Effect of Dietary Supplementation of Amla (*Emblica Officinalis*) Powder on Carcass traits and meat composition in broiler Chicken

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Abstract

To study the effect of dietary supplementation of amla fruit powder on meat composition and carcass traits of broiler chicken meat, 160 broiler chicks were randomly distributed into four treatments having four replicates consisting of ten birds each. The dietary treatments were: T0 (Control group): Basal diet; T1: Basal diet + 0.5% amla powder; T2: Basal diet + 1% amla powder and T3: Basal diet + 1.5% amla powder, respectively. The experiment was scheduled for 6 weeks in two phases with starter (1^{st} - 3^{rd} week) and finisher ration (4^{th} - 6^{th} week). The birds were weighed weekly to calculate performance parameters viz. feed intake, body weight change and FCR. From the observations it is indicated that non-significant difference was observed in carcass traits *viz.* shrinkage, relative weight of heart, gizzard, eviscerated yield and dressed yield. However, the significant difference was reported in other carcass traits *viz.* blood loss, feather loss, giblet and liver. The data reported that significantly ($P<0.05$ %) higher breast, drumstick and neck yield was obtained in treatment T_2 than other amla treated group. The yields of wing and thigh remained similar but that of breast, drum stick and neck increased with reduction of back yield on dietary addition of amla fruit powder. Moisture percentage and crude protein content of both breast and thigh muscle did not differ significantly among treated and control group while, fat percentage in both breast and thigh meat decreased significantly in amla supplemented group as compare to control group.

Keywords: Broiler, Amla, Dressing percentage, Meat composition

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INTRODUCTION

Indian poultry industry has made a tremendous and remarkable progress evolving from a small-scale backyard venture to the status of commercial, full fledge, self-sufficient and most progressive agro-based industry and become an attractive enterprise particularly because of the small capital investment, increased returns, quick turn over, comparatively less risk involved, low land requirement, ease of production and high feed efficiency. Due to increasing demand for poultry meat, short supply of mutton and limited acceptability of beef and pork, the poultry production is under rapid expansion in the country. Broilers are much more prolific than other livestock and through

careful scientific breeding policies; they have become efficient converters of vegetables protein into high quality animal protein food for human consumption.

Poultry industry in India has emerged as one of the fastest growing segments of the agriculture sector. It is projected that during the period 2000-2020, total poultry meat consumption is likely to expand from 687 million kilograms to 1674 million kilograms. The annual per capita consumption of broiler meat in India is only 2.96 kg which is much less than the ICMR recommendation of 11 kg. It indicates that broiler production in India is yet very low and has vast scope for growth. Over a period of time, extensive efforts have been made to lower down the cost of production by lowering the expenses on feed. Feed additives are one of the important tools used for improving feed conversion ratio, growth rate and disease resistance. The range of feed additives used in animal production industry is very broad ranging from growth promoters to disease preventing agents. Supplementations of these agents in poultry nutrition are mainly aimed to improve digestibility and bioavailability of various nutrients, thereby, enhancing economic gains by reducing the input costs. Herbs, spices and various plant extracts have received increased attention as possible antibiotic growth promoter replacements. In this view, the plants identified with properties of secondary metabolites became interesting due to their antimicrobial, antioxidant effects and their stimulating effects on animal performance and digestive enzymes. In poultry health management.

Emblica officinalis (Amla) is one of the richest sources of ascorbic acid, minerals, amino acids, tannins and phenolic compounds (Yokozawa in 2007). Rapid growth rate in commercial broilers accelerate the metabolic rate and make them vulnerable to oxidative stress owing to increased free radical generation (Feng 2008). Gallic acid and tannic acids are the phenolic acids present in *E. officinalis* contribute to the antioxidant activity in addition to ascorbic acid (Suresh Kumar in 2006). The active tannoid principles of *E. officinalis* is important hypolipidaemic agents that directly act upon the sympatho-adrenal axis and lower the synthesis of corticosterone (Sairam *et al.,* 2003). The hypolipidaemic effect of *E. officinalis* has been attributed to its potential in reducing lipid peroxidation. Impairment of immunological function in heat stress such as T and B lymphocyte activity has also been attributed to the effects of lipid peroxidation or oxidative damage in cell membranes (Pardue and Thaxton, 1986).

