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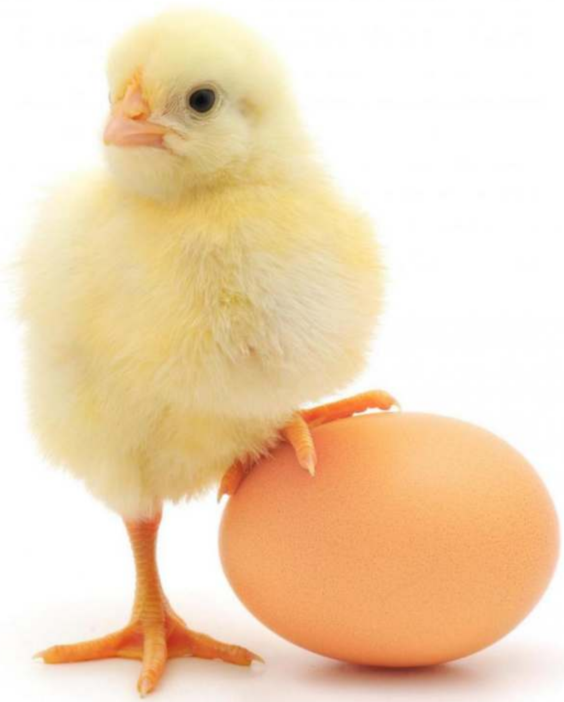

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Panchagavya and *Andrographis paniculata* as Alternatives to Antibiotic Growth Promoter on Broiler Production and Carcass Characteristics

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Abstract: A biological experiment was conducted to study the effect of panchagavya and *Andrographis paniculata* as alternatives to antibiotic growth promoter on broiler production and carcass characteristics with one hundred and eighty commercial, straight run day-old broiler chicks. The chicks were fed basal diet (T_1), basal diet with virginiamycin -20 mg/kg (T_2), basal diet with panchagavya -7.5 g/kg (T_3), basal diet with *A. paniculata* -2.0 g/kg (T_4), basal diet with probiotics -0.5 g/kg (T_5) and basal diet with mannanoligosaccharide (MOS) - 2.0 g/kg from 1 to 28 days and 0.5 g/kg from 29 to 42 days growing period (T_6) for 6 weeks period. The result revealed that the mean body weight and weight gain of T_6, T_5 and T_3 groups were significantly ($P<0.05$) higher as compared to the body weight of T_2 and T_1 groups at 6 weeks of age. The feed consumption did not show any difference between treatment groups. The FCR was ($P<0.05$) better in T_4 (1.87) compared to T_1 and T_2 groups, which recorded inferior FCR (2.04 each) at 6 weeks of age. Livability did not differ between treatment groups from 1 to 6 weeks of age. The carcass characteristics, cut-up parts of carcass and sensory qualities of meat did not differ due to dietary supplements.

Key words: Panchagavya, *Andrographis paniculata,* antibiotic growth promoter, broilers

Introduction

Antimicrobials have been used as feed supplement for more than 50 years in poultry feed to enhance the growth performance and to prevent diseases in poultry. Most of the antibiotic growth promoters act by modifying the intestinal flora, which are associated with poor health and reduced performance of animals (Bedford, 2000). However, in recent years great concern has arisen about the use of antibiotics as supplement at sub therapeutic level in poultry feed due to emergence of multiple drug resistant bacteria (Wray and Davies, 2000).

The presence of undesired antibiotic residues in poultry products and environmental contamination has largely added to the public concern regarding the use of antibiotics in the feed. As a consequence to the above facts, European Union Scientific Steering Committee has banned majority of the antibiotics used as growth promoters in monogastric animal diet from June 1999 in European Union.

Antibiotics can be replaced by alternatives such as prebiotics, probiotics and botanicals. Mannanoligos-accharide (MOS) is a prebiotic, which increased beneficial organisms in gastrointestinal tract (Spring *et al.,* 2000), improved the immunity of the birds (Shashidhara and Devegowda, 2003) and improved body weight gain and feed conversion (Parks *et al.*, 2001). Similarly, probiotics also improved the production performance of poultry (Jin *et al.*, 2000). Both can be used as alternative to antibiotic growth promotants.

