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Role of polyherbal liquid antistressor product in improving meat quality attributes in broilers

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Adverse effect of various stressors is exhibited through impairment of cellular functions by altering oxidative metabolism leading to poor meat quality. This may be associated with reduction in growth, performance and feed efficiency. An experiment was carried out on 90 day old Vencob straight run commercial broiler chicks for a period of 42 days (6 weeks), which were randomly divided into three groups (n=30) of three replicates each. Untreated control group (I) was fed standard basal diet without any supplement, treatment group II was supplemented with AV/LAP/19® (0-14 days)- 1ml/ 100 birds /day, 14-28 days: 2ml/100 birds/day and 28-42days: 3ml/100 birds/day) in water for 0-42 days and treatment group III supplemented with synthetic ascorbic acid@100g/tonne of feed. 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. The product contains constituent herbs, *Phyllanthus emblica, Ocimum sanctum, Terminalia chebula* and *Withania somnifera.* During present experiment, growth and performance parameters were recorded at weekly intervals. Carcass traits, physicochemical attributes of raw and cooked meat were analyzed at the end of experiment. The mean live body weight (g) on 42nd day was significantly (P<0.01) higher in AV/LAP/19 supplemented group II (2281.67±4.05) than group III (2173.33±4.31) and the control group (2000.00±8.35), the mean weekly feed consumption and FCR was non-significantly different between both the treatment groups and better and lower than the control group. The carcass yield (g) of the treated group II (1643.35±8.21) was significantly (P<0.01) higher than Vitamin C treated group III (1585±12.06) and control group (1425.37±9.25). Treated group II and III revealed significantly (P<0.01) higher dressing % (75.24±0.57 and 76.23±0.57) as compared to control (74.41±0.06). The mean value of fillet, tender and giblet yield was also significantly (P<0.01) higher in treatments than control. Physicochemical analysis of raw meat revealed that supplementation of herbal antistressor product are efficacious in optimizing protein and fat content of raw meat and also in maintaining sensory quality of meat. During frozen storage (-18±20 C) at 60th day, higher mean value of thiobarbituric acid (TBA) and tyrosine value of control is indicative of oxidative rancidity of meat and breakdown of proteins, respectively. In contrast, supplementation of AV/LAP/19 and ascorbic acid significantly lowered TBA and tyrosine value suggesting its efficacy to improve shelf life of raw meat. Sensory quality analysis of Microwave Cooked Breast Fillets (MWBF) of Broilers and Microwave Cooked Breast Tenders (MWCT), indicated a significant improvement in organoleptic characteristics (appearance, colour, odor, flavour, juiciness, texture and tenderness) in treated groups than control. It can be concluded that supplementation of herbal antistressor product as well as acorbic acid is efficacious in improving overall meat quality attributes in broiler s and the results of two treatments are non-significantly different from each other.

Keywords: Antioxidant, carcass, organoleptic, physicochemical, sensory.

INTRODUCTION

More emphasis than ever before is now placed on global food security. Raw and cooked meat quality is of immense consideration to consumers. Appearance is the major criterion for purchase, selection and initial evalua-

tion of meat quality. The ISO definition of quality is “the totality of features and characteristics of a product that bear on its ability to satisfy stated or implied needs” (ISO, 1986). Quality aspects of meat include food safety, sensory quality, animal welfare and sustainability of production. With respect to sensory quality, appearance is important in choosing meat and factors like taste may dominate over appearance in re-purchase of meat (Dransfield et al., 2005). Poultry meat is susceptible to development of off-flavour (Gray and Pearson, 1987), changes in texture and nutritive value (Pearson et al., 1983). In addition to this, textural characteristics in general and tenderness particularly have been noted as the most important factors determining quality of meat products (Savell, 1989). Apart from texture, juiciness, hysic and colour are the main quality parameters that could impact the acceptability of the products (Wood et al., 1995). Inherent characteristics of animal, long and short-term environmental influences on animal, a number of stress factors and processing parameters that affect the carcass or meat directly are all factors that influence meat colour, texture and hysic (Lyon et al., 2004). Stress has long been recognized as having a detrimental effect on broiler production efficiency and meat yield (Aksit et al., 2006). Exposure to high ambient temperatures has been reported to cause undesirable changes in meat quality in broilers. Among various stressors, oxidative stress constitutes an important mechanism of biological damage in live animals and it is regarded as the cause of several pathologies that affect poultry growth. In a similar way, oxidative rancidity represents one of the main causes of meat deterioration (Morrissey et al., 2006). Besides producing unpleasant odors, it is responsible for the loss in hysic, texture, consistency, appearance and oxidative rancidity of the meat (Valenzuela and Nieto, 1996). In a similar way, oxidative rancidity represents one of the main causes of meat deterioration (Morrissey et al., 2006). Certain antioxidant control mechanisms may be adopted so as to reduce the oxidative stress induced generation of reactive oxygen species (ROS) and free radicals, tissues susceptible to oxidation, in order to improve the meat oxidative stability. There has been a resurgence of interest in improving the physicochemical and sensory properties of meat, as well as its storage life. In pursuit of improved chicken healthiness and in order to fulfil consumer expectations in relation to food quality, poultry producers more and more commonly apply natural feeding supplements, mainly herbs (Gardzielewska et al., 2003). The positive effects of herbal supplements on broiler performance, carcass quality and quality traits of meat have been demonstrated (Schleicher et al., 1996). (Onibi, 2003) reported the use of supplementary tocopheryl acetate in the diets of pigs which increased the concentration of vitamin E as well as the oxidative stability of meat. Thyme (*Thymus vulgaris*) addition to minced broiler chicken meat similarly retarded the rate of lipid peroxidation (Onibi, 2003). A variety of herbal supplements including garlic (*A. sativum)* have been widely used to maintain and improve health of humans (Freeman and Kodera, 1995). Garlic supplements in broiler chicken have been recognized for their strong stimulating effect on the immune system and the very rich aromatic oils enhance digestion of birds (Gardzielewska et al., 2003). Keeping in view the points as elaborated above, the present trial is conducted to assess efficacy of polyherbal antistressor and antioxidant formulation AV/LAP/19 (M/S Ayurvet Limited, Baddi (H.P.), India that is a natural source of ascorbic acid and bioflavanoids, in improving meat quality attributes in broilers.

