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# Supplementation of Broilers Diet with Different Sources of Growth Promoters

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## Abstract

A study was conducted at the Institute of Agriculture and Animal Sciences (IAAS), Rampur, Chitwan from 29 August to 17 October, 2007 to compare the effects of antibiotic (chlortetracycline) and probiotic (*Lactobacillus acidophilus*) with three herbal growth promoters, Amala (*Emblica officinalis),(*EO), Tulsi (*Ocimum sanctum),* (OC) and Aswogandha (*Withania somnifera)*,(WS) on growth performance, feed consumption, feed conversion efficiency, carcass characteristics, and economics of broiler production. The experiment was laid out in a completely randomized design with day-old broiler chick (192) randomly assigned to eight groups containing 8 chick in each and replicated three times. The control group received the maize-soybean based basal diet. In the treatment groups, the basal diet was supplemented with one of the following: antibiotic, probiotics, Tulsi, Amala, and Aswogandha and also in combination of herbs, forming eight treatments respectively. Results showed significantly better production in herbs. Significantly higher digestibility of all the nutrients ($P<0.05$) was observed in Amala+Tulsi+Aswogandha ($T_8$) supplemented group. Highest body weight (1.440kg) was recorded in birds fed diet supplemented with Amala and Tulsi, and the lowest body weight (1.317kg) was seen in antibiotics ($T_{2)}$ fed birds. The highest income over expenditure (Rs.26.36) was recorded in birds fed diet supplemented with Tulsi ($T_6$), although the difference was not significant among the treatments. Looking at the benefit cost ratio, highest B/C ratio was found in birds supplied with Tulsi (1.19) supplemented diet and minimum (1.12) was recorded in Amala supplied diet. Hence, this experiment showed that herbs as growth promoters can replace antibiotics in the diet of broiler chicken. However, it needs multilocational trials before recommendation for adoption by poultry growers.

**Key words:** antibiotics, herbs, income, performance, poultry

## Introduction

Poultry industry in Nepal has emerged as the most dynamic and fastest expanding segment in animal husbandry sector. There has been a phenomenal growth in the Nepalese poultry industry in the last three decades. The contribution of agriculture to the gross domestic products (GDP) is 39 percent and the contribution of livestock to agricultural gross domestic products (AGDP) is 25.7 percent (MOAC 2009/10). The total fowl population in the country was 25,760,373 in the year 2009/10. The net meat production during the year 2009/10 was 250,213 metric ton (mt), out of which the contribution from chicken was 17,551 mt (MOAC 2009/10). Chitwan district is among the limited poultry pockets in Nepal, and shares around 30 percent of the broiler and 80 percent of the total layer chicks produced in the country. This resembles to 8.5 percent fowl population of the country, and shares 7.8 % of total chicken meat produced in Nepal (MOAC 2009/2010).

World food production is now relying more and more on animal source and ironically, it is facing the dual challenges of sufficiency and safer production. The economic and nutritional demands of our modern society for food from poultry necessitate raising of poultry under intensive production system in densely populated colonies or flocks, which result in stress.

Under such circumstances, anti-microbial feed additives such as antibiotics are often used to suppress or eliminate harmful microorganisms in the intestine of birds and to improve growth and feed efficiency (Bird 1980, Miles *et al*. 1984, 1986, Izat *et al*. 1990). However, one major aspect of food production and safety today is the reduction in the use of antibiotics and other medicinal products in the poultry production, largely due to fears of over bacterial resistance and possible transmission of these antibiotic residues into the human food chain (Reddy *et al*., 2008). Consequently, the animal feed industry is exposed to increasing consumer pressure to reduce the use of antibiotic growth promoters (AGPs) in poultry diets. Therefore, it has been very important to find alternative feed additives (Botsoglou *et al*. 2004 & Humphrey *et al*. 2002) in poultry diet. Probiotics are also used extensively in animal production. They are the live organisms fed to the birds. In spite of their benefits, the most common adverse reactions with the use of probiotics are gastrointestinal problems that include flatulence and constipation, even death has been reported (Sanders 2000).

Feed safety has come to be recognized as one of the major drivers of the modern feed industry. The use of herbs as growth promoters can be a solution to this dilemma. The basic strategies for using these herbs in poultry diets are to influence the metabolism by combating stress and microbial activity. Scientific evidences exist that herbs and plant extracts stimulate the growth of beneficial bacteria and minimize pathogenic bacterial activity in the gastrointestinal tract of poultry (Langhout 2000 & Wenk 2000).

