



Effect of Supplementation of Herbal Antistress Product and Synthetic Vitamin C on performance of broiler birds under physiological heat Stress

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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 (T₀) was fed standard basal diet without any supplement, treatment group T₁ was supplemented with Ayucee premix at the rate of 100gm/tonne of feed from 0-42 days and treatment group T₂ 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). Ayucee premix is a polyherbal formulation containing natural vitamin C and bioflavonoids, scientifically well known for their anti-oxidant and free radical scavenging activities. The mean live body weight (gm) at 6th week was significantly (P<0.05) improved in Ayucee supplemented group T₁ birds (2503.66) as compared to control group (2385) and varied non significantly from synthetic ascorbic acid supplemented group T₂ birds (2527.16). FCR on 42nd day was significantly (P<0.05) better in Ayucee supplemented group T₁ birds (2.08) than synthetic ascorbic acid supplemented group T₂ birds (2.12) and control group (2.25). Hematological and biochemical parameters, which were altered under stressful conditions, also improved in Ayucee supplemented group T₁ birds.

Keywords: Antioxidant, broiler, stress, performance, hemato-biochemical



INTRODUCTION

Broiler production has developed at very fast rate in the last two decades to become the most important sector in animal production industry. Indian poultry sector has been growing at around 8-10% annually over the last decade with broiler meat volumes growing at more than 10%. Broiler production in all hot regions suffers great losses every year due to the effect of heat stress [1]. High ambient temperatures can be devastating to commercial broilers; coupled with high humidity they can have an even more harmful effect. Depressed growth rate and decreased feed consumption of broilers raised in higher temperature environments have been reported in many studies over a number of years [2]. To optimize feed utilization and weight gain of broiler chickens, environmental temperature should be about 23°C. Animals utilize multiple ways for maintaining thermoregulation and homeostasis when subjected to high environmental

temperatures, including increasing radiant, convective and evaporative heat loss by vasodilatation and perspiration [3]. Birds subjected to heat stress conditions spend less time for feeding, more time for drinking and panting, as well as more time with their wings elevated, less time moving or walking, and more time resting [4]. Chronic heat stresses significantly reduce feed intake (16.4%), lower body weight (32.6%), and higher feed conversion ratio (+25.6%) at 42 days of age in broilers [5]. Many additional studies have shown impaired growth performance in broilers subjected to heat stress [6, 7]. The adverse environmental conditions lead to oxidative stress associated with increased oxidative damage and lowered plasma concentrations of antioxidant vitamins [8]. Ascorbic acid synthesis is decreased at elevated environmental temperature making it an essential dietary supplement during the summer [9]. Thus sticking to the emergency for dietary incorporation of vitamin C, it is being constantly added to poultry diet in synthetic form. However

nowadays, the poultry industry has focused more attention towards addressing public concern for environmental and food safety [10]. For this the ascorbic acid in organic and herbal form is being preferred by poultry producers. Keeping in view the points as elaborated above, the present trial is conducted to assess efficacy of polyherbal antistressor and antioxidant formulation Ayucee (M/S Ayurved Limited, Baddi, H.P. India), a natural source of ascorbic acid and bioflavonoids that owes its beneficial properties to the constituent herbs *Phyllanthus emblica*, *Ocimum sanctum*, *Terminalia chebula* and *Withania somenifera*.

MATERIAL 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

continued 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 $39 \pm 2^\circ\text{C}$, relative humidity (RH) $82.57 \pm 1.40\%$ (Recorded twice daily at a fixed time by hygrometer)

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 T₀: Untreated control, Group T₁: supplemented with Ayucee premix @ 100gm/tonne of feed from 0-42 days. Group T₂: supplemented with synthetic ascorbic acid @ 100gm/tonne of feed from 0-42 days.

