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Production performance and blood biochemical changes in broiler chickens fed amla during induced-stress conditions

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ABSTRACT

An experiment was conducted in broiler chickens to evaluate the efficacy of *Emblica officinalis* (amla) fruits rich in vitamin C in alleviating stress induced by ACTH injection @ 3 IU / kg body weight for 5 d from 22 d of age. The birds were fed standard broiler diet supplemented with 5, 10 or 20 g amla dry powder or 250 mg synthetic vitamin C / kg diet. Body weight and feed efficiency were measured weekly. The plasma glucose, serum total cholesterol, high-density lipoprotein and triglycerides were measured at 21, 28 and 42 d of age. The results suggested that while the mean body weight was not influenced by amla supplementation, the feed efficiency was significantly improved by 10 g / kg amla feeding, compared to other groups. Serum triglycerides level decreased in amla-fed groups compared to control at third and fourth weeks of age. Other blood biochemical parameters like plasma glucose, serum total cholesterol and high-density lipoprotein did not vary between treatments. It can be concluded that the broiler diet can be supplemented with amla at 10 g / kg as an anti-stress agent during stress periods of broiler production.

Key words: Biochemical changes, Broiler chicken, *Emblica officinalis* feeding, Stress induction

Broiler chickens are continuously confronted by a multitude of stressors during the rearing period (e. g. heat stress, immunodepression) which constantly challenge the bird's internal homeostasis. Addition of anti-stress agents including synthetic vitamin C through water or diet reduced adrenocortical steroidogenesis that helped in ameliorating the negative effects of stress (Satterlee *et al.* 1989). Chickens can synthesize ascorbic acid (Satterlee *et al*. 1989), however, the metabolic need for this vitamin far exceeds the synthesis during disease conditions and in stress since vitamin C is involved in several biochemical processes including reversible oxidation and reduction characteristics.

Amla (*Emblica officinalis*), a fruit obtained from tropical perennial tree, is believed to be a very rich source of vitamin C in India (Ghosal *et al*. 1996) and contains about 333.3 mg/ 100 g on DM basis. To the author's knowledge, the effects of amla in poultry diet had not been studied in detail. Hence, the present work was undertaken to study the effects of *amla* on production performance and blood biochemical parameters of broilers.

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MATERIALS AND METHODS

Day-old Vencobb broiler chicks (120) were wing-banded, weighed and randomly allotted to 5 groups with 3 replicates of eight chicks each. The maximum temperature ranged from 33.0 to 35.0°C over the 6-week trial period and the minimum temperature ranged from 31.0 to 33.9°C with difference of 0.5 to 2.5°C. The relative humidity of the poultry house ranged from 81.14% in the morning to 31.21% in the evening Stress was induced by adrenocorticotrophic hormone (ACTH) @ 3 IU/kg body weight injected intramuscularly for 5 d from 22 d of age (Puvadolpirod and Thaxton 2000).

Diets: The broiler birds were fed air-dried and pulverized amla powder mixed with experimental diet @ 5, 10 and 20 g/ kg diet. The experimental diet was formulated to meet Bureau of Indian Standards (BIS 1992) for all nutrients. All the birds received a starter diet from d 1 to 21. Finisher diet was provided from 22 to 42 d of age. The metabolizable energy level was 11.73 and 12.16 (MJ/kg), respectively for the starter and finisher diets. The crude protein content of the diet was 236.4 and 200.4 g / kg respectively.

Variables measured

Body weight and feed consumption were measured weekly and feed efficiency was calculated. Blood samples

Table 1. Mean (±SE) body weight, feed efficiency and serum biochemical characteristics of broiler chickens fed amla and vitamin C before and after stress induced by ACTH injection

Treatment	Age in weeks	Body weight* (g)	Feed conversion ratio**	Glucose (mg/dl)	Total cholesterol (mg/dl)	HDL-cholestrol (mg/dl)	Triglycerides (mg/dl)
Control	III	618±2.0	1.50±0.04	182.78±16.12	120.28±2.19	50.06±1.83	100.30^{A}±4.08
	IV	1042±9.0	1.68^{AB}±0.03	182.78±15.16	128.38±4.88	49.45±1.83	110.00^{X}±5.40
	VI	1720±11.4	2.09^{Y}±0.03	249.43±7.03	185.04±5.57	46.17±0.30	80.05±2.12
Amla 5 g/kg	III	657±6.1	1.36±0.06	182.08±9.12	113.66±2.51	46.79±1.46	75.40^{B}±3.44
	IV	1039±10.3	1.78^{A}±0.02	180.70±3.85	129.56±6.70	47.51±1.14	76.89^{Y}±7.77
	VI	1827±12.3	2.19^{Y}±0.01	243.00±10.51	176.37±4.60	50.02±0.49	78.75±3.04
Amla 10 g/kg	III	636±16.9	1.51±0.05	188.33±8.09	120.98±9.88	47.19±1.46	79.52^{B}±1.42
	IV	1021±5.1	1.48^{C}±0.02	184.86±5.48	157.92±3.52	45.26±0.17	82.77^{Y}±5.16
	VI	1765±23.0	1.98^{Z}±0.05	258.55±31.34	180.30±5.75	48.61±0.63	76.71±1.12
Amla 20 g/kg	III	538±8.2	1.48±0.01	179.13±4.57	118.33±12.68	52.02±1.90	76.82^{B}±0.97
	IV	1066±16.9	1.66^{B}±0.03	170.13±10.97	123.81±9.21	50.14±1.91	79.27^{Y}±4.58
	VI	1781±9.2	2.25^{X}±0.01	254.33±14.02	189.78±14.61	48.55±1.23	75.88±1.34
Vitamin C 250 mg/kg	III	662±4.2	1.16±0.05	183.67±11.17	115.99±8.07	41.62±1.09	80.54^{A}±3.58
	IV	1064±8.7	1.71^{AB}±0.01	186.82±8.08	130.75±13.1	50.01±70.38	82.50^{Y}±4.31
	VI	1801±17.5	2.11^{Y}±0.04	259.79±17.31	181.37±9.80	46.88±0.46	76.15±0.67