Recently, Council for Scientific Industrial Research (CSIR), India has obtained US patent (No.689690 / and 6410059) for cow urine distillate, which claimed a novel pharmaceutical composition (Khanuja, 2002), and is effective as an antimicrobial and antifungal. Panchagavya is one such formulation mentioned in Ayurveda, which is prepared with five components derived from cow viz. milk, curd, ghee, urine and dung. These formulations were claimed to be useful against liver disorders, fever and inflammations and has hepatoprotective effect in toxicity induced rats (Achliya *et al.*, 2003) and immunostimulant activity with herbs in rats (Fulzele *et al.*, 2003). However, much work has not been carried out with panchagavya on bird's performance.

Commercial additives of plant origin like herbs, spices and various plant extracts are considered to be natural products that consumers would have received an increased attention as possible antibiotic growth promoter replacement and improved broiler performance (Hernandez *et al.*, 2004). *Andrographis paniculata* is having antimicrobial and growth promoting activity and hence may be used as alternative to antibiotics and tonic (Chopra *et al.*, 1992). Tipakorn (2002) found that feeding of *A. paniculata* to broiler chickens improved feed conversion ratio, live weight, decreased mortality rate and suggested as an alternative to chlortetracycline in the broiler diet. Hence, the present study was carried out to evaluate the use of panchagavya and *A. paniculata* as alternatives in addition to known alternatives like prebiotics and probiotics to antibiotic growth promoter on broiler production performance.

Materials and Methods

Preparation and analysis of panchagavya: The panchagavya samples were prepared by using dung (5 parts), urine (3 parts), milk (2 parts), curd (2 parts) and ghee (1 part) obtained from indigenous cow along with other ingredients viz. sugarcane juice - 3 parts, tender coconut juice - 3 parts, ripened banana - 12 numbers and toddy - 2 parts as per the methods of Natarajan (2003). The fresh dung was thoroughly mixed with ghee in a wide mouth mud pot and kept for three days. The above mixture was thoroughly mixed once in daily. On the fourth day, other ingredients were added to the mud pot, mixed properly and covered with nylon net to prevent entry of flies into the pot. The pot was placed in shade and mixed thoroughly twice a day for 30 days.

Panchagavya samples were taken and analyzed for its chemical and microbial composition. The pH of the samples was assessed using digital pH meter. The total volatile fatty acids (TVFA) content of panchagavya was assessed by using micro-Kjeldahl apparatus. Identification and quantification of individual volatile fatty acids were performed by using gas chromatograph (Chemito 8610 HR, India.).

The panchagavya samples were serially diluted in 10 folds using sterile triple glass distilled water. The selective media used for microbial culture were MacConkey agar for coliforms and *Salmonella*, Kanamycin Aesculin Azide agar for *Streptococci*, Mannitol salt agar for *Staphylococci*, de Man Rogosa Sharpe (MRS) agar for *Lactobacilli*. The selective media for the microbial counts of coliforms, *Streptococci* and *Staphylococci* were incubated aerobically at 37°C for one day. The agar plates for the counts of *Lactobacilli* were incubated in aseptic anaerobic jars at 37°C for two days. Anaerobic environment was created in the jars using AnaeroGen (Himedia) sachets. The microbial numbers were expressed as $\log_{10}$ colony forming units per gram ($\log_{10}$ cfu/g) of sample (Smits *et al.*, 1998).

Andrographis paniculata: The whole plants of *A. paniculata* (English: Creat) were collected from the local area after ascertaining their identity. The leaves of *A. paniculata* were collected and shade dried, powdered and kept ready for experimental use.

