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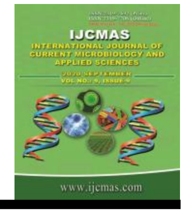

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Efficacy Evaluation of Heat Ameliorating Activity and Immunomodulatory Properties of Ayucee® & AV/LAP/19 in Broilers

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A B S T R A C T

This present study was conducted to evaluate the comparative effects of supplementation of ascorbic acid, Ayucee® and AV/LAP/19 in diet and water on the performance of heat-exposed broilers. One hundred and Twenty day-old unsexed broiler chicks of strain Vencobb were purchased from a local hatchery for this study and were randomly allotted into four treatment groups (T0, T1, T2 and T3) with each treatment having three replicates and each replicate having ten birds. T0 was control group with no treatment, T1 group was administered with Synthetic Vit. C (AA) 100g/ton of feed, T2 was given Ayucee^{R} premix @100g/ton of feed whereas, T3 was administered with AV/LAP/19Starter:@1 ml/100 birds/day in water Grower: @ 2ml/100 birds/day in water Finisher: @ 3ml/100 birds/day in water. Performance parameters, Internal Organs Weight, Meat quality and carcass traits were studied. The present study on performance indicated lower body weights and poor feed efficiency in the heat stressed group as compared to the treatment groups (T2 followed by T3 and T1).The meat quality and carcass traits of the birds of T2, T3 and T1 are significantly different from the control (T0) group. Thus Ayucee is having heat ameliorating activity and immunomodulatory properties as compared to AV/LAP/19 and synthetic Vitamin C.

Introduction

Heat stress is of major concerns for poultry production. Biochemical and physiological changes associated with hyperthermia can potentially promote reactive oxygen species (ROS) formation. The impaired muscle membrane integrity in breast muscle of heat-stressed broiler chickens (Sandercock *et al.*, 2001) was also considered to be related with the changed redox balance because broiler chickens that were exposed to acute heat stress exhibited more than a 2-fold increase of MDA as an indicator for lipid peroxidation, in the skeletal muscle (Sahin *et al.,* 2002). High ambient temperature negatively influences the performance of broilers. Several methods are available to alleviate the effect of high environmental temperature on the performance of poultry. Because it is expensive to cool animal buildings, such methods are focused mostly on dietary manipulations. An ambient temperature above 30°C is considered to have an adverse effect on the performance of broiler chicks. The negative effects of high temperatures on poultry performance can be minimized by the use of appropriate housing design, installation of cooling systems, feed formulations designed according to feed in take and weather conditions, and the use of some minerals, electrolytes, ascorbic acid, or acetylsalicylic acid (ASA) in the drinking water of birds (Branton *et al.,* 1986; Smith and Teeter, 1992). Poultry have the ability to synthesize ascorbic acid, but this ability is inadequate under stress conditions, such as high environmental temperatures, high humidity, a high productive rate, and parasitic infestation Pardue and Thaxton (1986) documented evidence that particular environmental stressors can alter the use or synthesis of ascorbic acid in poultry. This study was conducted to evaluate the comparative effects of supplementation of ascorbic acid, Ayucee® and AV/LAP/19in diet and water on the performance of heat-exposed broilers.

Materials and Methods

Experimental location

The present study was carried out at a poultry house at Kamthana, Bidar (KS), India. The daily minimum, maximum and mean ambient temperatures, relative humidity and wet-and dry-bulb temperatures at the level of the birds in the pen at 0800 hand 1600h were monitored through out the experimental period. The temperature-humidity index was determined from relative humidity and wet- and dry-bulb temperature data using the formula given by Palmer (2000).

Drugs and Chemicals

Ayucee® premix (Antistressor and Immunomodulator) @ 100g/ton of feed and AV/LAP/19 (Antistressor and Immunomodulator) @ Starter:@1 ml/100 birds/day in water; Grower: @ 2ml/100 birds/day in water; Finisher: @ 3ml/100 birds/day in water was procured from Ayurvet LTD, India. All the chemicals used in this study were of analytical grade.