MATERIAL AND METHODS

An experiment was carried out at the College of Veterinary and Animal Sciences, Parbhani, Maharashtra in India in collaboration with Ayurvet Limited Baddi, (H.P.), India. 90 day old Vencob straight run commercial broiler chicks were randomly divided into two groups (n=30) of three replicates each. Untreated control group (I) was fed standard basal diet without any supplement; treatment group II was supplemented with AV/LAP/19® (/LAP/19® (0-14 days)- 1ml/ 100 birds /day, 14-28 days: 2ml/100 birds/day and 28-42 days: 3ml/100 birds/day)) in water for 0-42 days and treatment group III is supplemented with synthetic ascorbic acid@100g/tonne of feed. 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. The product contains constituent herbs, *Phyllanthus emblica, Ocimum sanctum, Terminalia chebula* and *Withania somnifera*. Birds of both the experimental groups were fed with standard basal ration with CP (%): 23.05, 22.02 and 20.05, and ME (kcal/kg): 3011, 3100 and 3200 for pre-starter, starter and finisher, respectively. Feed formula is described in Table 1. For both the groups, individual body weights were recorded at the time of grouping at 0 day. The weekly live body weight, the average feed intake and the weekly feed conversion ratio were recorded throughout the experimental period at 7, 14, 21, 28, 35 and 42 days of age at weekly intervals. Among post-slaughter observations, the carcass quality and the raw meat analysis was done by slaughtering representative three birds per replicate at the end of the study during last week of experimental trial. The various parameters were analysed carcass yield, dressing percentage, fillet, tender and giblet yield. Assessment of hysic-chemical attributes of raw meat included Ph (by the method of Troutt et al., 1984), cooking yield, moisture (AOAC, 1995), fat and protein content (AOAC, 1995). The raw meat samples were packed in LDPE pouches and kept at refrigerated temperature (-18±2°C) to assess the shelf life. The shelf life of the raw meat was determined by

Table 1. Feed composition of pre-starter, starter and finisher of control and treatment group (per 100Kg).

Feed ingredients	Prestarter	Starter	Finisher
Maize	53.2	54.0	58.5
Vegetable oil	3.0	4.2	4.9
Soybean meal	41.0	39.0	33.8
Dicalcium phosphate	1.5	1.5	1.5
Limestone powder	1.0	1.0	1.0
Salt	0.3	0.3	0.3
Total	100	100	100
Protein	23.05	22.02	20.05
ME (kcal/kg)	3011.16	3100	3202.22
E : P ratio	130.63:1	140.78 : 1	159.71 : 1
Supplements/additives (g/100 kg)			
Mineral mixture*	300	300	300
Vitamin mixture**	150	150	150
Methionine	180	190	160
Lysine	170	130	100
Choline chloride	60	60	60

* Mineral Mixture: - Copper, , zinc, iron. ** Vitamin Mixture: - Vit. A, D, E, K and Vit. B Complex (riboflavin, thiamine, choline, pantothenic acid, niacin, pyridoxine, biotin, cynocobalamine).

Table 2. Effect of feeding of different herbal formulations on carcass traits in broilers.