Biological experiment: One hundred and eighty commercial, straight run day-old broiler chicks belonging to a single hatch were purchased from a local hatchery, wing banded, weighed and randomly allotted into six treatment groups with three replicates of ten chicks each. The chicks were fed basal diet (T_1), basal diet with virginiamycin -20 mg/kg (T_2), basal diet with panchagavya -7.5 g/kg (T_3), basal diet with *A. paniculata* -2.0 g/kg (T_4), basal diet with probiotics (provilacc*) -0.5 g/kg (T_5) and basal diet with mannanoligosaccharide (MOS) - 2.0 g/kg from 1 to 28 days and 0.5 g/kg from 29 to 42 days growing period (T_6). The chicks were reared in broiler cages in a gable roofed, open sided house. All the chicks were provided with uniform floor, feeder and waterer space and were reared under standard management conditions throughout the experimental period of six weeks. The experimental diet was formulated according to the standards prescribed in Bureau of Indian Standards (B.I.S, 1992). The broiler starter and finisher diets were fed *adlibitum* to the birds from 1 to 28 and 29 to 42 days of age, respectively.

Collection of data: Data on body weight and feed consumption were recorded every week and mortality was recorded at occurrence. From the above data body weight gain, feed efficiency and livability were calculated. At the end of the experiment, one male and one female from each replicate, totally six birds per treatment were randomly picked up and slaughtered. The pre-slaughter weight, eviscerated carcass weight, giblets weight, ready-to-cook carcass weight and cut-up parts weight were recorded. The thigh and breast muscle samples were collected from each carcass and stored at –20°C for organoleptic study. The data collected on various parameters were subjected to statistical analysis as per the methods suggested by Snedecor and Cochran (1989). Angular transformation was applied to percentages wherever needed before carrying out statistical analysis.

Results

Analysis of panchagavya: The result revealed that the pH of the panchagavya sample was 4.52. The TVFA was 154.87 mmol/litre. The acetate, propionate and butyrate levels in panchagavya were 60.76, 15.66 and 6.40 per cent, respectively. The *Lactobacillus* count was 8.71 $\log_{10}$ cfu/g. Coliforms, *Streptococci* and *Staphylococci* counts were not in detectable range.

Production performance: The body weight (Table 1) showed a significant difference from 2 to 6 weeks of age between treatment groups. The mean body weight of T_6, T_5 and T_3 were 1911.33, 1901.40 and 1889.00 g, respectively, which were significantly (P<0.05) higher as compared to the body weight of T_2 (1766.80 g) and T_1 (1785.52 g) at 6 weeks of age. The group T_4 recorded 1875.07 g. Similarly, the body weight gain showed a significant difference between treatment groups from 1 to 6 weeks of age. The body weight gain was significantly (P<0.05) higher in T_6, T_5 and T_3, while T_2 recorded the lower body weight gain. *A. paniculata* fed group recorded the intermediate level of body weight gain of 1828.97 g at 6 weeks of age.

The cumulative feed consumption (Table 2) did not show significant difference between treatment groups. The mean cumulative feed consumption was 3427.30, 3506.63, 3511.73, 3555.47, 3555.97 and 3611.37 g/bird

*Each gram contained 5.85 billion *Saccharomyces cerevisiae*, 14.04 million *Lactobacillus acidophilus*, 2.34 million *Lactobacillus sporogenes* and 2.34 million *Streptococcus faecium*

Table 1: Mean (± S.E.) body weight (g) and weight gain (g) of broilers as influenced by dietary inclusion of dietary inclusion of different alternatives to antibiotic growth promoter

