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ORIGINAL ARTICLE **OPEN ACCESS**

Effect of Polyherbal Mixture on Growth, Carcass characteristics and Sensory Quality of Meat in Broilers Production

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ABSTRACT

A study was conducted to assess the effect of polyherbal mixture as a replacement antibiotic in broilers. Day-old commercial broiler chicks (n=250) were distributed equally into five groups of 50 chicks each, which were further replicate to five groups of ten chicks each over a period of 6 weeks. The chicks were placed on one of the five dietary treatments- NCON (basal diet),PCON (basal diet + antibiotics), NGP-1.0 (basal diet + 1% polyherbal mixture), NGP-1.5 (basal diet + 1.5% polyherbal mixture)andNGP-2.0 (basal diet + 2% polyherbal mixture).Body weight and feed intake were recorded weeklyand accordingly feed conversion ratio were calculated. At the end of 6th week 5 birds per treatment were sacrificed to determine the carcass characteristics and sensory quality of meat. The heart weight and gizzard weight exhibited some differences between groups but herbal supplemented birds had significantly (P<0.05) higher spleen weight in comparison to NCON and PCON group birds. Weights of pancreas showed differences between herbal treated groups but did not observed any variation with NCON and PCON group birds. Herbal supplemented bird's viscera weight was similar to NCON but lower to PCON group birds. Drumstick weight of NGP-1.0 group birds was significantly (P<0.05) higher to NCON birds. Breast portion of the broilers in herbal supplemented birds were similar and significantly (P<0.05) higher than NCON and PCON birds breast. Wing portion of NGP-1.5 group had lower wing weight than PCON birds. Although statistically similar but mean sensory scores for appearance and flavour were slightly better in NGP-2.0 group than the NCON and PCON groups. Data showed that broiler's meat consistency was significantly (P<0.05) better in herbal groups in comparison to NCON group.The overall acceptability of NGP-2.0 group broiler's meat is significantly higher than NCON bird's meat No differences existed in the proximate principles of thigh and breast meat in different group birds. It was concluded that polyherbal mixture at level of 2% supplemented in the diet of birds showed potential to improve body weight, feed conversion ratio and sensory quality of broiler's meat and may prove a good alternate to AGP's for commercial broiler production.

Keywords: *Broiler, carcass, herbal mixture, meat and sensory*

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INTRODUCTION

The history of herbs is as long as the story of mankind, for people has used these plants since earliest times. Wars have been fought and lands conquered for the sake of plants, and even today we continue to depend on exotic species for many of our newest medicines and chemicals [25]. Recently, many countries tended to minimize or prohibit the chemical components for their deleterious side effects on both animals and human. So, it is important to use natural promoters.

The emphasis here is on those herbs that, when used to supplement feeds, are helpful in achieving the objectives of improving growth performance, improving immunity response, improving intestinal microflora and controlling particular diseases; in other words the focus is on multifunctional herbs. Some important herbs are turmeric, mangrail, garlic, methi, aloe vera, ashwagandha, bhuiamla, punarnava, neem and tulsi.

Turmeric *(Curcuma longa*) have antifungal, immunomodulatory, antioxidative, antibacterial and nematocidal activities [17]. It is demonstrated that black cumin *(Nigella sativa)* seeds have considerable antioxidant, antibacterial, digestive and appetite stimulant, hepatoprotective and immunomodulative

properties [15]. Garlic (*Allium sativum*) has bioactive components like sulfur containing compounds (alliin, diallylsulfides and allicin) that act as antibacterial, antifungal, antiparasitic, antiviral, antioxidant and hypocholestramic characteristics [7]. Methi (*Trigonella foenum-graecum)* contains neurin, biotin, trimethylamine which tends to stimulate the appetite by their action on the nervous system. Moreover, fenugreek rich in minerals, B-complex, iron, phosphates, PABA (para-amino benzoic acid), vitamins (A, D), lecithin and choline that helps to dissolve cholesterol and fatty substances [11].