Herbs like *Withania somnifera* containing repartitioning agents help decrease body fat deposition and increase protein accretion without any residual effects on human. Similarly, *W. somnifera* is believed to tone up the physiological and immunological function of birds affected by stress (Dharma *et al*. 2007). It is known to positively moderate the immune system of man and animals (Kuttan 1996). Various studies on *O. sanctum* have revealed it as growth promoting, hypo-tensive, cardiac depressant, smooth muscle cell relaxant, antiseptic properties and anti-stress activities (Bhargava & Singh 1981). *Emblica officinalis* is not only a useful antioxidant and anti-inflammatory, but also has adaptogenic activity as well. *E. officinalis* extract has shown to protect against biological, physical, and chemical stressors (Rege *et al*. 1999). These plant also posses the properties like antioxidative, antiviral, antiemetic, antihepatotoxic, immuno modulator, resistance building properties, and antibacterial properties (Ahmed *et al*. 1999).

The use of herbs help produce lean meat and enhance production, which improve and increase taste of meat thus improving the overall quality of meat to the consumers (Vatsyayan 2007). Being components of nature, these herbs are considered safe, cost-effective, and environment-friendly with no side effects in most occasions (Guo *et al.* 2004). This practice will not only increase the performance in the animals but also increase the safety of the product for the end consumer.

It is hoped that the study will aid to finding out the solution to residual effects caused to human health due to the consumption of antibiotic fortified chicken.

## Methodology

This study was carried out between 29 August through 17 October, 2007 in the livestock farm at IAAS, Rampur, Chitwan. Day old Ven-cobb broiler chicks (192) of similar weight were used for the experiment. These chicks were divided into eight treatments (8 chicks/ treatment) with three replications in a poultry house which was disinfected and kept clean. The chicks were kept in a brooder for one week under special care and management.

The experimental diet containing 20% Crude Protein (CP) and 3000 KCal ME/kg diet and finisher ration containing 19% CP and 3000 KCal ME/kg was formulated to meet the requirements of National Research Council (NRC 1994). Requirements for all nutrients were met using primarily maize, soybean meal, sunflower meal, rice polish, and smaller amounts of deoiled cake, soyaoil, minerals and vitamins. A basal diet was formulated for each treatment and then antibiotics, probiotics and herbs were added to it individually as per the required treatment and thoroughly mixed. The birds were fed *ad libitum* up to the 6 weeks of age. Each diet was fortified with antibiotics, probiotics, dried and powdered Amala, Tulsi, and Aswogandha as per the requirement per ton of feed. Primary data were collected on the basis of direct recording and observation in the farm and the secondary information was collected from published literature.

The treatments assigned were: (T1) Basal diet, (T2) Basal diet + Antibiotic (Chlorotétracycline), (T3) Basal diet + Probiotic (*Lactobacillus acidophillus*), (T4) Basal diet + Amala (EO), (T5) Basal diet + Aswoganda (WS), (T6) Basal diet + Tulsi (OC), (T7) Basal diet + Tulsi + Amala, (T8) Basal diet + Tulsi+ Amala+ Aswogandha. Data on weekly feed consumption, weekly feed conversion ratio, digestion trial, carcass characteristics, intestinal fat and digestion trial was also conducted. The data were analysed using statistical programme MSTAT for the analysis of variance and Duncan's Multiple Range Test (DMRT) was used to measure the difference between treatments at 5% level of significance (Duncan, 1955) as modified by Kramer (1957).

## Results and Discussion

### Live weight

Weekly cumulative body weight of Ven-cobb broilers fed with herbs mixed diet are presented in Table 1. The live weights of birds were significantly different during the fourth week of the experiment. However, a non significant difference was observed in 2nd week of the trial which continued in 3rd, 5th and final week of the experiment. During the 2nd week of the trial, maximum live weight of Vencobb broilers was observed in $T_5$ (0.290kg), which was higher than $T_1$ and the rest of the treatments being in consistent with $T_5$ (0.297kg). However, during third week of experiment, maximum live weight was for $T_7$ (0.572kg), which was non, significantly different with other treatments. Similar trend was observed in succeeding weeks as well. A significant difference among the live weight of broilers was recorded during the 4th week of the experiment. The maximum body weight was observed in $T_7$ (0.929kg) which was similar other treatments and the minimum body weight was recorded in $T_2$ (0.833kg). No significant difference between treatments was observed among the treatments in 5th week of the experiment. Similarly, during 6th week of the trial, the highest body weight (1.875kg) was observed in $T_6$ and minimum weight (1.771kg) was recorded in $T_2$, other treatments remaining in between these values.