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

Starter Ration			
Ingredients	Groups		
	T ₀ (Control)	T ₁ (Ayucee 100gm/tonne) Premix	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
Cocciostat	0.050	0.050	0.050
Sodium Bicarbonate	0.150	0.150	0.150
	100.000	100.000	100.000
Finisher mashes			
Ingredients	Groups		
	T ₀ (Control)	T ₁ (Ayucee 100gm/tonne) Premix	T ₂ (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

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: Growth rate and body weight gain decreases at high environmental temperature which might be due to many factors which include decreasing feed consumption, inefficient digestion [11], and impaired metabolism [12]. Also at high ambient temperatures, there is a decrease in protein synthesis [13], probably due to reduced plasma amino acid concentration and to lower energy supply [14]. In the current study, the body weight at the end of 4th and 5th week was found to be significantly ($P < 0.05$) improved in Ayuucee supplemented group T₁ birds (1327.08gm and 1917.73gm, respectively) as compared to control group (1312.45gm and

1890.93gm, respectively). This significant ($P < 0.05$) improvement in body weight in Ayuucee supplemented group T₁ birds continued up to 6th week. The final body weight at the end of 6th week in Ayuucee supplemented group T₁ birds (2503.66gm) was found to be significantly ($P < 0.05$) better from un supplemented control group T₀ birds (2385gm) and varied non significantly from synthetic ascorbic acid supplemented group T₂ birds (2527.16gm) (Table 2).

The mean weekly weight gains at 1st week of age were 114.82gm, 108.51gm and 106.50gm for treatment group T₀, T₁ and T₂ respectively (Table 3). At 5th and 6th week of age significantly ($P < 0.05$) better body weight gain was found in Ayuucee supplemented Group T₁ birds (601.60gm and 560.49gm, respectively) as compared to control group (568.50gm and 496.10gm, respectively) and body weight gain varied non-significantly from synthetic ascorbic acid supplemented group T₂ birds (603.67gm and 587.96gm, respectively) (Table 3). The improvement in weekly body weight and body weight gain may be attributed to ingredient herbs of Ayuucee premix viz *Phyllanthus emblica* and *Withania somnifera* which are known to have antistress and immunomodulatory properties [15, 16]. Perusal of literature reveals many authors had reported that dietary incorporation of synthetic and herbal antistressor vitamin C to increase body weight gain as well as improve growth and performance of birds during summer [17, 18, 19].

Table 2: Weekly body weight (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1 st	2 nd	3 rd	4 th	5 th	6 th
T ₀	162.80 ^a	411.38	780.73	1312.45 ^b	1890.93 ^b	2385 ^b
T ₁	150.80 ^b	413.47	801.41	1327.08 ^b	1917.73 ^a	2503.66 ^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 3: Weekly body weight gain (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1 st	2 nd	3 rd	4 th	5 th	6 th
T ₀	114.82	250.61 ^b	371.37	527.69 ^c	568.50 ^c	496.10 ^b
T ₁	108.51	250.77 ^b	381.64	533.74 ^{bc}	601.60 ^b	560.49 ^b
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)

Weekly Feed Consumption and Feed conversion ratio (FCR): Stress in broilers results in a decline in feed consumption and overall feed efficiency. Decreased feed consumption observed in heat stressed birds is closely related to the extra heat load accumulated in the course of heat stress [20]. Feed consumption was recorded to be non-significantly better in Ayucee supplemented group T₂ birds throughout the experiment as compared to untreated control group T₀ birds. 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 Ayucee supplemented group T₁ birds (2.08) as compared to un-supplemented control group T₀ birds (2.25) whereas feed consumption in group T₁ birds varied non-significantly from synthetic ascorbic acid supplemented group T₂ birds (2.12) (Table 5). Antioxidant plays an important role in both nutrition and production performance in poultry. Significantly better feed consumption ration in Ayucee supplemented group T₁ birds may be attributed to its ingredient herbs viz *Ocimum sanctum* and *Phyllanthus emblica* which are known to have antistress and antioxidant property [21, 22].