Parameters	T_1 - Basal diet	T_2 - Basal diet + Virginiamycin	T_3 - Basal diet + Panchagavya	T_4 - Basal diet + *A. paniculata*	T_5 - Basal diet + Probiotics	T_6 - Basal diet + MOS
A. Body weight (g)						
Day old chick	46.09±0.69	46.03±0.64	46.07±0.64	46.10±0.63	46.07±0.62	46.01±0.62
I week	155.63±2.13	160.53±2.81	154.93±2.87	149.90±3.24	160.80±2.46	156.50±2.44
II week	334.50^{bc}±9.84	349.10^{ab}±7.70	339.10^{ab}±5.63	318.77^{c}±7.68	343.13^{ab}±6.11	352.87^{a}±5.99
III week	651.47^{A}±17.73	630.60^{AB}±15.60	630.43^{AB}±12.27	588.83^{B}±14.58	644.63^{A}±12.06	661.67^{A}±13.39
IV week	1053.23^{abc}±20.82	1019.57^{bc}±24.96	1081.73^{a}±21.11	1007.43^{c}±21.75	1066.83^{ab}±17.69	1079.16^{a}±15.41
V week	1407.62^{bc}±29.13	1377.43^{c}±33.77	1466.67^{ab}± 28.30	1405.33^{bc}±28.98	1466.13^{ab}±25.38	1487.63^{a}±27.30
VI week	1785.52^{bc}±36.47	1766.80^{c}±40.37	1889.00^{a}±39.10	1875.07^{ab}±38.88	1901.40^{a} ±32.32	1911.33^{a} ±33.81
B. Body weight gain (g)						
I week	109.54^{ab}±1.93	114.50^{a}±2.52	108.86^{ab}±2.56	103.80^{b}±3.17	114.73^{a}±2.29	110.49^{a}±2.18
II week	288.41^{ab}±9.81	303.07^{a}±7.56	293.03^{a}±5.72	272.67^{b}±7.72	297.06^{a}±5.96	306.86^{a}±5.86
III week	605.38^{A}±17.56	584.57^{AB}±15.51	584.36^{AB}±12.37	542.73^{B}±14.63	598.56^{A}±12.01	615.66^{A}±13.19
IV week	1007.14^{abc}±20.66	973.54^{bc}±24.86	1035.66^{a}±21.16	961.33^{c}±21.70	1020.76^{ab}±17.66	1033.15^{a}±15.38
V week	1361.13^{b}±28.97	1331.41^{b}±33.60	1420.60^{ab}±28.31	1359.23^{b}±28.89	1420.06^{ab}±25.34	1441.62^{a}±27.16
VI week	1739.33^{bc}±36.33	1720.77^{c}±40.16	1842.93^{a}±39.13	1828.97^{ab}±38.78	1855.33^{a}±32.33	1865.32^{a}±33.66

Value in each cell is the mean of 30 observations except T_2 at 5 and 6 weeks of age, which had only 29 observations

$^{a-c}$Means within a row with no common superscript differ significantly (P<0.05)

^{A,B}Means within a row with no common superscript differ significantly (P<0.01)

in T_4, T_2, T_3, T_6, T_1 and T_5, respectively up to 6 weeks of age. The mean cumulative FCR significantly (P<0.05) differed between treatment groups at 5 and 6 week of age. The FCR was superior in T_4 (1.87), which did not differ from T_3 (1.90), T_6 (1.90), and T_5 (1.94) as compared to T_2 and T_1, which recorded a FCR of 2.04 at 6 weeks of age.

Livability was 100 per cent in all the treatment groups except in T_2, which recorded the livability 98.75 percent at 5 and 6 weeks of age and no significant difference was observed between treatment groups from 1 to 6 weeks of age.

Carcass characteristics: The carcass characteristics (Table 3) viz. pre-slaughter live weight, New York dressed carcass, eviscerated carcass and ready-to-cook carcass percentage to live weight did not significantly differ between treatment groups at 6 weeks of age. Similarly, there was no significant difference among the treatment groups in cut-up parts of carcass viz. breast, leg, back, wing, neck and giblets. The sensory qualities of meat like appearance, flavour, juiciness, tenderness and overall acceptability did not differ due to dietary supplements.

Discussion

Analysis of panchagavya: The pH of the panchagavya was 4.52 at 30 days of fermentation. The lowered pH may be due to *Lactobacillus* bacteria in panchagavya, which produced more organic acids during fermentation. This value is in agreement with the report of Somasundaram (2003) who recorded a mean pH of 5.45 at 15 days of fermentation in panchagavya. However, the observed value is slightly higher than the report of Subramaniam (2003) who recorded the pH of 6.37 in panchagavya. The difference in pH might be due to variation in composition of ingredients and method of panchagavya preparation.