Experimental birds and management

One hundred and Twenty day-old unsexed broiler chicks of strain Vencobb were purchased from a local hatchery for this study and were randomly allotted into four treatment groups with each treatment having three replicates and each replicate having ten birds (Table 1). During the first three weeks of trial the chicks were fed *adlibitum* with standard starter mash and there after with finisher mash. The composition of the diets (starter and finisher phases) given to the birds is shown in Table 2. Water at ambient temperature was supplied *adlibitum* through out the period of the experiment in plastic drinkers.

Birds of all the groups were vaccinated with Marek's Disease(day 1) New castle disease (ND) vaccine on 7th and 21st and 31st day and infectious bursal disease (IBD) vaccine on 14th day.

Performance parameters

The chickens were weighed individually on d 1, 7, 14, 21, 28, 35 and 42. Feed intake was recorded weekly Body weight gain was calculated.

Organ weight

Two birds from each treatment were chosen at random, weighed and then slaughtered according to the Islamic method (Halal). The weights of spleen and bursa of Fabricius were recorded. Organ weights were expressed on a relative body weight basis.

Carcass traits evaluation

Weight analysis and physical evaluation

The carcasses were weighed and deboned 24 hr after slaughter, and the breast muscle, thigh meat with skin, liver, gizzard, abdominal fat, spleen, Bursa of Fabricius and thymus were then removed and weighed. The weight of abdominal fat was determined by collecting all fat spreading to the ischium, around the cloaca, and into the neighboring abdominal muscles. The dressing percentage was calculated as the ratio of the carcass weight to the live weight. The weight of the breast muscle and thigh meat were expressed as their rates to the carcass weight and the relative weight of liver, gizzard, abdominal fat, spleen, Bursa of Fabricius, and thymus and are reported as the percentage of live weight. Among the broiler chickens sacrificed without stress via cervical dislocation, carcass were used for sensory evaluation.

Meat Color Evaluation

The meat color was measured in the breast muscle using Minolta reflectance Colorimeter (Minolta Chroma Meter, CR-300, Minolta corp, Osaka, Japan). Briefly, the breast muscle was cut and exposed to air for 15 min at room temperature prior to color measurement.

Statistical design and analyses

The data were statistically analyzed by applying paired sample t-test. Remaining data were subjected to statistical analysis by applying one way ANOVA using statistical package for social sciences (SPSS) 15.0 version. Differences between means were tested using Duncan's multiple comparison test and significance level was set at 0.05.

Results and Discussion

Weekly body weights

The body weights (g) in the control group 1 was significantly ($p<0.05$) lower (ranged from 107.8 ± 2.9 to 1951.9 ± 72.5) as compared to the other groups throughout the experiment. The body weights in group T1 were significantly ($p<0.05$) higher as compared to all the other groups upto day 42 (ranged from 108.9 ± 4.5 to 2299.1 ± 60.3). The weights in groups T2 were significantly ($p<0.05$) higher (ranged from 110.8 ± 3.0 to 2178.6 ± 101.7) as compared to group T0 and T3 at the end of day 42 but lower in comparison to group T1. The body weights in the groups T3 were significantly ($p<0.05$) higher as compared to group T1 at the end of day 42 (Table 3).

The present study on performance indicated lower body weights and poor feed efficiency in the heat stressed group and were comparable with the earlier findings (Stephen *et al.,* 1998; Cooper and Washburn, 1998; Sahin and Kucuk, 2001). During the stress, nutrients are not digested and absorbed efficiently and animal must rely on nutrient reserves of the body which is mostly diverted to perform the vital functions of the body depriving the energy to less important functions such as egg production, growth and immunity. Also the muscle protein synthesis is retarded as the carbon skeleton of the amino acids is used for energy. Thus the full genetic potential of the bird for growth is not expressed during stress, thus resulting in lower body weights as observed in the present study. Stress in broilers results into decline in body weight, feed consumption and overall feed efficiency. However, supplementation of antioxidants along with basal diet is scientifically well proven to improve growth and performance in birds (Sahin *et al.*, 2003).