Table 4: Weekly feed consumption (gm) per bird of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1 st	2 nd	3 rd	4 th	5 th	6 th
T ₀	134.90	345.51	559.50	855.26 ^c	1051.18 ^b	1179.44 ^a
T ₁	121.41	354.90	578.91	846.28 ^c	1060.28 ^b	1194.83 ^a
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 5: Weekly feed conversion ratio (FCR) of broilers at weekly interval in different treatment groups

Age Groups	Age (weeks)					
	1 st	2 nd	3 rd	4 th	5 th	6 th
T ₀	1.19	1.40	1.51	1.62	1.82	2.25 ^c
T ₁	1.15	1.35	1.50	1.62	1.80	2.08 ^{ab}
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)

Hematological Parameters: Heat distress causes reduction in Packed cell volume (PCV) and hemoglobin which is apparently associated with hemodilution because the excess glucocorticoids stimulate water and sodium chloride reabsorption in the kidney and cecum [23]. At 3rd and 5th week of age hemoglobin level was found to be improved in Ayuucee supplemented group T₁ birds (9.34 gm/dl and 9.63 gm/dl), respectively) as compared to un-supplemented control group T₀ birds (8.31 gm/dl and 8.47 gm/dl, respectively) (Table 6). 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 6). PCV concentration at the 3rd week of age was found to

be non-significantly improved in Ayuucee supplemented group T₁ birds (25.41%) as compared to un-supplemented group T₀ birds (23.69%) (Table 6). In synthetic ascorbic acid supplemented group T₂ 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 T₀ (24.86%), Group T₁ (25.30%) and Group T₂ (25.80%) (Table 6). The normalization in the haematological blood values may be attributed to the efficacy of individual constituent herbs of Ayuucee premix namely; *Withania somnifera*, *Ocimum sanctum* and *Phyllanthus emblica* in ameliorating stress and restoring hematological profile [24].

Table 6: 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	
	3 rd week	5 th week	3 rd week	5 th week
T ₀	8.31 ^a ± 0.13	8.47 ^a ± 0.11	23.69 ^{ab} ± 0.26	24.86 ± 0.44
T ₁	9.34 ^a ± 0.08	9.63 ^a ± 0.06	25.41 ^{ab} ± 0.42	25.30 ± 0.15
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)

Biochemical Parameters: Plasma total protein level tended to be lower during maximum heat load [25] caused by initial haemoconcentration followed by haemodilution. At 3rd and 5th week of age total protein values increased non-significantly in Ayuucee supplemented group T₁ birds (3.43gm/dl and 4.67gm/dl, respectively) as compared to un-supplemented control group T₀ birds (2.26gm/dl and 2.68gm/dl, respectively) (Table 7). In ascorbic acid supplemented group T₂ 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 Ayuucee supplemented group T₁ birds (1.46gm/dl and 2.02gm/dl, respectively) as compared to un-supplemented control group T₀ birds (1.03gm/dl and 1.20gm/dl, respectively) (Table 7). In ascorbic acid supplemented group T₂ 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 [26]. Exposure of Japanese quails to a temperature of 34°C elevated plasma cholesterol concentrations [27]. At 5th week significantly (P<0.05) lower cholesterol level was found in Ayuucee supplemented group T₁ birds (111.64mg/dl) as compared to un-supplemented control group T₀ birds (155.09mg/dl) and the concentration varied non significantly from ascorbic acid supplemented group T₂ birds (111.64mg/dl) (Table 7). Vitamin C supplementation increases plasma protein concentration while markedly decreases blood cholesterol concentrations in heat-stressed broilers. Lower level of cholesterol in Ayuucee supplemented group T₁ birds may be attributed to its ingredient herb viz *Phyllanthus emblica* which reduces lipidperoxidation and enhances clearance of endogenous cholesterol [28].

Table 7: 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	
	3 rd week	5 th week	3 rd week	5 th week	3 rd week	5 th 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	3.43 ^a ± 0.11	4.67 ^a ± 0.10	1.46 ^a ± 0.05	2.02 ^a ± 0.05	117.16 ^b ± 2.54	111.64 ^c ± 2.52
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

CONCLUSION

To alleviate the problem of heat stress recommendations regarding housing, ventilation, and cooling systems are possible at large commercial scale as it involves high cost. Instead, because of being practical, nutritional manipulation with its low cost is a common approach in poultry production. Thus it may be concluded that natural vitamin C and bioflavonoids supplementation in the form of Ayuceed premix had beneficial effect on

growth, feed efficiency and hemato-biochemical profile. Dietary incorporation of herbal Ayuceed premix will be beneficial to minimize the production losses out of heat stress in broilers..

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