**Table 1.** The average live weight of Ven-cobb broiler fed diet mixed with different sources of growth promoters

| Treatments | Time (week) and live weight (kg) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| T1=Basal diet | 0.103 | 0.278bc | 0.560abd | 0.891ab | 1.367 | 1.833ab |
| T2=Basal diet + Antibiotics | 0.102 | 0.272c | 0.515c | 0.833b | 1.317 | 1.771ab |
| T3=Basal diet + Probiotics | 0.102 | 0.289abc | 0.553bcd | 0.891ab | 1.404 | 1.850a |
| T4=Basal diet + Amala | 0.102 | 0.287abc | 0.568abc | 0.895a | 1.362 | 1.754ab |
| T5=Basal diet + Aswogandha | 0.100 | 0.297a | 0.570ab | 0.892ab | 1.398 | 1.700b |
| T6=Basal diet + Tulsi | 0.104 | 0.295ab | 0.550cd | 0.925a | 1.435 | 1.875a |
| T7=Basal diet + Tulsi + Amala | 0.105 | 0.296ab | 0.572a | 0.925a | 1.440 | 1.852a |
| T8=Basal diet + Tulsi + Amala +Aswogandha | 0.102 | 0.280abc | 0.547d | 0.887ab | 1.400 | 1.808ab |
| SEM± | 0.005 | 0.005 | 0.005 | 0.018 | 0.036 | 0.044 |
| CV% | 4.01 | 3.94 | 3.83 | 3.23 | 4.82 | 4.42 |

Means within the column followed by different superscript are significantly different by DMRT $_{(P<0.05)}$. From these results, it can be interpreted that diet fortified with Tulsi and Amala gave the best output than the diet supplied with antibiotics, however, probiotics also have proved their own benefits. These results were probably due to adaptogenic, antimicrobial, immunomodulator, and antistress properties of Tulsi and Amala as demonstrated by Rao (2005). Shon *et al*. (2002) also reported Tulsi as anti-microbial, disease resistant, maintaining normal functions and improving production performance in broilers. Liver stimulating action of Amala have been proved to be effective for improving production performance and carcass quality in broilers as stated by Bahera *et al*. (2003), Roy *et al*. (2003), and Singh *et al*. (2002). These results are also in agreement with Chatterjee and Agrawala (2002), and Kassim *et al*.

(1995). Reddy (2005) also reported increased live weight in broilers with Amala. However, Pardue *et.al* (1985) was not in agreement with above results, who did not find improved growth in the Vitamin C supplemental groups. Live weight of birds supplied with probiotic was at par with Tulsi and Amala fed diet (Kabir *et al.* 2004 and Kannan *et al.* 2007) proved improved live weight of broilers supplied with probiotics. This has also been supported by Safalaohl (2006).

## Weight gain

The average weekly body weight gain of Ven-cobb broilers influenced by different sources of growth promoters are presented in Table 2. ANOVA showed non-significant result among the treatments. However, the comparison of treatment means by Duncan's Multiple Range Test (DMRT) showed variation among the treatments. During the 2nd week, the effect of treatment did not show much disparity. The mean comparison by LSD showed variation among the treatments in 3rd week of the trial. Maximum weight gain was recorded in $T_5$ (0.194kg) and least weight gain was recorded in $T_2$ (0.169kg). During 4th week of the trial, birds fed with only basal diet ($T_1$) showed highest weight gain (0.2825kg) and the minimum were recorded in $T_2$ (0.242kg). A significant variation among the treatments was observed in 5th week of the experiment. Birds fed with $T_5$ showed maximum weight gain (0.412kg) and lowest gain was recorded in $T_2$ (0.318kg). During sixth week of age maximum gain was found in $T_6$ (0.527kg), followed by $T_7$ (0.510kg) and the lowest, was recorded in $T_5$ (0.414kg). However, the overall mean showed highest gain (0.289kg) in $T_7$, and the lowest in $T_5$ (0.263kg).