MATERIALS AND METHODS

Day- old (Vencobb 400) broiler chicks (n=160) were procured from Venky's Hatcheries Private Limited, Pune, Maharashtra. On arrival, chicks were weighed and distributed randomly into four treatment groups viz., T_0, T_1, T_2, and T_3, with 40 chicks in each treatment as replicates, on equal weight basis. The chicks were housed in separate compartments. All 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) specification. The dietary treatments were: T0 (Control group): Basal diet; T1: Basal diet + 0.5% amla powder; T2: Basal diet + 1% amla powder and T3: Basal diet + 1.5% amla powder, respectively. The feed samples were analysed for crude protein content (AOAC, 2005). The chicks were fed pre-starter (2900 Kcal/Kg ME, 22% CP), starter (2900 Kcal/Kg ME, 20% CP) and

finisher (3000 Kcal/Kg ME, 18% CP) diets during six weeks period, respectively. Feed and fresh water were made available ad libitum at all times. The chicks were reared under standard conditions of housing and management in floor pens with paddy husk as litter material. The chicks were provided 23 h light and one dark hour, 95°F temperature during first week, which was reduced by 5°F during every successive week. The relative humidity of the shed was maintained to 60+5%. The chicks were weighted individually on days 1, 7, 14, 21, 28, 35, and 42 for each pen by using digital balance then calculated average body weights and FCR for each treatment.

For carcasses evaluations, eight birds per dietary treatment (two from each replicate) were selected randomly, at the end of 6^{th} week. The birds were kept off feed and water were withdrawn three hours prior to their sacrifice. Immediately after recording their live weights, the birds were killed by severing the jugular vein and allowed to bleed completely following Halal method. Their heads were removed at the atlanto-occipital joint and shank at hock joint. The dressed weight thus obtained was recorded as follows.

Dressed weight = Live weight - (blood + feathers + head shank + skin losses).

Dressing percentage was calculated as follows.

$$\text{Dressing percentage} = \frac{\text{Dressed weight}}{\text{Live weight}} \times 100$$

Dressed birds were then eviscerated by removing the crop, trachea and viscera as a whole. A horizontal cut was given rear to the keel bone, thereby the breast was a little upturned and pushed forward, exposing the viscera along with the visceral organs, which were then removed completely by pulling. The lungs were scrapped off and the heart, liver and gizzard constituting giblets, were removed carefully from the viscera. The gall bladder was removed with care from liver to avoid its puncture. The gizzard was opened and its contents washed out and inner epithelial lining discarded. The heart was made free from blood and adhering vessels. The eviscerated and drawn weights were recorded and their percentage was calculated.

Eviscerated weight = Dressed weight - weight of viscera

$$\text{Eviscerated percentage} = \frac{\text{Eviscerated weight}}{\text{Live weight}} \times 100$$

Drawn weight = Eviscerated weight + weight of giblets

Separate weight of heart, liver and gizzard were also recorded after washing and bloating, and their relative weights (percentage of live weight) were then calculated.

Carcass composition

Samples of breast and thigh muscles were taken from each of the slaughtered birds and stored in deep-freeze separately for further analysis. These samples were

analyzed for moisture, protein and ether extract as per AOAC (2005).

Statistical Analysis

The data were analyzed using General Linear Model procedure of statistical package for social sciences (SPSS) 15" version and comparison of means tested using Duncan's multiple range test (1956) and significance was considered at ($P<0.05$).

RESULTS AND DISCUSSION

Ingredients and calculated composition of the experimental diets: The ingredients and calculated composition of the experimental diets for broilers are presented in Table 1. It was observed that experimental broiler rations contained adequate nutrients for growth as per BIS (1992). The average crude protein and calculated metabolizable energy (ME) of the starter (phase I) and Finisher diet (phase II) was 23.02 per cent and 2951.20Kcal/kg, 20.01 per cent and 3006.44 Kcal/kg, respectively.

Carcass traits (% live weight)

Table 2 represents the data on carcass traits (% live weight) due to different dietary treatments of amla during experimental period. The data reported that significantly ($P<0.05$ %) higher blood loss was observed than other amla treated group. However, treatment T_1, T_2 and T_3 were at par to each other. The data shows that the control group reported significantly ($P<0.05$ %) higher feather loss as compared to other treated group. The per cent live weight of giblet and liver significantly ($P<0.05$ %) lower as compared to other group. However, treatment T_1, T_2 and T_3 were at par to each other. From the observations it is indicated that non-significant difference was observed in carcass traits *viz.* shrinkage, relative weight of heart, gizzard, eviscerated yield and dressed yield. However, the significant difference was reported in other carcass traits *viz.* blood loss, feather loss, giblet and liver (Table 2). Similar trend was reported by Mandal *et al.* (2016).

