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RESEARCH ARTICLE

PERFORMANCE OF BROILER BIRDS SUPPLEMENTED WITH HERBAL ANTISTRESS PRODUCT AND SYNTHETIC VITAMIN C UNDER PHYSIOLOGICAL HEAT STRESS

[1]Sandeep Rindhe, [1]Shrinivas Uttamrao Suryavanshi, [1]Kakasaheb Kalyanrao Khose, [2]Kotagiri Ravikanth, [2]Adarsh and [2,*]Ankush Reothia

[1]College of Veterinary and Animal Sciences, MAFSU, Parbhani, Maharashtra, India.
[2]Research & Development Division, Ayurvet Limited, Baddi, India

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ABSTRACT

An experiment was carried out on 135 day old Vencob straight run commercial broiler chicks for a period of 42 days (6 weeks). The chicks were randomly divided into three groups (n=45) of three replicates each. Untreated control group (T_0) was fed standard basal diet without any supplement, treatment group T_1 was supplemented with AV/LAP/19 at the rate of 1ml/100 birds/day from 0-14 days, 2ml/100 birds/day from 14-28 days and 3ml/100 birds/day from 28-42 days in water and treatment group T_2 supplemented with synthetic ascorbic acid@100g/tonne of feed. Record of temperature were maintained on daily basis with mean maximum daily temperature of 39±2°C, relative humidity (RH) 82.57 ± 1.40 % (Recorded twice daily at a fixed time by hygrometer). AV/LAP/19 is a polyherbal formulation containing natural vitamin C and bioflavonoids, scientifically well known for their anti-oxidant and free radical scavenging activities. During present experiment, growth and performance parameters were recorded at weekly intervals. Hematological and biochemical parameters were analyzed at 3rd and 5th week of study. The mean live body weight (gm) mean weekly feed consumption (gm) on 42nd day was significantly ($P<0.05$) improved in AV/LAP/19 supplemented group T_1 birds (2572.72 and 1108.69, respectively) as compared to control group (2385 and 1179.44, respectively) and varied non significantly from synthetic ascorbic acid supplemented group T_2 birds (2527.16 and 1211.95, resopectively). FCR on 42nd day was significantly ($P<0.05$) better in AV/LAP/19 supplemented group T_1 birds (2.05) than synthetic ascorbic acid supplemented group T_2 birds (2.12) and control group (2.25). Hematological and biochemical parameters, which were altered under stressful conditions, also improved in AV/LAP/19 supplemented group T_1 birds.

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INTRODUCTION

Heat stress is the result of negative balance between the net amount of energy flowing from the animal's body to its surrounding environment and the amount of heat energy produced by the animal. Environmental stressors, such as heat stress, are particularly detrimental to animal agriculture (Nienaber and Hahn, 2007). High temperatures, especially when coupled with high humidity, impose severe stress on birds and lead to reduced performance (Ajakaiye *et al,* 2011). Prolonged, severe heat stress affects DMI and daily gain of broiler chickens, especially after 28 d of age (Cooper and Washburn, 1998; Yalcin *et al.,* 2001).

Corresponding author: Ankush Reothia,
Research & Development Division, Ayurvet Limited, Baddi, India.

During the periods of heat stress, most of the production energy is diverted to thermoregulatory adaptations which results in oxidative stress induced immunosupression, predisposing birds to various infectious diseases and high mortality rates (Maini *et al*., 2007). Acclimation to high thermal conditions at an early age (4 to 7 d) noticeably reduces the effect of heat stress at a later age (Yahav and Plavnik, 1999; Altan *et al*., 2000). Male broiler breeders are affected more by heat stress than females (McDaniel *et al*., 1995). Dietary parameters can modulate the effect of diet stress (Bollengier-Lee *et al*., 1998; Sahin *et al*., 2002) as well as management factors (Kassim and Sykes, 1982; Sahin and Kucuk, 2001). Vitamin C and vitamin E are used in the poultry diet because of their anti-oxidant properties in the neutralization of the free radicals generated during heat stress (Ramnath *et al*., 2008). Poultry are renal synthesizers of vitamin C but its quantity becomes insufficient during heat stress as a result of the increased rate of usage in combating the free radicals thus generated. In the past few decades a number of Ayurvedic herbal preparations have been extensively used in poultry industry (Ramnath *et al*., 2008). Polyherbal products containing different immunomodulator (*Withania somnifera*), antistressor (*Phyllanthus emblica, Mangifera indica*) and adaptogenic (*Ocimum sanctum*, *W. somnifera)* herbs have been used to protect tissues from superoxide radicals and enhance cell survival by stimulating antioxidative enzymatic systems (Sujatha *et al.,* 2010).Therefore present study was conducted to evaluate comparative effects of supplementation of synthetic ascorbic acid (Vitamin C) and AV/LAP/19, a polyherbal antistressor product (M/S Ayurvet Limited, India) on growth and performance related parameters and haemato-biochemical parameters in broiler birds exposed to a heat stress.