The results of body weight gain after 6th week corraborates with those of Sapcota *et al.*, (2006) and Maini *et al.*, (2007), who reported increase in body weight gain when *Phyllanthus emblica* was fed to the broilers at the end of 6th week. Sahin *et al.*, (2003) and Njoku (1986), in their studies found increased body weight gain in ascorbic acid supplemented group than the control broilers under heat stress. Mujeeb (1995) and Pradhan (1995) in their study observed that Stresroak (polyherbal formulation) supplemented birds showed increased body weight gain as compared to control group. The results of Production performance of Herbal drug supplementations were on par with synthetic Vit.C (AA) supplementation which is in agreement with Njoku (1986) who concluded that during periods of heat stress in the tropics, dietary supplementation of broiler diets with 200 mg of ascorbic acid per kg (90 mg per lb) of feed was necessary and economically advantageous as body weight and feed:gain responses were improved.

Internal Organs Weight, Meat quality and carcass traits

From table 4 it is observed that there was no any significance difference between different groups in the internal organs weight and all organs within normal weight, only bursa in T1 group was slightly higher than other groups. This explains that the anti-stress feed additives either Ayucee® and AV/LAP/19 or vitamin C; has no any adverse effect in internal organs.

Table.1 Therapeutic groups

]	Treatment group	No. of birds/pen/ replication	No. of replicates	Total number of birds/ treatment	Dose (kg/tone feed)
1	Group- $\mathbf{T_0}$: Control (Environment stress without Antistressor	10	3	30	**No treatment**
2	Group- $\mathbf{T_1}$ Summer stress (environmental) + synthetic vitamin C	10	3	30	**Synthetic Vit. C (AA) 100g/ton of feed**
3	Group- $\mathbf{T_2}$: Summer stress (environmental) + Ayucee®	10	3	30	**Ayucee^R premix @100g/ton of feed**
4	Group- T_3: Summer stress + (environmental)+ AV/LAP/19	10	3	30	AV/LAP/19 Starter: @1 ml/100 birds/day in water Grower: @ 2ml/100 birds/day in water Finisher: @ 3ml/100 birds/day in water

Table.2 Composition of diets for broiler (starter and finisher phases)

Ingredients	Starter phase (%)	Finisher phase (%)
Maize	46.00	50.00
Soybeanmeal	18.50	12.00
Groundnutcake	15.00	11.00
Fishmeal	2.00	2.00
Wheatoffal	12.45	19.05
Bonemeal	2.00	2.00
Oystershell	3.00	3.00
Salt	0.25	0.25
Premix	0.25	0.25
Methionine	0.30	0.25
Lysine	0.25	0.20
	100	**100**

Calculated Crude protein(%)	23.05	19.91
M.E(Kcal/kg)	2816	2809.6
Etherextract(%)	3.93	3.89
Crude fibre(%)	3.67	3.79
Calcium(%)	1.75	1.74
Phosphorus(%)	0.43	0.41

* 1kg of premix contains:
Vitamin A-10,000,000 IU; Vitamin D3-2,000,000; Vitamin E-20,000 IU;Vitamin K-2,250mg; Thiamine B1-1,750mg; RiboflavinB2- 5,000mg;PyridoxineB6-2,750mg;Niacin-27,500mg;VitaminB12-15mg;Pantothenicacid-7,500mg;Folicacid-7500mg;Biotin-50mg;Cholinechloride-400g;Antioxidant-125g;Magnesium-80g;Zinc-50mg;Iron-20g;Copper-5g;Iodine-1.2g;Selenium-200mg;Cobalt-200mg

Table.3 Effect of Ayucee/AVLAP supplementation via diet and drinking water on LBW and BWG of broiler chicks reared under summer conditions

Body weights (g)	T0	T1	T2	T3
Day 0	39.6 ± 0.4	39.5 ± 0.4	39.7 ± 0.3	39.8 ± 0.4
Day 7	107.8 ± 2.9	108.9 ± 4.5	110.8 ± 3.0	115.4 ± 3.7
Day 14	236.6 ± 9.9	258.5 ± 12.7	267.2 ± 14.7	267.0 ± 16.1
Day 21	511.3 ± 27.1	555.0 ± 25.2	563.4 ± 31.8	509.2 ± 38.4
Day 28	939.7 ± 45.2	995.3 ± 41.8	977.1 ± 47.9	984.7 ± 67.9
Day 35	1428.9 ± 56.9	1512.1 ± 61.1	1555.9 ± 46.7	1493.2 ± 90.6
Day 42	1951.9 ± 72.5	2299.1 ± 60.3	2178.6 ± 101.7	2070.0 ± 74.5

