P<0.05) lower than PCON group values. At break even point the total cost of production is equal to the total revenue generated. The break even output values of Phytogenic mixture supplemented groups were similar to NCON, however significantly (P<0.05) higher than PCON group. Economic efficiency (EE), relative economic efficiency to negative control (REE-NC) and relative economic efficiency to positive control (REE-PC) of broilers showed similar pattern. The values of EE, REE-NC and REE-PC of herbal supplemented groups did not showed any variation between groups and similar to NCON group. However, the values were significantly (P<0.05) lower than PCON group.

Table.1 Ingredients and calculated composition of basal diet (per 100kg)

Ingredient (kg)	**Pre-starter**	**Starter**	**Finisher**
Maize	50.42	55.52	59.82
Soybean meal	42.00	36.40	27.40
Rice polish	-	-	5.00
Vegetable fat	4.48	5.18	5.43
Dicalcium phosphate	1.15	0.97	0.80
Limestone powder	0.90	1.04	0.75
Common salt	0.40	0.38	0.36
DL-Methionine	0.25	0.18	0.16
Lysine	0.15	0.08	0.03
Choline chloride	0.10	0.10	0.10
Vitamin premix	0.05	0.05	0.05
Mineral premix	0.10	0.10	0.10
Nutrient composition			
Dry Matter (%)	87.15	87.77	89.22
Crude protein (%)	23.14	22.09	20.31
Crude fiber (%)	3.05	3.25	3.45
Ether extract (%)	4.98	5.80	7.78
Total ash (%)	5.79	5.18	6.86
Metabolizable energy(Kcal/kg, calculated)	3003.10	3107.00	3203.40

*Supplies per kg diet: Vitamin A, 16,500IU; Vitamin D_3, 3200IU; Vitamin E, 12mg; Vitamin K, 2 mg; VitaminB_2, 10mg; Vitamin B_6 , 2.4 mg ; Vitamin B_{12}, 12µg; Niacin, 18 mg; Pantothenic acid, 12 mg; Mn, 90mg ; Zn, 72mg; Fe, 60mg; Cu, 10 mg; I, 1.2 mg.

Table.2 Cost of productivity of broiler rearing fed with a herbal mixture supplemented diet

Attributes	**NCON**	**PCON**	**NGP-1.0**	**NGP-1.5**	**NGP-2.0**	**SEM**	**P-Value**
Prestarter cost	3.75^{a}	3.55^{b}	3.58^{b}	3.67^{ab}	3.58^{b}	0.024	0.044
Starter cost	24.77^{a}	23.25^{b}	24.61^{a}	22.93^{b}	22.83^{b}	0.223	0.001
Finisher cost	80.99^{b}	78.66^{d}	82.75^{a}	80.76^{bc}	79.64^{cd}	0.327	<0.001
Total feed cost	109.51^{a}	105.46^{b}	110.94^{a}	107.35^{b}	106.06^{b}	0.514	<0.001
Feed additive cost	0.00^{e}	0.43^{d}	6.77^{c}	9.82^{b}	12.93^{a}	1.042	<0.001
Feed productivity	0.54^{c}	0.64^{a}	0.58^{bc}	0.60^{ab}	0.62^{ab}	0.009	0.002
Cost productivity	0.016^{b}	0.019^{a}	0.017^{b}	0.017^{b}	0.017^{b}	0.000	0.002
Feed price ratio	1.44^{c}	1.71^{a}	1.55^{bc}	1.59^{ab}	1.65^{ab}	0.025	0.002

Table.3 Economic efficiency of broiler rearing fed with a herbal mixture supplemented diet