The mean TVFA level of panchagavya was from 154.87 mmol/litre. This might be due to availability of nutrients (Bhadauria, 2002) for the growth of microorganisms, which produced organic acids during fermentation (Dhama *et al.,* 2005) from the components of panchagavya.

The *Lactobacillus* count was 8.71 $\log_{10}$ cfu/g at 30 days of fermentation and this might be due to the presence of curd and milk in panchagavya as a source of *Lactobacillus acidophilus* (Dhama *et al*., 2005) which lower the pH and favour the growth of beneficial and inhibit the growth of pathogenic microorganisms (Ferd, 1974).

The coliforms, *Salmonella, Streptococci* and *Staphylococci* counts were not in the detectable range. This may be accomplished by lowered pH of panchagavya in later stage of fermentation as expressed by Ferd (1974) who reported that the pH level could affect the specific microbial population and most of pathogenic organisms grew at pH of 7 or slightly higher.

Production performance: The body weight showed a significant difference from 2 to 6 weeks of age between treatment groups. Panchagavya, probiotic and MOS fed groups recorded significantly (P<0.05) higher body weight than virginiamycin and control groups at 6 weeks of age. This is in agreement with the report of Jin *et al.* (1998), Kralik *et al.* (2004) and Karaoglu and Durdag (2005) who observed that supplementation of *Lactobacillus* strain significantly increased the body weight compared to control birds. This might be due to more efficient utilization of energy and amino acids (Penkov and Hristova, 2004). On the contrary, Parks *et al.* (2001) and Flemming *et al.* (2004) observed no

Table 2: Mean (± S.E.) feed consumption (g/bird) and feed conversion ratio of broilers as influenced by dietary inclusion of dietary inclusion of different alternatives to antibiotic growth promoter

Parameters	T_1 - Basal diet	T_2 - Basal diet+ Virginiamycin	T_3 - Basal diet+ Panchagavya	T_4 - Basal diet+ *A. paniculata*	T_5 - Basal diet+ Probiotics	T_6 - Basal diet+ MOS
A. Feed consumption (g/bird)						
I week	119.67±2.40	126.50±3.44	117.57±3.67	113.80±0.55	122.03±2.36	124.30±5.60
II week	431.36±11.53	452.73±3.63	431.30±10.04	414.00±0.15	448.60±8.00	448.90±14.50
III week	932.28±29.62	958.00±14.85	926.33±7.21	908.00±3.93	949.37±14.17	958.83±17.65
IV week	1696.37±23.04	1739.63±12.94	1716.33±4.71	1642.97±6.22	1723.20±8.13	1755.10±20.71
V week	2576.11±63.14	2563.70±28.52	2575.50±11.35	2505.07±10.35	2620.97±27.02	2608.63±20.54
VI week	3555.97±109.93	3506.63±51.03	3511.73±16.62	3427.30±28.23	3611.37±56.81	3555.47±54.12
B. Feed conversion ratio						
I week	1.09±0.02	1.10±0.02	1.08±0.03	1.09±0.02	1.06±0.04	1.12±0.03
II week	1.49±0.08	1.49±0.04	1.47±0.02	1.52±0.03	1.51±0.02	1.46±0.03
III week	1.54±0.05	1.64±0.07	1.58±0.04	1.67±0.01	1.58±0.04	1.56±0.04
IV week	1.68±0.03	1.79±0.06	1.66±0.02	1.71±0.02	1.68±0.03	1.71±0.02
V week	1.89^{ab}±0.02	1.92^{b}±0.04	1.81^{a}±0.02	1.84^{a}±0.02	1.84^{a}±0.02	1.81^{a}±0.02
VI week	2.04^{b}±0.06	2.04^{b}±0.05	1.90^{a}±0.02	1.87^{a}±0.02	1.94^{ab}±0.02	1.90^{a}±0.02

Value in each cell is the mean of three observations. $^{a,\,b}$Means within a row with no common superscript differ significantly ($P<0.05$)

significant difference in body weight between antibiotics and MOS fed turkeys and broilers, respectively.