BWG (g)	T0	T1	T2	T3
BWG0-7	68.2 ± 3.8	69.4 ±7.4	71.1 ±3.3	75.6 ±4.0
BWG_{7-14}	128.8 ± 8.9	148.6 ±8.1	154.8 ±12.1	158.7 ±18.7
BWG_{14-21}	273.6 ± 20.9	293.3 ±22.7	294.4 ±17.7	252.2 ±42.6
BWG_{21-28}	427.3 ± 27.0	437.1 ±24.0	412.3 ±10.0	483.9 ±40.2
BWG_{28-35}	493.1 ± 41.1	515.4 ±44.3	585.0 ±35.9	518.8 ±31.6
BWG35-42	515.8 ± 46.7	456.9 ±15.4	540.7 ±23.8	595.2 ±78.3
$cBWG_{0-21}$	470.6 ± 17.4	511.2 ±32.8	520.3 ±32.1	486.5 ±56.6
$cBWG_{0-42}$	1906.8±90.09	1920.6 ±105.9	2058.2 ±44.5	2084.4 ±146.5
$cBWG_{21-42}$	1436.2 ± 87.9	1409.4 ±76.0	1538.0 ±28.0	1597.9 ±123.1

Results are expressed as mean ± standard deviation.
BWG: body weight gain; BWGi-i+1: body weight gain calculated weekly; cBWG0-i: cumulated body weight gain calculated for a period of idays; cBWG21-42: cumulated body weight gain determined for the finish period (from day 21 to day 42).

Table.4 Effect of Ayucee and AV/LAP/18 supplementation via diet and drinking water on the carcass traits and visceral organ weights in broiler chickens reared under summer conditions

	T0	T 1	T2	T3
Slaughter weight (g)	1951.6 ±27.4	2070.9 ±68.1	2299.1 ±60.5	2178.9 ±44.6
Hot carcass weight (g)	1264.4 ±24.3	1323.1 ±58.7	16750.6 ±59.7	1528.8 ±32.9
Carcass yield (%)	64.78 ±0.9	67.15 ±0.9	72.85 ±0.8	70.15 ±0.5
Heart weight (g)	12.69 ±1.29	12.39 ±1.04	12.47 ±0.65	12.51 ±0.68
Heart yield (%)	0.63 ±0.06	0.60 ±0.04	0.57 ±0.04	0.60 ±0.03
Liver weight (g)	43.11 ±1.61	44.53 ±2.61	46.30 ±0.83	45.44 ±1.14
Liver yield (%)	2.16 ±0.08	2.15 ±0.11	2.12 ±0.06	2.18 ±0.06
Spleen weight (g)	2.66 ±0.18	3.91 ±0.85	3.87 ±0.38	3.66 ±0.35
Spleen yield (%)	0.13 ±0.01	0.19 ±0.04	0.18 ±0.01	0.18 ±0.02
Gizzard weight (g)	30.71 ±1.12	34.99 ±1.53	34.91 ±1.98	32.14 ±1.52
Gizzard yield (%)	1.54 ±0.08	1.69 ±0.05	1.61 ±0.11	1.53 ±0.05
Bursa weight (g)	3.90 ±0.44	5.01 ±0.85	3.97 ±0.37	5.49 ±0.37
Bursa yield (%)	0.20 ±0.02	0.24 ±0.04	0.18 ±0.02	0.26 ±0.02
Abdominal fat weight (g)	4.60 ±1.35	7.73 ±1.36	6.15 ±2.59	4.90 ±0.97
Abdominal fat yield (%)	0.23 ±0.07	0.36 ±0.06	0.28 ±0.12	0.24 ±0.05

Organ yield was calculated by the following formula: 100 x organ weight / carcass weight