Ashwagandha (*Withania somnifera*) possesses antistress, adaptogenic and immunomodulatory properties; beside this, it have hypo-cholesterolemic, anti-coccidial and growth promoting properties . Major ingredients of Aloe vera include anthraquinones, saccharides, vitamins, enzymes, and low-molecular-weight compounds which give *Aloe vera* to its anti-inflammatory, immunomodulatory, wound-healing, anti-viral, anti-fungal, anti-diabetic, and anti-oxidant effects [9]. Bhuiamla *(Phyllanthus amarus)* showed its natural antibiotic value with some bacteria such as *Staphylococcus aureus, Escherichia coli* and *Klebsiella spp* [2].

Punarnava (*Boerhaavia diffusa*) have antistress, antiinflammatory, hepatoprotective [19] and anti-bacterial properties [24]. Neem is called '*Sarvaroga nivarini*' meaning '*the curer of all ailments* [14]. Neem tree has vast range of medicinal properties like antibacterial, antiviral, antifungal, antiprotozoal, hepatoprotective and various other properties without showing any adverse effects [16]. Tulsi (*Ocimum sanctum)* phyto-constituents possess antioxidant, antibiotic, antiatherogenic, immunomodulatory, antiinflammatory, analgesic, antiulcer and antipyretic properties [20]. Thus present study has been planned to investigate the effect of an herbal mixture on carcass characteristics of broilers.

MATERIALS AND METHODS

A total number of two hundred fifty Vencobb-400Y strain one-day-old straight run broiler chicks were used for the research to investigate the effect of dietary supplementation of polyherbal mixture (NARGROPHYT) in broiler diet. In the experimental study, the broiler chicks were randomly divided into five dietary groups (NCON, PCON, NGP-1.0, NGP-1.5 and NGP-2.0) in which each group contain 50 chicks and divided into five replications with 10 chicks in each over a period of 42 days. The chicks were placed on one of the five dietary treatments i.e. either a basal diet without any supplement (NCON) or that supplemented with antibiotic (PCON), polyherbal mixture at 1.0% (NGP-1), 1.5% (NGP-1.5) and 2.0% (NGP-2) level. Diets were formulated for pre-starter (1-7 days), starter (8-21 days) and finisher phase (22-42 days) separately as per BIS [6] requirements**.** All the feed ingredients were ground and required quantity of each ingredient was weighed for mixing to prepare the rations. A polyherbal mixture "NARGROPHYT" was prepared by using turmeric rhizome, mangrail seed, methi seed, neem leaf, tulsi leaf, aloe vera leaf, garlic bulb, punarnava root, ashwagandha root and bhuiamala root in a certain proportion. The mixture of polyherbal powder were premixed and then added successively to the whole lot. The composition of formulated pre-starter, starter and finisher feeds and their nutrient composition are presented in Table 1.

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.

The record of feed offered and residual amount left was maintained for each replicate to calculate the feed intake per bird in every week. The chicks were weighed at the start of experiment and thereafter weekly intervals to calculate body weight. Feed conversion ratio (FCR) of all group in each week were calculated as the ratio between feed intake and body weight. Towards end of feeding trial on 42th day, 5 birds from each group were randomly selected and slaughtered by "Modified Koscher" method for carcass quality evaluation. The sensory evaluation of meat samples was done by the method of Keeton [18]. The samples were evaluated for appearance and color, flavor, tenderness, juiciness and overall acceptability. The proximate analysis of meat was done by the standard methods [5].

Statistical analysis of data was done by using SPSS, version-20 software. The data obtained were subjected to variance (ANOVA) and mean were compared using Duncan's multiples range test.

RESULTS AND DISCUSSION

Graph 1, 2 and 3 showed the trend in weekly body weight, feed intake and feed conversion ratio. Data revealed that body weight of herbal treated birds was significantly ($P<0.05$) higher than NCON group birds. The present findings of better body weight of broilers due to herbal supplementation are in concurrence with the report of Singh *et al.* (2009) who opined that provision of herbal and alternative essential oils as supplement to birds was capable of advancing growth and development of birds. It was found that NGP-2.0 group bird's feed intake was lower than NCON group but similar to PCON group birds. This result is equally in harmony with findings of Abdullah *et al.* (2010), who shows lower feed intake in birds that receiving feed supplemented with 0.5 and 1.0% garlic powder. In general weekly FCR was increases with the age of birds in all the groups. FCR of both antibiotic as well as "NARGROPHYT" supplemented birds were significantly ($P<0.05$) lower than un-supplemented group birds. Lowest FCR was found in NGP-2.0 group that was similar to PCON group FCR. Yakhkeshi *et al.* [28] also observed positive effect of antibiotic on the FCR of broilers.