MATERIALS AND METHODS

The present study was undertaken at Department of Livestock Products Technology, College of Veterinary and Animal Sciences, MAFSU, Parbhani, India during hot dry season. (June to July, 2011). The experimental chicks were housed in three different pens and each pen was partitioned for treatment group to have 3 replications accommodating 15 birds in each. Brooding was contin.ued until 2 weeks of age in the respective pen of each replication and treatment group. The experimental birds were vaccinated against Ranikhet disease on 6th day, Gumboro disease/IBD on 14th day and vaccination of booster dose of Gumboro was carried out on 24th day and of Ranikhet (strain) disease given on 29th day. All the birds were subjected to artificially induced heat stress using room heaters and electric bulb. Record of temperature were maintained on daily basis with mean maximum daily temperature of 39±2°C, relative humidity (RH) 82.57 ± 1.40 % (Recorded twice daily at a fixed time by hygrometer)

Table 1. Percent (%) ingredient and nutrient of different dietary composition of starter rations used in experimental diet

Ingredients	Groups		
	T_0 (Control)	T_1 (AV/LAP/19 In drinking water)	T_2 (Synthetic Ascorbic Acid @ 100gm/tonne)
Maize	57.00	57.00	57.00
Soyabean meal	35.60	35.60	35.60
Vegetable oil	3.50	3.50	3.50
DCP	1.50	1.50	1.50
LSP	1.00	1.00	1.00
Salt	0.30	0.30	0.30
	98.90	98.90	98.90
Micro-ingredients			
Trace Mineral	0.300	0.300	0.300
Vitamin Mix	0.150	0.150	0.150
Methionine	0.200	0.200	0.200
Lysine	0.140	0.140	0.140
Choline chloride 60%	0.060	0.060	0.060
Toxin binder	0.050	0.050	0.050
Coccidiostat	0.050	0.050	0.050
Sodium Bicarbonate	0.150	0.150	0.150
	100.000	100.000	100.000

Experimental design

135 day old Vencob straight run commercial broiler chicks were randomly allotted to three treatment groups with each treatment having three replicates and each replicate comprised of fifteen birds. Group T_0: Untreated control, Group T_1 supplemented with AV/LAP /19 along with drinking water @1ml/ 100 birds /day from 0-14 days, 2ml/100 birds/day from 14 to 28 days and 3ml/100 birds/day from 28 to 42 days and Group T_2: supplemented with synthetic ascorbic acid @ 100gm/tonne of feed from 0-42 days.

Parameters studied

The growth performance parameters (body weight, growth rate, cumulative weight gain, average feed intake and mean FCR) were recorded at weekly intervals throughout the experimental period. Blood samples were drawn from the wing vein for estimation of Hb and PCV as per standard procedure. Serum samples were separated from the blood. These samples were used for the estimation of total protein, albumin and cholesterol on 3rd and 5th weeks from 6 representative birds of each group (2 birds /replicate).

Statistical analysis

Observations were summarized in tabular form for each individual group. The data were analyzed following standard procedure (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Growth and Performance Parameters

Body weight

High ambient temperature constitutes a significant hindrance to poultry production in the tropical world. Thermal stress exerts its deleterious effects on feed intake and body weight gain (MacLeod and Hocking, 1993).