**Table 2.** The average weekly weight gain of Ven-cobb broiler fed diet mixed with different sources of growth promoters

| Treatments | Time (week) and weight gain(kg) 2 | 3 | 4 | 5 | 6 | Overall mean |
|---|---|---|---|---|---|---|
| $T_1$=Basal diet | 0.103 | $0.174^{bc}$ | $0.282^{a}$ | 0.364 | 0.441 | 0.273 |
| $T_2$=Basal diet + Antibiotics | 0.102 | $0.169^{c}$ | $0.242^{b}$ | 0.318 | 0.483 | 0.263 |
| $T_3$=Basal diet + Probiotics | 0.102 | $0.187^{abc}$ | $0.263^{a}$ | 0.338 | 0.512 | 0.280 |
| $T_4$=Basal diet + Amala | 0.102 | $0.188^{ab}$ | $0.277^{a}$ | 0.327 | 0.466 | 0.272 |
| $T_5$=Basal diet + Aswogandha | 0.100 | $0.194^{a}$ | $0.272^{a}$ | 0.412 | 0.414 | 0.279 |
| $T_6$=Basal diet + Tulsi | 0.104 | $0.190^{ab}$ | $0.265^{a}$ | 0.357 | 0.527 | 0.288 |
| $T_7$=Basal diet + Tulsi + Amala | 0.105 | $0.190^{ab}$ | $0.276^{a}$ | 0.362 | 0.510 | 0.289 |
| $T_8$=Basal diet + Tulsi + Amala +Aswogandha | 0.102 | $0.177^{abc}$ | $0.267^{a}$ | 0.339 | 0.493 | 0.276 |
| SEM ± | 0.005 | 0.005 | 0.018 | 0.036 | 0.044 | |
| CV% | 4.01 | 5.38 | 5.86 | 16.08 | 16.38 | |

Means within the column followed by different superscript are significantly different by DMRT $(P< 0.05)$

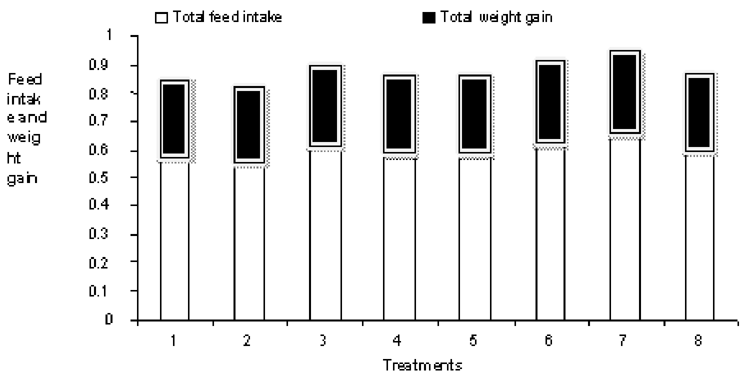


**Fig. 1.** Feed intake and weight gain of the Ven-cobb broilers

Thus, the results showed that herbs proved superior to antibiotics in the performance of Ven-cobb broilers. Higher body weight gain of birds fed with Amala and Tulsi ($T_7$) in combination with Basal diet might be due to higher feed consumption (Fig. 1). Incorporation of vitamin C, the major constituent of Amala improved a positive linear correlation between the supplemental levels and the weight gain. Feed intake significantly increased when birds gained weight. Higher weight gain was followed during the finisher phase (4 weeks-6 weeks) in broilers supplied with vitamin C as reported by Kutlu and Forbes (1993). These results were also in agreement with McKee and Harrison (1995).