To evaluate the effect of herbal mixture and antibiotics on the carcass characteristics of the broilers at the end of the experimental period in terms of heart, liver, gizzard, spleen, pancreas, blood, feather, viscera and inedible components weight were assessed (Table-2). The carcass parameters data when subjected to analysis of variance revealed that the heart weight and gizzard weight exhibited some differences between groups. Spleen weight was ranged from 0.12 to 0.19 percent of live weight and herbal supplemented birds had significantly ($P<0.05$) higher spleen weight in comparison to NCON and PCON group birds. The lowest spleen weight was in PCON group (0.12 percent of live weight) birds. Weights of pancreas showed differences between herbal treated groups but did not observed any variation with NCON and PCON group birds. The blood percentage in different group of birds was ranged 3.06 to 4.83 and NGP-1.0 group birds blood weight was significantly ($P<0.05$) higher than other groups. Feather weight was lower in PCON birds than other group birds. Herbal supplemented bird's viscera weight was similar to NCON but lower to PCON group birds. The weight of non-edible components which was expressed as percentage of their live weight data revealed that supplementation of herbal mixture did not influences the non-edible components in comparison to unsupplemented birds, however in comparison to PCON birds, inedible components of NGP-1.5 and NGP-2.0 group birds was significantly ($P<0.05$) lesser.

The percentage yield of various cut of parts such as thigh, drumstick, neck, back, breast and wings are given in Table-3. Pursuing of the data, it was found that thigh portion of birds supplemented with herbal mixture not showed any differences with NCON and PCON groups. Drumstick weight of NGP-1.0 group birds was significantly ($P<0.05$) higher to NCON birds. Neck portion of different group birds was in-between 3.87 and 4.55 percent and no variation ($P>0.05$) was seen between groups. The back portion in NGP-2.0 group birds was significantly ($P<0.05$) higher than negative control (NCON), however similar to positive control (PCON) birds. Breast portion of the broilers in herbal supplemented birds were similar that ranges from 34.77 to 35.41 percent and significantly ($P<0.05$) higher than NCON and PCON birds breast. Wing portion of dressed carcass of 42 days old broilers showed differences between groups, treated groups showed no differences with untreated i.e. NCON birds. However, NGP-1.5 group had lower wing weight than PCON birds.

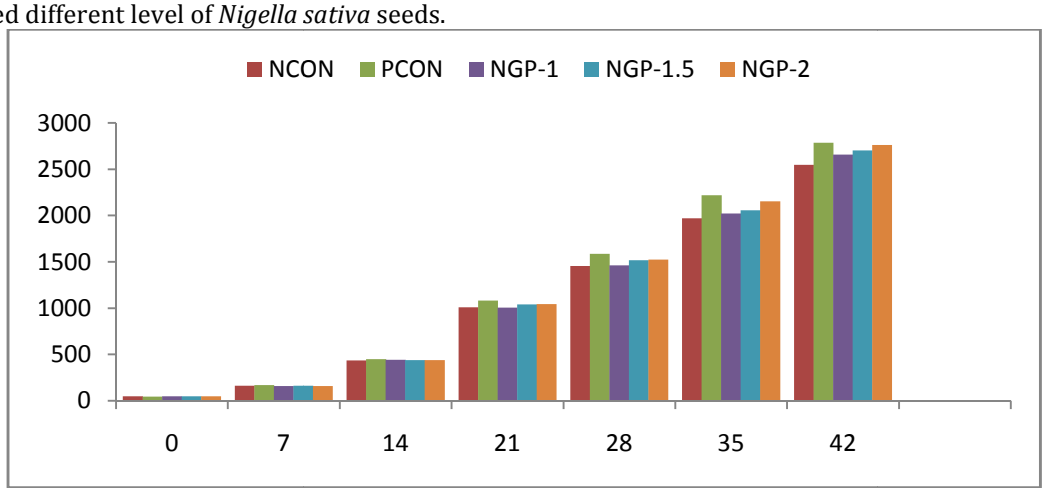
Sensory quality of breast meat from all the treatment groups indicated no significant difference in the mean scores for appearance and flavor (Table 4). Although statistically similar but mean sensory scores for appearance and flavor were slightly better in NGP-2.0 group than the NCON and PCON groups. Data showed that broiler's meat consistency was significantly ($P<0.05$) better in herbal groups in comparison to NCON group. The overall acceptability scores for breast meat from all the treatments ranged from 7.00 in NCON to 7.75 in NGP-2.0 group and exhibited that overall acceptability of NGP-2.0 group broiler's meat is significantly ($P<0.05$) higher than NCON bird's meat. No differences existed ($P>0.05$) among thigh meat with respect to proximate analysis from broilers that were fed either antibiotic or different levels of