Feeding of *A. paniculata* significantly ($P<0.05$) improved the body weight as compared to virginiamycin fed birds at 6 weeks of age, which is contrary to the finding of Sapcota *et al*. (2005) who concluded that feeding of *A. paniculata* in induced aflatoxicosis increased the body weight on dose dependent ratio in broilers at 6 weeks of age.

The body weight gain also significantly varied between treatment groups from 1 to 6 weeks of age. Panchagavya, probiotics and MOS fed groups recorded significantly ($P<0.05$) better body weight gain at 6 weeks of age as compared to virginiamycin and control. Similar observation was made by Kabir *et al*. (2004), Djouvinov *et al*. (2005) and Karaoglu and Durdag (2005) who observed better body weight gain in probiotics fed group than control. On the contrary, Gunal *et al*. (2006) recorded no beneficial effect on live weight gain of broilers fed with antibiotic growth promoter and probiotics in diet. Feeding of *A. paniculata* did not improve the body weight gain compared to control group. This finding is in agreement with earlier report of Tipakorn (2002) who observed no significant difference in average daily weight gain among *A. paniculata* and control groups. The increased body weight gain in panchagavya and probiotics fed groups might be due to the presence of higher concentration of beneficial organisms, which may reduced the pH, viscosity and intestinal thickness favouring better utilization of nutrients by the broilers.

Feed consumption did not vary between treatment groups from 1 to 6 weeks of age. However, Garg *et al*. (2005) reported that feeding of cow urine increased the feed intake in White Leghorn layers and Sapcota *et al*. (2005) found that feeding of *A. paniculata* increased the feed intake on dose dependent pattern in broilers.

The FCR was significantly ($P<0.05$) better in T_3, T_4 and T_6 as compared to control group at 6 weeks of age. This finding is in agreement with Jin *et al*. (1998); Guclu (2003); Garg *et al*. (2005) and Sapcota *et al*. (2005) who reported that feeding of *Lactobacillus,* Bio-Mos, cow urine and *A. paniculata,* respectively had significantly improved the FCR in chickens. Feeding of probiotic did not influence the FCR compared to other treatments at 6 weeks of age. Similar report was also made by Zulkifli *et al*. (2000) who observed that the better FCR was not extended to the finishing period in broilers fed *Lactobacillus* culture. On the contrary, Jin *et al*. (2000) and Kalavathy *et al*. (2003) concluded that supplementation of the diet with probiotics significantly improved the FCR in chicken. The better FCR in panchagavya, *A. paniculata* and MOS fed groups might be due to better utilization of nutrients by reduced pH, viscosity and intestine thickness in broilers.

The livability was not significantly different between treatment groups. Similar observations were made for antibiotic growth promoters (Salmon and Stevens, 1990 and Sreenivas and Devegowda, 1994), probiotics (Karaoglu and Durdag, 2005) and MOS (Parks *et al*., 2001 and Flemming *et al*., 2004) in chicken. However, better livability was obtained by Tipakorn (2002), Pelicano *et al*. (2004) and Djouvinov *et al*. (2005) by supplementation of *A. paniculata*, MOS, antibiotic growth promoter and probiotics, respectively in broilers.