In the current study, the body weight at the end of 1st week was found to be significantly improved ($P < 0.05$) in AV/LAP/19 supplemented group T_1 birds (164.15 gm) as compared to synthetic ascorbic acid supplemented group T_2 birds (152.82gm) (Table 3). At the end of 4th and 5th week the body weight in AV/LAP/19 supplemented group T_1 birds (1343.67gm and 1986.35gm, respectively) was significantly improved as compared to control group (1312.45gm and 1890.93gm, respectively).

supplemented group T_2 birds (264.69gm and 553.17gm, respectively) (Table 4). But at 5th week of age the body weight gain was found to be significantly (P<0.05) better in AV/LAP/19 supplemented group T_1 birds (637.71gm) from

Table 2. Percent Ingredient Composition of Finisher mashes

Ingredients	Groups		
	A (Control)	B (AV/LAP/19 In drinking water)	C (Synthetic Ascorbic Acid @ 100gm/tonne)
Maize	59.00	59.00	59.00
Soyabean meal	31.80	31.80	31.80
Vegetable oil	5.00	5.00	5.00
DCP	1.50	1.50	1.50
LSP	1.28	1.28	1.28
Salt	0.30	0.30	0.30
	98.88	98.88	98.88
Micro-ingredients			
Trace Mineral	0.300	0.300	0.300
Vitamin Mix	0.150	0.150	0.150
Methionine	1.140	1.140	1.140
Lysine	0.080	0.080	0.080
Choline chloride 60%	0.150	0.150	0.150
Toxin binder	0.100	0.100	0.100
Coccidiostat	0.050	0.050	0.050
Sodium Bicarbonate	0.150	0.150	0.150
	100.000	100.000	100.000

Table 3. Weekly body weight (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
T_0	162.80^a	411.38	780.73	1312.45^b	1890.93^b	2385^b
T_1	164.15^a	412.90	792.52	1343.67^a	1986.35^a	2572.72^a
T_2	152.82^b	417.80	799.80	1358.66^a	1969.25^a	2527.16^a
SE +	2.529	5.145	7.988	9.956	23.10	30.70
CD	7.957	NS	NS	33.32	72.67	96.58

Means with common superscripts did not differ significantly (P < 0.05)

Table 4. Weekly body weight gain (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
T_0	114.82	250.61^b	371.37	527.69^c	568.50^c	496.10^b
T_1	111.85	266.99^a	383.99	560.89^a	637.71^a	599.82^a
T_2	106.50	264.69^a	389.96	553.17^{ab}	603.67^b	587.96^{ab}
SE +	2.410	3.383	5.477	6.319	10.57	11.011
CD	NS	10.643	NS	19.873	31.103	34.653

Means with common superscripts did not differ significantly (P < 0.05)

This significant (P < 0.05) improvement in body weight in AV/LAP/19 supplemented group T_1 birds continued up to 6th week. The final body weight at the end of 6th week in AV/LAP/19 supplemented group T_1 birds (2572.72gm) was found to be significantly (P<0.05) better from un supplemented control group T_0 birds (2385gm) and varied non significantly from. synthetic ascorbic acid supplemented group T_2 birds (2527.16gm) (Table 3).

The mean weekly weight gains at 1st week of age were 114.82gm, 111.85gm and 106.50gm for treatment group T_0, T_1 and T_2 respectively (Table 4). At 2nd and 4th week of age significantly (P<0.05) better body weight gain was found in AV/LAP/10 supplemented Group T_1 birds (266.99gm and 560.89gm, respectively) as compared to control group (250.61gm and 527.69gm, respectively) and body weight gain was non-significantly better from synthetic ascorbic acid supplemented group T_2 birds (264.69gm and 553.17gm, respectively) (Table 4). But at 5th week of age the body weight gain was found to be significantly (P<0.05) better in AV/LAP/19 supplemented group T_1 birds (637.71gm) from both control group (568.50gm) and synthetic ascorbic acid supplemented group T_2 birds (603.67 gm) (Table 4). At 6th week of age the body weight gain was significantly (P<0.05) better in AV/LAP/19 supplemented group T_1 birds (599.82gm) as compared to control group (496.10gm) and varied non-significantly from synthetic ascorbic acid supplemented group T_2 birds (587.96gm) (Table 4). The improved in weekly body weight and body weight gain may be attributed to ingredient herbs of AV/LAP/19 viz *Phyllanthus emblica and Withania somnifera* which are known to have adaptogenic properties (Krupavaram *et al*., 2007: Anila and Vijayalaxmi, 2000).