*, Body weight-each value is mean of 24 observations: **, feed efficiency-each value is mean of three observations; means bearing superscripts ABC for fourth week and XYZ for sixth week in feed efficiency column and ABC for third and XYZ for fourth week in triglycerides column differ significantly (P<0.01).

were taken on 21 (before ACTH injection), 28 and 42 d age to measure the blood biochemical constituents like plasma glucose (Tietz 1976), serum total cholesterol (Wybenga *et al*. 1970), triglycerides (McGowan *et al*. 1983) and high-density lipoprotein (Warnick *et al*. 1985). All the data collected were statistically analyzed by completely randomized block design as per the method of Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The effects of different dietary levels of amla and synthetic vitamin C supplementation on mean body weight of broilers from 3, 4 and 6 weeks of age are presented in Table. Mean body weight did not vary among the treatment groups and control indicating that amla in poultry diet had no growth depressing effect even at a level of 20 g / kg diet. Amla protected the birds by keeping weight gain similar to control birds even after the stress induced by ACTH injection. However, Maini *et al*. (2007) reported a better weight gain in broiler chickens fed amla and electrolyte mix. The body weight gain in our study was similar to the findings of Karimi *et al*. (2000) who reported no significant increase in live body weight of broiler chicks due to vitamin C supplementation @ 400 to 800 mg/kg diet. On the contrary, Sahin *et al*. (2004) and Lohakare *et al*. (2005) reported improved weight gain by vitamin C supplementation to broilers at different levels varying from 200 to 1000 mg/kg diet. Doan and Giang (1998) stated that vitamin C supplementation might not influence the body weight in broilers. In the present study, the vitamin C supplementation @250 mg/kg diet did not improve the body weight gain and amla supplementation up to 20 g/kg of diet had similar effect.

The feed efficiency was improved significantly (P<0.01) in the group fed amla at 10 g/kg at fourth and fifth weeks of age. The feed efficiency of 5 g / kg amla fed group was similar to vitamin C fed group at sixth week (Table 1). Feed efficiency obtained in the present study was in agreement with the findings of Mas *et al*. (1997) and Maini *et al*. (2007) who also reported improved feed efficiency in vitamin C supplemented layers and broiler chickens compared to control group.

The plasma glucose and serum total cholesterol levels did not show any variation among the treatment groups. The serum triglycerides level decreased significantly (P<0.01) in all the treated groups compared to control at third and fourth week of age (Table 1). However, the triglyceride level in blood did not vary between amla and synthetic vitamin C groups at sixth week of age. The blood biochemical study of the present work indicated that supplementing the broiler diet with vitamin C at 250 mg / kg or amla up to 20 g/kg diet did not produce any change in the level of plasma glucose, serum cholesterol and high-density lipoprotein.

To the author's knowledge, there are no reports on biochemical parameters to directly compare our results with other research workers in broiler chickens fed amla powder and therefore results are compared with vitamin C feeding in broiler chickens. Kutlu and Forbes (1993) reported that diets supplemented with ascorbic acid produced an increase in plasma cholesterol level, which alleviated heat induced changes in broiler chickens. On the contrary, Ritu Mathur *et*

al. (1996) and Muruganandam *et al*. (2002) reported that amla supplemented groups showed reduced serum total cholesterol in rabbits and rats. In the present study, neither vitamin C nor amla supplementation was able to produce any change in serum cholesterol level. The lowered serum triglyceride might be due to higher utilization of lipids for energy or lesser absorption of lipids (Ritu Mathur *et al*. 1996) or it might be due to the effect of amla and vitamin C on the fatty acid metabolism, which needs further study.

In general, amla supplementation to the broiler chickens diet alleviated the stress by preventing the growth depressing effect of stress and can be used as anti-stress supplement in broiler production.

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