## Feed consumption

The average weekly feed consumption of Ven-cobb broiler fed diets with different sources of growth promoters are presented in Table 3. The effect of treatments showed a non-significant difference (P<0.05) in feed consumption except in 3rd week. During 2nd week of experiment, maximum feed intake was recorded in $T_7$ (2.338kg) while lowest feed intake was found in $T_8$ (0.197kg). Maximum feed intake during the 3rd week of the experiment was observed in $T_6$ (0.464kg) which was in consistent with $T_3$ (0.455kg) and the minimum feed consumption was recorded in $T_2$ (0.423kg) which was similar to $T_4$ (0.439kg) and $T_7$ (0.440kg). A significant difference among treatments was recorded during the fourth week of the trial. Maximum feed consumption was recorded in $T_1$ (0.772kg) and $T_6$ (0.775kg). Minimum feed consumption was found in $T_2$ (0.699kg). The feed intake among birds was almost similar during 5th week of the trial. The highest value of feed intake recorded in 6th week was $T_3$ (0.859kg) which was similar to $T_6$ (0.864kg) and the minimum value recorded was in $T_1$ (0.6654kg). These values differed non significantly among the treatments. The overall mean (Table 3) showed highest (0.654kg) feed consumption in $T_7$ diet supplied with Amala and Tulsi and lowest (0.557kg) in $T_2$ diet fortified with antibiotics. During the entire experimental period, feed intake was found higher in birds fed diet fortified with Tulsi and Amala; this higher feed consumption might be due to the constituents of the herbs (including vitamin C) and their effect in the body. Higher feed intake may be due to higher feed conversion ratio as well.

**Table 3.** The average weekly feed consumption of Ven-cobb broilers fed diet with different sources growth promoters

| Treatments | Time (weeks) and feed consumption(kg) | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | Overall mean |
| $T_1$=Basal diet | $0.215^{abc}$ | $0.443^{bc}$ | $0.772^{a}$ | 0.777 | $0.665^{b}$ | 0.574 |
| $T_2$=Basal diet + Antibiotics | $0.223^{ab}$ | $0.423^{d}$ | $0.699^{b}$ | 0.683 | $0.755^{ab}$ | 0.557 |
| $T_3$=Basal diet + Probiotics | $0.230^{ab}$ | $0.455^{ab}$ | $0.755^{ab}$ | 0.796 | $0.859^{a}$ | 0.619 |
| $T_4$=Basal diet + Amala | $0.210^{bc}$ | $0.439^{bcd}$ | $0.739^{ab}$ | 0.771 | $0.805^{ab}$ | 0.593 |
| $T_5$=Basal diet + Aswogandha | $0.222^{ab}$ | $0.432^{cd}$ | $0.716^{ab}$ | 0.764 | $0.798^{ab}$ | 0.586 |
| $T_6$=Basal diet + Tulsi | $0.233^{a}$ | $0.464^{a}$ | $0.775^{a}$ | 0.788 | $0.864^{a}$ | 0.625 |
| $T_7$=Basal diet+Tulsi+Amala | $0.218^{ab}$ | $0.440^{bcd}$ | $0.757^{ab}$ | 0.807 | $0.836^{ab}$ | 0.654 |
| $T_8$=Basal diet + Tulsi +Amala+ Aswogandha | $0.197^{c}$ | $0.448^{abc}$ | $0.734^{ab}$ | 0.764 | $0.838^{ab}$ | 0.596 |
| SEM+ - | 0.005 | 0.005 | 0.054 | 0.070 | 0.160 | |
| CV% | 6.61 | 4.59 | 3.33 | 5.66 | 11.9 | |

Means within the column followed by different superscript are significantly different by DMRT $_{(P<0.05)}$

According to Kassim *et al*. (1995) broilers fed diets containing vitamin C were less stressed due to having reduced body temperature and respiratory rates (Pardue *et al*. 1986, Thaxton *et al*. 1984) and showed higher feed intake (Kutlu *et al*. 1993 & Mckee et al. 1995) than control birds. Although the feed intake was higher it was not significantly different as mentioned by Kassim *et al.* (1995), and Kutlu *et al.* (1995). This was also in agreement with Forbes (1993) and (Lohakare *et al.* 2005). Kassim and Norziha (1995) who also found improved growth and feed efficiency in the broiler chicks supplemented with vitamin C at higher levels.

## Feed conversion ratio

The average weekly feed conversion ratio (FCR) of Ven-cobb broiler fed diets with different sources of growth promoters is presented in Table 4. Although the analysis of variance showed no significant difference among the treatments ($p<0.05$).The mean FCR in second week of experiment was observed lowest in $T_3$ (2.250) and best was observed in $T_8$ (1.923). However, during the third week of the trial, low efficiency was observed for $T_1$ (2.547) and the higher efficiency was recorded in $T_5$ (2.22). Almost similar trend was observed in fourth week of the trial. Fifth week of the experiment showed a high conversion efficiency in $T_5$ (1.990) and lowest was observed in $T_3$ (2.353). Finally, during the sixth week of trial good feed conversion efficiency was observed in $T_1$ (1.537) followed by $T_2$ (1.560) and $T_7$ diet fortified with Tulsi and Amala (1.633). However, these values were not significantly different. The cumulative efficiency was observed to be best in Tulsi and Amala fortified diet $T_7$ (2.198). Hence, it could be concluded that incorporation of Tulsi and Amala improved the feed conversion efficiency of broilers; however these differences were not significant.