Incorporation of *E. officinalis* in broiler diet tends to positively alter the yield composition of the broiler carcass. However, the dietary supplementation of ascorbic acid did not cause any significant differences among the analyzed treatments on carcass and cut-up part yields of 33-day-old birds (Pena *et al*., 2008). Mehala and Moorthy (2008) reported that data on carcass parameters in terms of dressed, eviscerated, and drawn yield revealed no significant differences among the groups. Kurkure *et al.* (2002) stated that dressing per cent and liver per cent on live weight were better in herbal premix fed group having amla as an integral part. Singh *et al.* (1992) reported improved dressing percentage and giblet weights in broilers fed diets with amla, turmeric powder and their combination.

Cut of parts (% body weight):

The data on cut of parts (% body weight) in different groups are presented in Table 3. The data reported that significantly ($P<0.05$ %) higher breast, drumstick and neck yield was obtained in treatment T_2 than other amla treated group. However, treatment T_0, T_1, T_3 and T_1, T_2 were at par to each other. The data shows that the control group reported significantly ($P<0.05$ %) higher feather loss as compared to other treated group. The yields of wing and thigh remained similar but that of breast, drum stick and neck increased with reduction of back yield on dietary addition of amla fruit powder. Similar findings were reported by Mandal *et*

al. (2016). The incorporation of *E. officinalis* in broiler diet tends to positively alter the yield composition of the broiler carcass. However, the dietary supplementation of ascorbic acid did not cause any significant differences among the analyzed treatments on carcass and cut-up part yields of 33-day-old birds (Pena *et al*., 2008).

Meat Composition

Data pertaining to composition of breast meat of the experimental birds under different dietary treatments are presented in Table 4. The moisture percentage of breast muscles was obtained in the range of 71.28 % (T_0) to 73.24 % (T_2) and significantly higher moisture percentage was recorded in the groups supplemented with amla fruit powder. Crude protein percentage of different dietary treatments ranged from 21.52 % (T_2) to 22.21 % (T_0) and didn't differ significantly among the supplemented and control group. Fat percent in all treatment groups ranged from 3.45 % (T_1) to 4.54 (T_0) and fat percentage was significantly decreased in amla supplemented groups as compared to control group. Mehala and Moorthy (2008) observed that the abdominal fat percentage, breast and thigh muscle cholesterol in broilers showed no significant difference among treatment groups due to dietary inclusion of herbs and their combination.

Moisture percentage of thigh muscles under different dietary treatments ranged between 69.87 % (T1) to 70.75 % (T0) and did not differ significantly among amla supplemented group and control group. Durrani *et al.* (2008) reported that by feeding varying levels of herbal plants extracts to broilers has significant effect on breast weight deposition. Per cent crude protein of thigh muscle ranged from 19.87 % (T3) to 21.29 % (T0) and the trends shows that crude protein per cent of thigh muscle was reduced as the level of amla is increase in the diet of birds. The fat percentage of thigh muscles ranged from 6.18 % (T_3) to 7.12 % (T0). Fat percentage was lowered significantly in amla fruit supplemented as compared to control group due to the hypolipidemic effect of amla. The data pertaining to ash ranged from 1.35 % (T_0) to 1.37 % (T1). In contrary to our study Mehala and Moorthy (2008) observed that the abdominal fat percentage, breast and thigh muscle cholesterol in broilers showed no significant difference among treatment groups due to dietary inclusion of herbs and their combination.

CONCLUSION

It is concluded that the carcass traits such as shrinkage, relative weight of heart, gizzard, eviscerated yield and dressed yield were not affected by supplementing Amla powder in the diet of broiler chicken. But the significant difference was reported in other carcass traits *viz*. blood loss, feather loss, giblet and liver. Fat percentage significantly decreased in amla supplemented groups as compared to control group showing the hypolipidemic effect of amla.

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Table 1: Ingredients (%) and chemical composition of basal diet used during starting (0-3 week) and finishing (3-6 week) phases of the experiment

Particulars	Starter (0-3 week)	Finisher (3-6 week)
Ingredients %		
Yellow maize	62.17	70.31
Soybean meal	34.2	26.40
Vegetable oil	0.30	00
Dicalcium phosphate	1.40	1.40
Limestone	1.20	1.20
Salt	0.30	0.30
DL-methionine	0.15	0.12
B-complex	0.02	0.02
Choline chloride	0.06	0.05
Trace mineral premix1	0.10	0.10
Vitamin premix2	0.10	0.10
Total	100.00	100.00
Nutrient composition %		
Dry matter	94.71	94.32
Crude protein	23.02	20.01
Ether extract	04.80	04.30
Crude fiber	04.60	03.78
Total ash	07.20	06.85
ME, kcal/kg	2951.20	3006.44