herbal feed additives (Table-4). For moisture, ash, fat and protein content of thighs, P-values were 0.284, 0.856, 0.957 and 0.396, which demonstrate that moisture, ash, total fat and protein were not only statistically insignificant but also practically identical with low ranges and standard errors. The moisture, ash, fat and protein in thighs muscles were ranges from 73.48 to 74.90, 0.99 to 1.04, 7.86 to 8.06 and 17.57 to 18.16 percent, respectively. For breast meat, no differences (P>0.05) observed among herbal, antibiotic or un-supplemented groups with respect to moisture and ash. Breast fat content of herbal supplemented birds was similar to NCON birds; however, NGP-2.0 group birds (3.26%) had significantly lower breast fat level in comparison to PCON group birds (3.54%). Protein contents in breast meat in herbal mixture supplemented birds (23.68 to 23.74%) was significantly (P<0.05) higher than NCON (22.15%) and PCON (22.38%) birds.

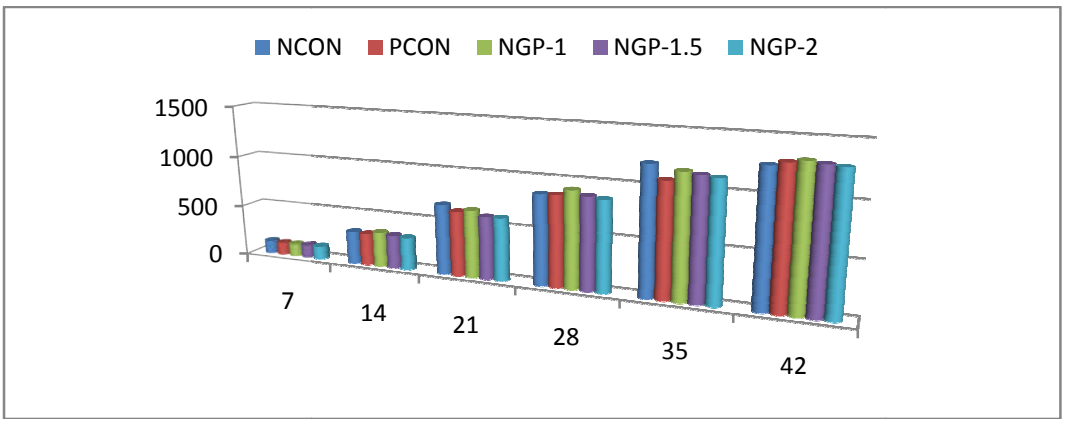
The non-significant variations on carcass parameters are in agreement with the earlier researchers [1, 27]. Similar to our finding on drawn yield, Chaudhary [8] did not found any change by supplementing a mixture of turmeric, mangrail and amla on the carcass yield of broiler chickens reared to six weeks of age. Nouzarian *et al.* [23] also reported that supplementation of turmeric powder upto 10 g/ kg diet to the broiler chickens did not influenced the carcass, heart, pancreas, bursa of fabricious and spleen yield. Ali *et al.* [3] found that supplementation of garlic, kalongi and turmeric mixture did not influenced the relative weights of heart, liver, spleen, gizzard and pancreas of broilers.