**Table 4.** The average weekly feed conversion ratio of Ven-cobb broiler fed diet mixed with different sources of growth promoters

| Treatments | Time (week) and feed conversion ratio | | | | | |
|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | Overall mean |
| $T_1$=Basal diet | 2.070 | 2.547 | 2.733 | 2.130 | 1.537 | 2.203 |
| $T_2$=Basal diet + Antibiotics | 2.180 | 2.500 | 2.883 | 2.143 | 1.560 | 2.253 |
| $T_3$=Basal diet + Probiotics | 2.250 | 2.427 | 2.863 | 2.353 | 2.087 | 2.396 |
| $T_4$=Basal diet + Amala | 2.087 | 2.330 | 2.660 | 2.337 | 1.817 | 2.246 |
| $T_5$=Basal diet + Aswogandha | 2.207 | 2.220 | 2.627 | 1.990 | 2.113 | 2.234 |
| $T_6$=Basal diet + Tulsi | 2.243 | 2.363 | 2.710 | 2.183 | 1.893 | 2.278 |
| $T_7$=Basal diet + Tulsi + Amala | 2.067 | 2.283 | 2.750 | 2.260 | 1.633 | 2.198 |
| $T_8$=Basal diet + Tulsi + Amala +Aswogandha | 1.923 | 2.530 | 2.740 | 2.243 | 1.693 | 2.225 |
| SEM± | 0.098 | 0.093 | 0.093 | 0.147 | 0.302 | |
| CV% | 8.07 | 6.66 | 6.41 | 11.59 | 29.21 | |

The results of this study were in agreement with Wheeler (1993). It was recorded that birds showed a decrease of feed conversion ratio following the use of anti-stress and immuno-modulation herbs in the birds' diets. Similarly, in small-scale trials, using additional known stressors on chicken production, an increase in daily live weight gain of 6% and a decrease in feed conversion ratio of 7% was demonstrated by Reddy (2005). He also reported better FCR in vitamin C supplemented diets. Although the FCR was highest in vitamin C supplemented diet, it was not significantly different as reported by Lohakare (2005).

## Carcass characteristics

The average carcass characteristics and sharing of different organs relative to live weight of broilers supplemented with antibiotic, probiotics, Tulsi, Amala, and Aswogandha are presented in Table 5. The average live weight of birds selected randomly on the basis of treatments showed that the maximum dressing percentage in $T_6$ (80.81%) followed by $T_3$ and $T_5$ respectively (78.26%, 78%). Minimum dressing percentage (76%) was found in poultry supplied with only basal diet. The highest abdominal fat was found in $T_7$ (1.61%) and the lowest quantity was found in $T_3$ (0.43%). The weight of liver also showed similar trend as above, with maximum weight in $T_7$ (2.42%), followed by basal diet (2.37%) and the minimum liver weight was found in $T_8$ (1.83%). The highest leg weight was recorded in $T_6$ (23.63%) and the lowest leg weight was recorded in $T_7$ (21.96%).

**Table 5.** The average dressing percentage and share of different organs in Ven-cobb broilers

| Dressing percentage and share of different organs (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | Giblet wt (%) | | |
| **Treatments** | **Leg piece (%)** | **Back weight(%)** | **Empty gizzard (%)** | **Heart (%)** | **Liver (%)** | **Abdominal fat (%)** | **Dressing (%)** |
| $T_1$=Basal diet | 23.46 | 15.91 | 2.73 | 0.49 | 2.37 | 0.47 | 76.08 |
| $T_2$=Basal diet + Antibiotics | 23.58 | 15.00 | 2.55 | 0.53 | 2.50 | 0.49 | 77.50 |
| $T_3$=Basal diet + Probiotics | 22.82 | 17.39 | 2.03 | 0.53 | 2.17 | 0.43 | 78.26 |
| $T_4$=Basal diet + Amala | 22.91 | 16.45 | 2.44 | 0.44 | 2.21 | 1.48 | 77.50 |
| $T_5$=Basal diet + Aswogandha | 22.20 | 14.20 | 2.06 | 0.53 | 2.30 | 0.44 | 78.00 |
| $T_6$=Basal diet + Tulsi | 23.63 | 18.18 | 2.40 | 0.50 | 1.99 | 1.37 | 80.81 |
| $T_7$=Basal diet + Tulsi + Amala | 21.96 | 16.07 | 2.13 | 0.56 | 2.42 | 1.61 | 76.47 |
| $T_8$=Basal diet + Tulsi+ Amala + Aswogandha | 22.64 | 17.16 | 1.70 | 0.45 | 1.83 | 0.55 | 77.35 |