Carcass characteristics: The carcass characteristics viz. pre-slaughter weight, New York dressed carcass, eviscerated carcass and ready-to-cook carcass percentage to live weight did not vary significantly between treatment groups. Similarly, feeding of *A. paniculata* (Tipakorn, 2002) and Bio-Mos (Guclu, 2003) to broilers did not significantly affect the carcass characteristics of broilers and Japanese quails, respectively compared to antibiotic growth promoter and control. On the contrary, Sreenivas and Devegowda

Table 3: Mean (± S.E.) Carcass characteristics, per cent cut-up parts and meat sensory qualities of broilers as influenced by dietary inclusion of dietary inclusion of different alternatives to antibiotic growth promoter

Parameters	T_1 - Basal diet	T_2 - Basal diet+ Virginiamycin	T_3 - Basal diet+ Panchagavya	T_4 - Basal diet+ *A. paniculata*	T_5 - Basal diet+ Probiotics	T_6 - Basal diet+ MOS
A. Carcass characteristics						
Pre-slaughter live weight (g)	1729.83±136.31	1716.67±57.56	1817.50±103.47	1872.83±72.03	1761.50±76.41	1781.67±69.17
New York dressed percentage	91.60±0.51	91.64±0.55	91.73±0.38	92.35±0.25	90.36±0.83	91.44±0.37
Eviscerated percentage	70.78±0.86	69.55±0.87	70.21±0.69	70.88±0.46	70.27±0.73	69.99±1.31
Ready-to-cook percentage	76.38±0.81	75.85±0.92	75.78±0.75	76.45±0.52	76.13±0.70	75.84±1.32
B. Cut-up parts (%)						
Breast	26.36±0.71	24.92±0.65	26.19±0.56	26.28±0.24	26.78±0.84	24.80±0.35
Leg	27.42±0.56	28.02±0.72	28.24±0.46	28.35±0.40	27.17±0.71	29.32±0.58
Back	23.20±0.54	22.86±0.46	23.45±0.34	23.19±0.72	23.86±0.31	22.70±0.26
Wing	11.21±0.24	10.94±0.28	10.29±0.21	10.51±0.22	10.44±0.32	10.63±0.32
Neck	6.21±0.24	6.96±0.17	6.26±0.34	6.10±0.48	5.89±0.35	6.70±0.33
Giblets	5.60±0.23	6.30±0.24	5.57±0.32	5.57±0.31	5.86±0.23	5.85±0.22
C. Sensory qualities of meat						
Appearance	7.00±0.36	6.17±0.60	5.83±0.50	6.33±0.42	6.83±0.65	6.00±0.57
Flavour	6.17±0.30	5.83±0.47	5.67±0.49	6.33±0.42	6.33±0.49	5.67±0.55
Juiciness	6.33±0.42	6.00±0.57	6.17±0.47	6.33±0.42	6.50±0.50	6.33±0.61
Tenderness	6.50±0.42	6.00±0.57	6.17±0.60	6.33±0.42	6.50±0.61	6.33±0.61
Overall acceptability	6.67±0.33	6.17±0.54	6.17±0.47	6.33±0.42	6.83±0.65	6.50±0.58

Value in each cell is the mean of six observations

(1994) recorded significantly better dressing percentages in broilers raised on virginiamycin supplemented diet at 6 weeks of age. Similarly, Kalavathy *et al.* (2003) and Kabir *et al.* (2004) also got similar result for probiotic feeding in broilers.

The results on cut-up parts revealed no significant difference between different treatments. Similarly, Pelicano *et al.* (2004) also reported that the cut-up parts yield was not significantly affected by the inclusion of probiotics. However, Kabir *et al.* (2004) observed feeding of probiotics increased the breast yield compared to control.

The sensory qualities like appearance, flavour, juiciness, tenderness and overall acceptability of broiler meat did not differ between treatment groups even though *A. paniculata* was considered as king of bitters (Ajaya Kumar *et al.*, 2004). Similarly, Nagalakshmi *et al.* (1996) reported that incorporation of neem kernel cake did not impart any untoward taste in pressure cooked broiler meat.

The results suggested that panchagavya and *A. paniculata* can be used as alternatives to antibiotic growth promoter in broiler diet. The production and carcass parameters of using alternatives to antibiotic growth promoters like panchagavya, *A. paniculata,* probiotics and MOS in feed was better than virginiamycin. However, further works need to be carried out in challenged conditions.

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