Table.5 Effect of Ayucee and AV/LAP/18 supplementation via diet and drinking water on Meat traits in Broiler Chickens reared under summer conditions

	T0	T1	T2	T3
Color traits				
Lightness	55.76[b]	60.17[a]	60.72[a]	60.42[a]
Redness	4.67[a]	3.94[ab]	3.29[b]	3.53[b]
Yellowness	16.15	15.98	16.37	15.73
Sensory traits				
Color	7.55[c]	8.02[b]	8.74[a]	8.13[b]
Flavor	7.67[c]	7.53[c]	8.74[a]	8.13[b]
Taste	7.38[c]	8.07[b]	8.64[a]	8.13[b]
Texture	7.51[c]	8.05[b]	8.52[a]	8.13[b]
Acceptibility	7.55[c]	8.24[b]	8.74[a]	8.13[b]

Mean ± SE bearing different superscripts differ significantly ($p \leq 0.05$)

Meat described as pale, soft, and exudative (PSE) has become a serious quality problem for many poultry processors and consumers. Meat exhibiting PSE has reduced water-holding capacity, protein extractability or denaturation, and textural gel strength properties (Warris and Brown, 1987; Camou and Sebranek, 1991; Northcutt *et al.*, 1994; McKee and Sams, 1997). The degree of myofibril protein denaturation is directly related to water-holding capacity, i.e., as denaturation increases, water content in the meat decreases. When pork or poultry exhibits PSE, it contains myoglobin that has been oxidized to metmyoglobin; thus, such meat exhibits a grayish-pink color with exudative, wet surfaces that reflect more light and have a pale appearance (Warris and Brown, 1987; Barbut, 1993; Ferket and Foegedling, 1994; Fernandez *et al.*, 1994; Northcutt *et al.*, 1994). In broilers, PSE is a condition that occurs most often during hot summer months and when there is a continuous increase in muscle metabolism (Froning*et al.*, 1978; Honikel, 1987; Northcutt *et al.*, 1994; Backstrom and Kauffman, 1995; McCurdy *et al.*, 1996; D'Souza *et al.*, 1998). In broilers, skeletal muscle on the breast (pectoralis muscles) and legs (iliotibialis) often exhibit areas that appear to contain damaged fibers. These areas are white, and strands of muscle fibers appearing to have been cooked are readily apparent (Kjolberg*et al.*, 1963; Thompson *et al.*, 1987). Exposure of animals to adverse environmental conditions evokes adaptive, i.e., acclimative, responses. These responses are generally of two types: specific or nonspecific. A specific response is mounted to alleviate a specific condition. As an example, when body temperature rises, surface blood vessels dilate, which allows greater blood flow to the periphery to ensure dissipation of excess heat (King and Farner, 1962). Specific responses are not stress responses, rather, they are adaptive or acclimative responses. A nonspecific response, regardless of the type of stimulus, acts to increase the animal's overall resistance to stress.

Nonspecific responses have been termed physiological stress responses. The most notable is secretion of glucocorticoids by the adrenal cortex (Nagra *et al.*, 1963).The initiation of a chain of events that culminates in secretion of glucocorticoids is recognition of the stimulus at the level of the hypothalamus, which results in secretion of corticotropin-releasing factor (Resko *et al.*, 1964; Salem *et al.*, 1970). Then corticotropin-releasing factor is secreted directly into the anterior pituitary via the hypophyseal portal circulation where it activates the release of adrenocorticotropin (ACTH). After entering general circulation, ACTH is targeted to cells in the adrenal cortical tissue, where it causes synthesis and secretion of specific glucocorticoids. In the case of birds, the major secretion is corticosterone (CS) (Nagra *et al.*, 1963). After CS enters general circulation, it acts on many cells, but particularly muscle cells, to convert proteins to glucose. This process is termed gluconeogenesis and is the major metabolic mechanism by which an animal resists stress and returns to the homeostasis (Siegel, 1995). The meat quality and carcass traits of the birds of T2, T3 and T1 (Table 5) are significantly different from the control (T0) which is in agreement with the above research findings. Thus Ayucee is having heat ameliorating activity and immunomodulatory properties as compared to AV/LAP/19 and synthetic Vitamin C.

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