The data revealed that the dressing percentage was higher in the birds supplied with Tulsi, an important antimicrobial and good source of vitamin C. The mode of action of antimicrobials and vitamin C in this specific application could be explained via the modulation of the release of corticosteroid hormones and the alleviation of the disturbance in the electrolyte balance, thus reducing catabolism of body reserves and preventing a strong dehydration in the bird (Cafantaris 1995).

## Economics of broiler production

The gross income, gross expenditure, net income per bird, gross income over gross expenditure, percent net income over expenditure with diet containing different sources of growth promoters are presented in Table 6. Gross expenditure per bird showed a significant difference among the treatments ($p<0.05$). The average cost of production per bird was highest in $T_8$ (Rs.143) whereas the minimum cost of production per bird was in birds fed with basal diet only $T_1$ (Rs.128.3). The gross income of bird was also found significantly different ($P<0.05$) among the treatments. The highest gross income was observed in Tulsi supplied diet $T_6$ (Rs 166.9) which was in consistent with $T_7$ (Rs.164.9), $T_3$ (Rs.164.8) and $T_8$ (Rs 161.2) and the lowest value was obtained in $T_1$ (Rs 148.7). The net income per bird was found highest in $T_6$ (Rs 26.36) and the lowest income was recorded in $T_4$ (Rs.17.10). Thus, highest benefit cost ratio (1.19) was observed in ($T_6$), birds supplied with Tulsi and the lowest benefit cost ratio (1.12) was observed in ($T_4$) birds supplemented with Amala.

**Table 6.** The income and expenditure of Ven-cobb broiler fed diet with different sources of growth promoters

| Economics of production | | | | |
|---|---|---|---|---|
| **Treatments** | **Gross expenditure (Rs)** | **Gross income (Rs)** | **Net income per bird (Rs)** | **B/C ratio** |
| $T_1$=Basal diet | $128.3^c$ | $148.7^c$ | 20.45 | 1.16 |
| $T_2$=Basal diet + Antibiotics | $135.5^b$ | $158.0^{abc}$ | 22.55 | 1.17 |
| $T_3$=Basal diet + Probiotics | $141.5^a$ | $164.8^a$ | 23.23 | 1.16 |
| $T_4$=Basal diet + Amala | $139.5^a$ | $156.6^{abc}$ | 17.10 | 1.12 |
| $T_5$=Basal diet + Aswogandha | $134.7^b$ | $152.0^{bc}$ | 17.30 | 1.13 |
| $T_6$=Basal diet + Tulsi | $140.5^a$ | $166.9^a$ | 26.36 | 1.19 |
| $T_7$=Basal diet +Tulsi +Amala | $142.4^a$ | $164.9^a$ | 22.55 | 1.16 |
| $T_8$=Basal diet +Tulsi +Amala +Aswogandha | $143.0^a$ | $161.2^{ab}$ | 18.19 | 1.13 |
| SEM± | 1.271 | 3.393 | 2.995 | |
| CV% | 1.59 | 3.69 | 24.75 | |

Means within the column followed by different superscript are significantly different by DMRT $_{(P<0.05)}$ The present findings are supported by Shon *et al*. (2002) and Reddy *et al*. (2002) who have reported the use of herbal preparations like anti-microbials to be economical. Thus, Tulsi fed birds proved better income provider.

From this study it could be concluded that the growth performance of broilers improved when they were fed diets containing Amala and Tulsi separately or in combination of Amala, Tulsi, and Aswogandha. Hence, herbs could replace antibiotics in the diet of broiler chicken. Since this is a new area of research, and limited studies have been conducted in this aspect, this study needs further verification of the results covering wider areas at large scale before the technology could be recommended for adoption by the poultry growers and feed manufacturers.

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