Weekly Feed Consumption and Feed conversion ratio (FCR)

Stress in broilers results in a decline in feed consumption and overall feed efficiency. Supplementation of antioxidants along with the basal diet has been scientifically well proven to improve growth and performance in birds (Sahin *et al*., 2003). At 1st, 2nd and 3rd week of age no significant variation in weekly feed consumption was recorded in different treatment groups. Feed consumption at 4th week of age was recorded to be significantly ($P<0.05$) better in AV/LAP/19 supplemented group T_1 birds (877.47gm) as compared to untreated control group T_0 birds (855.26gm) (Table 5). At 6th week of age significantly ($P<0.05$) low feed intake was recorded in AV/LAP/19 supplemented group T_1 birds (1108.69gm) from both untreated control group T_0 birds (179.4gm) and synthetic ascorbic acid supplemented group T_2 birds (1211.95gm).

FCR varied non significantly between different treatment groups from 1st week to 5th week of age. At 6th week of age feed conversion was found to be significantly better in AV/LAP/19 supplemented group T_1 birds (2.05) as compared to synthetic ascorbic acid supplemented group T_2 birds (2.12) and un supplemented control group T_0 birds (2.25) (Table 6). Antioxidant plays an important role in both nutrition and production performance in poultry. Significantly better feed consumption ration in AV/LAP/19 supplemented group T_1 birds may be attributed to its ingredient herbs viz *Ocimum sanctum* and *Phyllanthus emblica* which are known to have antistress and antioxidant property (Moinuddin *et al*., 2011; Reddy, 2011).

Hematological Parameters

Heat distress causes reduction in Packed cell volume (PCV) and hemoglobin which is apparently associated with hemodilution (Darre and Harrison, 1987). At 3rd week of age hemoglobin level was found to be improved in AV/LAP/19 supplemented group T_1 birds (8.51gm/dl) as compared to un supplemented control group T_0 birds (8.31 gm/dl), But at 5th week of age significantly ($P<0.05$) improved hemoglobin level was recorded in AV/LAP/19 supplemented group T_1 birds (8.81gm/dl) as compared to untreated control group (8.47gm/dl) (Table 7). The hemoglobin level in ascorbic acid supplemented group was found to be 8.82gm/dl and 9.10gm/dl at 3rd and 5th week, respectively (Table 7).

Packed cell volume (PCV) values also vary with the ambient temperature at which birds are reared. The exposure of chickens to high temperatures causes a decrease in blood PCV (Deyhim *et al*., 1991). PCV concentration at the 3rd week of age was found to be non significantly improved in AV/LAP/19 supplemented group T_1 (24.61%) birds as compared to un supplemented group T_0 birds (23.69%). In synthetic ascorbic acid supplemented group T_2 birds the PCV concentration was recorded to be 25.81% at 3rd week of age. At 5th week of age PCV concentration varied non significantly among Group T_0 (24.86%), Group T_1 (25.23%) and Group T_2 (25.80%).

Table 5. Weekly feed consumption (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
T_0	134.90	345.51	559.50	855.26^c	1051.18^b	1179.44^a
T_1	123.75	346.42	560.27	877.47^b	1101.91^{ab}	1108.69^b
T_2	123.09	349.17	573.47	897.57^a	1118.36^a	1211.95^a
SE +	4.288	5.912	6.194	6.163	14.81	18.13
CD	NS	NS	NS	19.37	46.67	58.92

Means with common superscripts did not differ significantly ($P < 0.05$)

Table 6. Weekly feed conversion ratio (FCR) of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
T_0	1.19	1.40	1.51	1.62	1.82	2.25^c
T_1	1.15	1.39	1.48	1.60	1.77	2.05^a
T_2	1.11	1.32	1.51	1.61	1.79	2.12^b
SE +	0.0240	0.02728	0.01038	0.01872	0.03173	0.0152
CD	0.078	0.08719	0.03402	0.0590	0.1104	0.0461

Means with common superscripts did not differ significantly ($P < 0.05$)

Table 7. Mean (+ SE) values of Haemoglobin (gm/dl) and Packed cell volume (PCV) (%) of broilers of different groups at 3rd and 5th week of age

Parameters Groups	Hemoglobin		PCV	
	3rd week	5th week	3rd week	5th week
T_0	8.31^a ± 0.13	8.47^a ± 0.11	23.69^{ab}± 0.26	24.86 ± 0.44
T_1	8.51^{ac}± 0.16	8.81^b± 0.16	24.61^{ab} ± 0.11	25.23 ± 0.10
T_2	8.82^c ± 0.17	9.10^c ± 0.13	25.81^c ± 0.27	25.80 ± 0.23