Table 2: Effect of different level dietary addition of amla powder on carcass trait of broilers

Treatments	Carcass traits (% live weight)								
	Shrink-age	Blood loss	Feather loss	Giblet	Heart	Liver	Gizzard	Eviscreated yield	Dressed yield
T0	3.72 ± 0.14	2.05± 0.06 ^{a}	6.86± 0.11 ^{d}	4.04± 0.18 ^{a}	0.56± 0.03	1.74± 0.08 ^{a}	1.74± 0.09	64.58± 1.17	74.13± 0.67
T1	3.51± 0.14	2.73± 0.16 ^{b}	4.46± 0.12 ^{a}	4.82± 0.18 ^{b}	0.51± 0.05	2.13± 0.06 ^{b}	1.95± 0.08	63.68± 0.10	75.31± 0.71
T2	3.53± 0.11	2.74± 0.13 ^{b}	5.09± 0.10 ^{b}	4.62± 0.19 ^{b}	0.52± 0.03	2.05± 0.08 ^{b}	1.88± 0.10	61.65± 0.90	74.36± 0.58
T3	3.65± 0.09	2.62± 0.14 ^{b}	5.98± 0.18 ^{c}	4.44± 0.12 ^{ab}	0.51± 0.05	1.95± 0.05 ^{b}	1.76± 0.08	61.09± 0.81	73.69± 0.15
Mean ± SE	3.60± 0.12	2.54± 0.12	5.60± 0.12	4.48± 0.17	0.52± 0.04	1.97± 0.07	1.83± 0.09	62.75± 1.00	74.37± 0.53
CD at 5%	NS	0.37	0.37	0.49	NS	0.20	NS	NS	NS

Table 3: Effect of different level dietary addition of amla on cut-up parts of broilers

Treatments	Cut of parts (% body weight)					
	Breast	Drumstick	Thigh	Wing	Neck	Back
T0	13.33 ± 0.64 [a]	8.61 ± 0.75 [a]	9.28 ± 0.58	8.92 ± 0.56	3.52 ± 0.42 [a]	19.57 ± 0.91 [ab]
T1	14.33 ± 0.78 [ab]	10.59 ± 0.69 [ab]	9.79 ± 0.72	9.14 ± 0.59	4.71 ± 0.53 [ab]	18.08 ± 0.88 [a]
T2	15.53 ± 0.82 [b]	11.3 ± 0.78 [b]	10.77 ± 0.8	10.65 ± 0.27	5.06 ± 0.58 [b]	16.31 ± 0.61 [a]
T3	12.65 ± 0.54 [a]	9.17 ± 0.39 [a]	9.53 ± 0.56	10.6 ± 0.74	3.29 ± 0.40 [a]	20.34 ± 0.92 [b]
Mean ± SE	13.96 ± 0.69	9.92 ± 0.65	9.85 ± 0.67	9.83 ± 0.54	4.14 ± 0.48	18.58 ± 0.83
CD at 5%	2.07	1.97	NS	NS	1.43	2.48
Level of Significance	*	*	NS	NS	*	*

Table 4: Effect of different levels of amla feeding powder on broilers meat composition

Parameters	Treatments							
	Moisture		Protein		Fat		Ash	
	Breast	Thigh	Breast	Thigh	Breast	Thigh	Breast	Thigh
T0	71.28± 0.32 [a]	70.75± 0.62	22.21± 0.22	21.39± 0.26 [b]	4.54± 0.09 [b]	7.12± 0.28 [a]	1.19± 0.02 [ab]	1.35± 0.05
T1	72.33± 0.39 [ab]	69.87± 0.82	21.97± 0.26	19.91± 0.57 [a]	3.45± 0.09 [a]	6.89± 0.34 [ab]	1.18± 0.02 [a]	1.37± 0.06
T2	73.24± 0.44 [b]	70.37± 0.67	21.52± 0.53	19.96± 0.33 [a]	3.66± 0.19 [a]	6.21± 0.18 [a]	1.24± 0.01 [ab]	1.35± 0.02
T3	72.53± 0.48 [ab]	70.38 ± 0.66	21.93± 0.47	19.87± 0.32 [a]	3.62± 0.13 [a]	6.18± 0.18 [a]	1.25± 0.03 [b]	1.33± 0.04
Mean ± SE	72.34± 0.41	70.34 ± 0.69	21.90± 0.37	20.28± 0.37	3.82± 0.12	6.60± 0.25	1.22± 0.02	1.35± 0.04
CD @ 5 %	1.20	NS	NS	1.14	0.38	0.75	0.38	NS