Treatment	Quality Parameters					
	Live weight (gm)	Carcass yield (gm)	Dressing (%)	Fillet yield (gm)	Tender yield (gm)	Giblet yield (gm)
Group I (Control)	$2000.00^{d}\pm 8.35$	$1425.37^{d}\pm 09.25$	$74.41^{c}\pm 0.06$	$215.49^{d}\pm 2.11$	$63.41^{b}\pm 0.30$	$105.12^{d}\pm 0.46$
Group II	$2281.67^{a}\pm 4.05$	$1643.35^{a}\pm 8.21$	$75.24^{ab}\pm 0.57$	$265.82^{a}\pm 3.35$	$71.58^{a}\pm 0.28$	$116.51^{a}\pm 0.34$
Group III	$2173.33^{b}\pm 4.31$	$1585.00^{b}\pm 12.06$	$76.23^{a}\pm 0.57$	$246.22^{b}\pm 3.55$	$68.26^{a}\pm 0.36$	$112.41^{b}\pm 0.35$
SE ±	14.40	12.63	0.362	2.16	1.42	0.46
CD	43.20	37.89	1.08	6.51	4.26	1.38

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

estimation of tyrosine value and thiobarbituric acid value (TBA) at 0, 15, 30, 45 and 60 days of frozen storage by the method of (Strange et al., 1977). The qualitative analysis of microwave cooked breast fillets and tenders was also done for which fillets and tenders were cooked at a standard power time combination. The other analysed parameters included organoleptic evaluation as per the hedonic scale method given by (Keeton, 1983). The data were analyzed by following standard procedure (Snedecor and Slen, 1994).

RESULTS AND DISCUSSION

A significantly (P≤0.01) higher body weight gain is evident in group II post 2nd week treatment as compared to untreated control group I (Table 2). The mean final body weight (g) at the 6th week is significantly (P≤0.01) higher in AV/LAP/19 supplemented group II (2281.67±4.05) followed by group III (2173.33±4.31) as compared to untreated control group I (2000±8.35). A non-significant difference was evident in feed consumption from 0-3 weeks, however, it was significantly higher from the 4th to 6th week (Figure 3). Feed efficiency was recorded to be non-significantly different from 0-4 weeks, however it was significantly (P≤0.01) lower and better in AV/LAP/19 supplemented group II and ascorbic acid supplemented gorup III as compared to untreated control group I at 5th and 6th week of experimental study (Table 3). The results of carcass traits are suggestive of

Table 3. Weekly feed conversion ratio (FCR) of broilers at different age groups fed with herbal formulation (AV/LAP/19) and Synthetic ascorbic acid.

Age / Treatment	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
A (Control)	1.19	1.40	1.51	1.62	1.82	2.25[c]
B	1.15	1.39	1.48	1.60	1.77	2.05[a]
C	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

Table 4. TBA (mg/kg) value of raw meat at fornitely intervals (60days) of frozen storage (-18±2°C).

Type of Product	Storage period (days)					Treatment mean
	0	15	30	45	60	
	TBA (mg malonaldehyde/Kg)					
Group I (Control)	0.31±0.02	0.39±0.04	0.50±0.02	0.60±0.02	0.66±0.05	0.49[d]
Group II	0.31±0.02	0.33±0.03	0.35±0.05	0.42±0.03	0.54±0.04	0.40[c]
Group III	0.26±0.02	0.28±0.03	0.30±0.05	0.37±0.03	0.49±0.04	0.33[a]
Storage period mean	0.29[a]	0.33[b]	0.35[c]	0.42[d]	0.54[e]	

The letters present the non-significant difference at 95% confidential level are same

Table 5. Tyrosine value (mg/g) of raw meat at fornitely intervals (0-60days) of frozen storage (-18±2°C).

Type of Product	Storage period (days)					Treatment mean
	0	15	30	45	60	
	Tyrosine (mg/100g)					
Group I (Control)	16.24±0.09[a]	16.32±0.12[a]	17.13±0.10[a]	17.98±0.09[a]	19.07±0.11[a]	17.35[a]
Group II	15.11±0.1[b]	15.19±0.13[b]	15.95±0.16[b]	16.76±0.14[b]	17.80±0.12[b]	16.16[bc]
Group III	13.04±0.08[b]	13.12±0.11[b]	13.88±0.14[bc]	14.69±0.12[bc]	15.73±0.10[bd]	14.09[bd]
Storage period mean	14.49[a]	14.56[a]	15.35[b]	16.17[c]	17.23[d]	