Means with common superscripts did not differ significantly ($P < 0.05$)

Table 8. Mean (+ SE) values of Total serum Protein (gm/dl), albumin (gm/dl) and Cholesterol (mg/dl) of broilers of different groups at 3rd and 5th week of age

Parameters Groups	Total Protein				Albumin				Cholesterol			
	3rd week		5th week		3rd week		5th week		3rd week		5th week	
T_0	2.26^{ab}	± 0.14	2.68^{ab}	± 0.14	1.03^{ab}	± 0.07	1.20^{ab}	± 0.07	155.09^{ab}	± 1.69	144.36^{ab}	± 3.66
T_1	2.50^{ab}	± 0.21	2.94^{ab}	± 0.21	1.13^{ab}	± 0.10	1.32^{ab}	± 0.10	154.53^{ab}	± 1.81	138.60^{ab}	± 2.11
T_2	3.27^c	± 0.20	4.06^c	± 0.20	1.45^c	± 0.09	1.80^c	± 0.09	117.16^c	± 2.54	111.64^c	± 2.52

The normalization in the haematological blood values may be attributed to the efficacy of indvidual constituent herbs of Ayucee premix namely; *Withania somnifera*, *Ocimum sanctum* and *Phyllanthus emblica* in ameliorating stress and restoring hematological profile (Pandurang *et al*., 2011).

Biochemical Parameters

Total protein, albumin and globulin concentration decreases significantly when birds are exposed to heat stress. This decline in blood protein levels in heat-stressed birds may be due to reduced protein synthesis (Hamoud *et al*.,1993; Zhou *et al*., 1998). At 3rd and 5th week of age total protein values increased non-significantly in AV/LAP/19 supplemented group T_1 birds (2.50gm/dl and 2.94gm/dl, respectively) as compared to un-supplemented control group T_0 birds (2.26gm/dl and 2.68gm/dl, respectively). In ascorbic acid supplemented group T_2 birds the total protein values were recorded to be 3.27gm/dl and 4.06gm/dl at 3rd and 5th week, respectively. Similarly, albumin level at 3rd and 5th week of age was found to be non-significantly more in AV/LAP/19 supplemented group T_1 birds (1.13gm/dl and 1.32gm/dl, respectively) as compared to un-supplemented control group T_0 birds (1.03gm/dl and 1.20gm/dl, respectively). In ascorbic acid supplemented group T_2 birds the albumin level was recorded to be 1.45gm/dl and 1.80gm/dl at 3rd and 5th week, respectively. High ambient temperature may result in hypercholesterolemia (Kutlu and Forbes, 1993). Exposure of Japanese quails to a temperature of 34°C elevated plasma cholesterol concentrations (Sahin *et al*., 2004). At 3rd and 5th week non significantly lower cholesterol level was found in AV/LAP/19 supplemented group T_1 birds (154.53mg/dl and 138.60mg/dl, respectively) as compared to un-supplemented control group T_0 birds (155.09mg/dl and 144.36mg/dl, respectively) (Table 8). In ascorbic acid supplemented group T_2 birds the cholesterol level at 3rd and 5th week of age were found to be 117.16mg/dl and 111.64mg/dl) (Table 8). Lower level of cholesterol in AV/LAP/19 supplemented group T_1 birds may be attributed to its ingredient herb viz *Phyllanthus emblica* which is known to have hypolipidaemic and hypocholesterolaemic effect (Sujatha *et al*., 2010).

Conclusion

It can be concluded that supplementation of polyherbal formulations is efficacious in improving growth and performance parameters such as body weight, body weight gain, feed consumption and feed conversion ratio. The hematological parameters viz hemoglobin and PCV and biochemical parameters viz total protein, albumin and cholesterol also improved in AV/LAP/19 supplemented group. AV/LAP/19 is a polyherbal antistressor and an antioxidant formulation which comprises herbal ingredients that are scientifically validated to possess antioxidant, hypocholesterolemic and hypolipidaemic activity. The product is a rich source of natural bioflavonoids and ascorbic acid that help to reduce oxidative stress thus ameliorate stress in broilers, potentiate immune response and combat lipid peroxidation.

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