Mahmood *et al.* [21] supplemented the different commercial herbal growth promoters in the diet of broilers to assess these effects on carcass parameters and reported that commercial herbal growth promoters did not exhibit any effect on dressing percentage and relative weights of liver, heart, spleen and gizzard of broilers. Amouzmehr *et al.* [4] and Dieumou *et al.* [10] reported that garlic essential oils did not have any significant effect on carcass dressing percentage of broiler chicks. The result of higher spleen weight in herbal supplemented birds is tandem with the findings of Fallah [13], who reported that broiler receiving *Aloe vera* and garlic powder had higher spleen weight. Similar to the results of NGP-2.0 group for organoleptic quality, Eugeiuszr and Edyta [12] reported that 5g/kg diet of dried garlic contributes to increase in the sensory assessment of chicken meat.

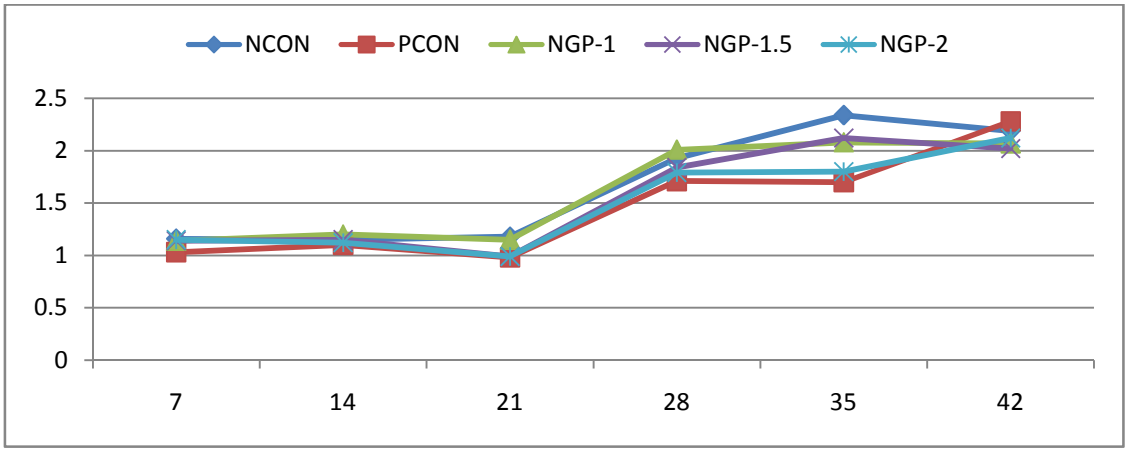
Naseer *et al.* [22] reported that no significant changes in liver, heart and spleen weight of Baldai chicks received different level of *Nigella sativa* seeds.



Graph:1 Body weight of broilers supplemented with antibiotic or herbal mixture



Graph:2 Feed Intake of broilers supplemented with antibiotic or herbal mixture



Graph:3 Feed Conversion ratio of broilers supplemented with antibiotic or herbal mixture

Table.2. Influence of antibiotic or an herbal powder supplementation on carcass characteristics (percentage of live weight) of broiler chickens at 42nd day of age

Attributes	Negative control (NCON)	Positive control (PCON)	1.0% Polyherbal mixture (NGP-1.0)	1.5% Polyherbal mixture (NGP-1.5)	2.0% Polyherbal mixture (NGP-2.0)	SEM	P-value
Heart weight	0.60^{c}	0.61^{c}	0.66^{b}	0.61^{c}	0.75^{a}	0.014	<0.001
Liver weight	2.23	2.49	2.98	2.80	2.47	0.117	0.297
Gizzard weight	1.46^{ab}	1.57^{a}	1.43^{ab}	1.21^{b}	1.53^{ab}	0.051	0.197
Spleen weight	0.15^{b}	0.12^{c}	0.19^{a}	0.19^{a}	0.18^{a}	0.008	<0.001
Pancreas weight	0.16^{ab}	0.18^{ab}	0.20^{a}	0.15^{b}	0.18^{ab}	0.007	0.146
Blood weight	3.36^{b}	3.06^{b}	4.83^{a}	3.18^{b}	3.59^{b}	0.187	0.005
Feather weight	5.55^{a}	4.13^{b}	6.15^{a}	5.45^{a}	5.97^{a}	0.204	0.003
Viscera weight	8.61^{ab}	13.11^{a}	6.67^{b}	5.11^{b}	5.30^{b}	0.913	0.013
Inedible component weight	23.03^{ab}	26.07^{a}	23.75^{ab}	20.02^{b}	20.72^{b}	0.752	0.055