Treatment	NCON	PCON	NGP-1.0	NGP-1.5	NGP-2.0	SEM	P-value
Benefit/cost ratio	0.06^{b}	0.24^{a}	0.10^{b}	0.10^{b}	0.11^{b}	0.017	0.002
Feed cost per kg Body wt gain (Rs/kg)	43.80^{a}	38.48^{d}	42.47^{b}	40.43^{c}	39.11^{d}	0.427	<0.001
Economic efficiency index (%)	84.80^{d}	96.51^{a}	87.46^{c}	91.86^{b}	95.03^{a}	0.944	<0.001
Cost index	117.93^{a}	103.61^{d}	114.36^{b}	108.87^{c}	105.31^{d}	1.149	<0.001
Return on feed	35.50^{c}	42.06^{a}	38.15^{bc}	39.24^{ab}	40.62^{ab}	0.612	0.002
Gross return	157.89^{b}	180.27^{a}	171.94^{a}	171.31^{a}	175.03^{a}	2.304	0.019
Return on investment	6.35^{b}	24.42^{a}	9.76^{b}	9.65^{b}	10.82^{b}	1.718	0.002
Profitability %	106.35^{b}	124.42^{a}	109.76^{b}	109.65^{b}	110.82^{b}	1.718	0.002
Profitability index	0.06^{b}	0.20^{a}	0.09^{b}	0.09^{b}	0.09^{b}	0.013	0.005
Break even output %	88.20^{ab}	78.60^{c}	89.20^{a}	87.60^{ab}	86.80^{b}	0.816	<0.001
Economic efficiency	0.064^{b}	0.244^{a}	0.100^{b}	0.096^{b}	0.108^{b}	0.017	0.002
Relative economic efficiency NC	100.04^{b}	377.24^{a}	162.50^{b}	161.42^{b}	181.75^{b}	26.869	0.004
Relative economic efficiency PC	26.52^{b}	99.99^{a}	43.07^{b}	42.78^{b}	48.17^{b}	7.122	0.004

Increase in the gross return of the birds fed diet containing phytogenic growth promoters than NCON may be attributed to the better efficiency of feed utilization, which resulted in more growth and better feed to gain ratio, ultimately leading to higher return in the broilers reared on an herbal product that have growth stimulating, antifungal, antioxidant and hepato-protective properties. However, non significant variations in other economic parameters of Phytogenic feed additive supplemented groups and NCON or lower values than PCON was due to the higher cost of the phytogenic mixture than AGPs.

The results of the present study are in line with the findings of Karangiya *et al*. (2016) who reported that return on feed cost was highest in garlic in comparing to control. Similarly, Oleforuh-Okoleh *et al*., (2014)

recorded that highest revenue and net return was obtained from birds fed on herbal supplemented diet. Our findings were in agreement with Puvaka *et al*. (2016) who fond lowest feed cost for per kg body weight gain at herbal powder supplementation in the diet of broiler chickens. They also reported that supplementation of herbal powder in diet leads to higher economic efficiency index as well lower cost in broiler production. Similarly, Abd El- Latif, *et al.* (2002) reported that the inclusion of herbal feed additives in Japanese quail diet resulted in the least feed cost/kg gain. EL-Faham *et al*. (2014) also found better economical and relative efficiency values in chicks fed diet contained herbal substance as compared with control group. In concurrence with the our findings Abaza *et al*. (2008) also reported better economic efficiency and relative economic efficiency in birds that supplemented with black seed oil. Similarly, Abo Omar *et al*. (2016) also found better economic efficiency in the birds fed a commercial herbal preparation compared to the control birds. In agreement with our findings Moustafa (2006) and Issa and Abo Omar (2012) found improved the economic efficiency of broilers on supplementation of herbal extracts. Abd El- Latif, *et al.* (2002) also reported that the inclusion of herbal feed additives in Japanese quail diet resulted in the higher percentage of economical efficiency compared with the control diet. This improvement could be due to improving the feed conversion or reducing the amount of feed required to produce one unit of meat.

In conclusions, data of the present study indicated that supplementation of broilers with phytogenic feed additives did not improved the economic efficiency of birds in comparing to AGPs supplemented birds. However, due to animal, environment and consumer friendly nature of Phytogenic feed additives it may be used at level of 2.0% in broilers feed as an effective alternative of antibiotic growth promoters.

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