beneficial effect of polyherbal antistressor and antioxidant formulation and synthetic ascorbic acid supplement in improving the carcass yield, dressing %, fillet, tender and giblet yield (Table 2). This may be attributed to presence of certain active constituents of each indvidual herb that plays important role in improving quantitative carcass traits of broilers. In AV/LAP/19 supplemented group II and Ascorbic acid suppleemnted group III, carcass yield is higher by 29.64% and 11.20%, dressing percentage by 0.83% and 1.82% fillet yield by 23.2% and 14.26%, tender yield by 12.88% and 8.18% and giblet yield by 10.8% and 6.93%, respectively. The carcass quality parameters were observed to be non-significantly different in the two treatments however fillet tender and giblet yield was numereically better in herbal liquid anbtistressor supplemented gorup. The increase in thiobarbiturate acid (TBA) value particularly at the end of storage is indicative of oxidative rancidity of meat. The TBA value was signficantly lower in AV/LAP/19 and Vit. C supplemented group as observed on day 15th, 30th, 45th and 60th of experimental trial as compared to untreated control group (Table 4). The values on 60th day in treatment group II were within the spoilage limit of 0.60 mg/kg where the off flavours are generally detected (Greene and Cumuze, 1982), this suggests that the meat of herbal antistressor AV/LAP/19 supplemented treatment group II and that of synthetic vitamin C supplemented group III is even fit for human consumption even at 60th day of frozen storage. The increase in tyrosine is attributed to breakdown of proteins. It is found to be constantly higher from day 0-60th in control group I (Table 3). However, lower tyrosine value in group II and III is indicative of beneficial effect of herbs of AV/LAP/19 in improving shelf life of frozen raw meat (Table 5).

The sensory evaluation of organoleptic traits, i.e. appear, colour, flavour, odor, texture, juiciness, palatability, tenderness. Sensory evaluation revealed significantly better organoleptic traits in group II and III

Table 6. Sensory evaluation of microwave cooked fillets and tenders of control and treatment group.

	Group	Quality Parameters							
		Appearence	Colour	Odour	Flavour	Juiciness	Texture	Tenderness	Overall Palatability
MCBF	Group I	6.10±0.1	6.00±0.1	5.80±0.1	5.66±0.1	6.10±0.2	6.0±01	6.1±0.7	6.0±0.3
	Group II	6.48±0.3	6.81±0.2	6.81±0.2	6.50±0.2	6.83±0.1	6.8±0.4	6.8±0.1	6.6±0.4
	Group II	6.52±0.3	6.91±0.2	6.93±0.2	6.34±0.2	6.73±0.1	6.6±0.4	6.7±0.1	6.91±0.4
MWCT	Group I	6.90±0.1	6.80±0.1	6.60±0.2	6.46±0.1	6.90±0.1	6.8±0.3	6.8±0.5	6.8±0.1
	Group II	7.28±0.5	7.61±0.1	7.61±0.3	7.30±0.4	7.63±0.3	7.6±0.2	7.6±0.1	7.4±0.2
	Group II	7.18±0.5	7.56±0.1	7.72±0.3	7.45±0.4	7.59±0.3	7.76±0.2	7.5±0.1	7.3±0.2
		***: Highly Significant (P≤0.01)*				**: Significant (P≤0.01)*			

(Table 6). The supplementations of AV/LAP/19 in the group II and that of synthetic ascorbic acid in gorup III lead to improvement in appearance and juiciness of cooked meat. Tenderness and overall palatability of meat is better in treated group, this may be attributed to improvement in collagen and myofibrillar solubility of meat due to AV/LAP/19 supplementation. The herbal product has not been observed to exert any untoward or detrimental effect on colour, flavour -and odor of meat.

CONCLUSIONS

It can be concluded that supplementation of polyherbal formulation is efficacious in improving overall meat quality attributes such as carcass yield, dressing %, giblet yield, fillet and tender yield, sensory characteristics of raw meat, proximate values along with marked improvement in digestibility of nutrients and the results so obtained are in confirmation with ascorbic acid suppleemnted gorup III. The organoleptic properties of microwave cooked meat, i.e. appearance, colour, odor, flavour, juiciness, texture, tenderness and overall palatability also improved along with improvement in sensory quality of microwave cooked liver. Based on the physico-chemical as well as microbial observations of storage study, it is indicated that TBA, tyrosine value and microbial count of raw meat of control groups (I) at the end of storage (60^{th} day) is more than the treatment groups which may lead to spoilage easily. Hence, it is concluded that herbal formulation improves shelf life of raw meat which was acceptable up to the 60^{th} day of freezing storage (-18 ± 2^0C). The product doesn't have any residual or adverse effect on raw, eating and cooking quality of meat as well as the products tested have been found safe for animal usage and do not exert any detrimental effect on animal health. AV/LAP/19 is a polyherbal antistressor and an antioxidant formulation which comprises herbal ingredients that are scientifically validated to possess immunomodulator, antioxidant, hypocholesterolemic and hypolipidaemic activity. The product is a rich source of natural bioflavanoids and ascorbic acid that help to reduce oxidative stress thus prevent oxidative rancidity of meat, ameliorate stress in broilers, potentiate immune response and combat lipid peroxidation thus plays an important role in improving meat quality attributes in broilers.

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