Values with different small letter superscripts in a row differ between groups significantly (P<0.05).

Table.3. Influence of antibiotic or an herbal powder supplementation on carcass cuts (percentage of dressed weight) of broiler chickens at 42nd day of age

Attributes	Negative control (NCON)	Positive control (PCON)	1.0% Polyherbal mixture (NGP-1.0)	1.5% Polyherbal mixture (NGP-1.5)	2.0% Polyherbal mixture (NGP-2.0)	SEM	P-value
Thigh weight	15.84^{ab}	15.23^{ab}	15.15^{ab}	17.12^{a}	14.09^{b}	0.274	0.222
Drumstick weight	13.02^{bc}	13.53^{ab}	13.86^{a}	13.43^{c}	13.48^{ab}	0.146	0.005
Neck weight	3.87	3.97	4.55	3.97	4.04	0.119	0.411
Back weight	23.87^{c}	25.15^{a}	21.96^{bc}	21.59^{c}	23.66^{ab}	0.576	<0.001
Breast weight	33.96^{b}	32.09^{b}	34.77^{a}	34.74^{a}	35.41^{a}	0.411	0.001
Wing weight	9.44^{ab}	10.03^{a}	9.71^{a}	9.15^{b}	9.32^{ab}	0.224	0.084

Values with different small letter superscripts in a row differ between groups significantly (P<0.05).

Table.4. Influence of antibiotic or an herbal powder supplementation on organoleptic quality assessment score indices and proximate composition of thigh and breast meat of broiler chickens at 42nd day of age

Attributes	Negative control (NCON)	Positive control (PCON)	1.0% Polyherbal mixture (NGP-1.0)	1.5% Polyherbal mixture (NGP-1.5)	2.0% Polyherbal mixture (NGP-2.0)	SEM	P-value
Sensory quality of meat							
Appearance	7.00	6.50	7.25	6.50	7.50	0.153	0.133
Flavour	6.50	6.75	6.50	6.75	7.25	0.123	0.306
Consistency	6.00^{c}	6.50^{bc}	6.75^{ab}	7.25^{a}	7.00^{ab}	0.128	0.006
Acceptability	7.00^{b}	7.25^{ab}	7.25^{ab}	7.25^{ab}	7.75^{a}	0.105	0.252
Thigh meat (%)							
Moisture	74.24	74.90	74.18	73.77	73.48	0.293	0.284
Ash	0.99	1.00	1.01	0.99	1.04	0.014	0.856
Fat	7.99	8.06	7.97	7.94	7.86	0.076	0.957
Protein	17.57	17.91	17.79	17.98	18.16	0.095	0.396
Breast meat (%)							
Moisture	74.03	74.46	73.88	74.02	73.69	0.109	0.254
Ash	1.12	1.11	1.09	1.08	1.09	0.021	0.990
Fat	3.49^{ab}	3.54^{a}	3.34^{ab}	3.30^{ab}	3.26^{b}	0.042	0.127
Protein	22.15^{b}	22.38^{b}	23.68^{a}	23.70^{a}	23.74^{a}	0.183	<0.001

Values with different small letter superscripts in a row differ between groups significantly (P<0.05).

CONCLUSION

It was concluded that polyherbal mixture (NARGROPHYT) at level of 2% supplemented in the diet of birds showed potential to improve body weight, feed conversion ratio and sensory quality of broiler's meat and may prove a good alternate to AGP's for commercial broiler production.

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