RESEARCH PAPER | Veterinary | Volume : 4 | Issue : 1 | Jan 2014 | ISSN - 2249-555X

Lean Meat Production in Broilers with New Polyherbal Formulation AV/LMP/10

KEYWORDS: AV/LMP/10, dressing percentage, hypolipidaemic, hypocholesterolemic, lean meat

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ABSTRACT *Meat fat contains saturated fat and cholesterol which may increase the risk of atherosclerosis & other associated diseases. A study was conducted to assess the efficacy of dietary supplementation of herbal formulation AV/LMP/10 (supplied by m/s Ayurvet Ltd Baddi, India) on meat quality attributes and production of lean meat in broilers for 0-6 weeks. Seventy five day-old Ven Cobb broilers chicks were divided randomly into 3 groups of 25 birds each. All the groups were fed with standard basal ration. Group (T0) was control without any supplement, group (T1) was supplemented with AV/LMP/10@500 g/tonne of feed and group (T2) was supplemented with AV/LMP/10@1 Kg/tonne of feed. The growth performance, carcass and sensory characteristics, proximate analysis of meat and lipid profile of meat was evaluated at the end of the experiment. At day 42, significant results in terms of mean FCR (1.83, 1.82 and 1.81), dressing percentage (%) (65.26, 63.82 and 65.41) and lean meat content were observed in treated groups as compared to control. The protein content (%) of breast and thigh muscle was significantly high (P<0.01) in treated groups as compared to control, whereas the fat (%) and cholesterol (%) content for breast and thigh muscle were lower in treated groups as compared to control. Significant difference in saturated fatty acid, mono and poly unsaturated fatty acids content was observed between treated and control groups. Overall acceptability in terms of flavour, tenderness and juiciness was significantly better in treated group T2 as compared to T1 and control. It can be concluded from the present study that the herbal lean meat product AV/LMP/10 was found to be effective in production of lean meat (chicken), which may be attributed to hypolipidaemic and hypocholesterolemic properties of constituent herbs viz. Commiphora mukul, Allium sativum & Trigonella foenum graecum and many more in fixed concentration.*

INTRODUCTION

Fat is an essential component of meat for sensory perception of juiciness, flavour and texture. But meat can also be a source of unhealthy fat and cholesterol, which are responsible for pathogenesis of various cardiovascular diseases (Department of health, 1994). The perception of healthiness and sensory expectation are important quality criteria that influence the decision of a consumer to purchase a particular food product. The increasing health concerns among the consumers lead to the efforts to develop new foods with positive health benefits (Mallika et al., 2009). During the growth and development of meat animals, genotype and animal diet are important due to their direct influence on muscle characteristics The opportunities to exploit the diet of meat animals and poultry to produce flavorsome meat that has an increased concentration of conjugated linoleic acid, a compound that may protect against obesity, cancer and heart disease, a low fat concentration and a fatty acid profile more compatible with current human dietary recommendations is being practised (Moloney et al. 2002). Strategies are being developed to alter the total fat concentration and the fatty acid composition of meat fat to be more compatible with consumer requirements. Lean meat comprises predominantly muscle protein although some amounts of fat and tallow are present. Reducing the fat content in meat leads to a firmer, rubbery, less juicy product with dark color, prevent rancidity, increase shelf life and more cost (Trout et al. 1992, Paneras et al. 1996). In addition to low fat & high protein the meat should be light in colour, of good smell & taste (Keeton, 1994). AV/LMP/10 is a scientifically developed non hormonal herbal blend in which constituent herbs are useful in producing low fat meat with better organoleptic properties without any negative impact on meat quality. Herbs of AV/LMP/10 viz. *Commiphora mukul*, *Allium sativum* & *Trigonella foenum graecum* are scientifically proven to reduce cholesterol & saturated fat from the body and can effect metabolization to lower and decompose a greater portion of fat as well as reduce the synthesis of fat (Joanna et al., 2003 and Andrianova et al., 2004). The present experimental study was conducted to evaluate the efficacy of new polyherbal formulation (AV/LMP/10) for lean meat production in poultry.

MATERIALS AND METHODS

The experiment was conducted in Department of Livestock Products Technology, College of Veterinary & Animal Sciences, Palampur, HP, India. In the experiment total 75 Ven Cobb day old broiler chicks were procured and maintained under standard housing and management condition. The birds were randomly divided equally to three groups. Group T0: control (basal diet without supplemented of herbal lean meat product AV/LMP/10), group T1: basal diet supplemented with herbal lean meat product AV/LMP/10 @ 500g/ton and group T2: basal diet supplemented with herbal lean meat product AV/LMP/10 @1kg/ton of diet. The product comprises of herbs viz. *Commiphora mukul*, *Allium sativum* & *Trigonella foenum graecum* and many more in fixed concentration. Standard management practices were followed throughout the experiment and all the birds were fed standard soya-maize based basal diet formulated according to the NRC (1994) throughout the experiment.

Growth performance parameters (Total feed consumption, final live body weight, mean Feed conversion ratio FCR and mortality rate), Carcass quality parameters, Physico-chemical analysis, proximate composition, Sensory attributes and Lipid profile were estimated as per the standard procedures at the end of experiment at day 42.

For estimation of carcass characteristics 7 birds from each group were slaughtered by at the end of trial. The live weight and individual weight of slaughter products/by-products of birds were recorded and based on these data dressing weight, lean meat, meat: bone ratio, including other parameter was calculated. In physico-chemical properties, pH was determined by pH meter, Proximate composition (moisture, ash, fat and protein) was determined as per AOAC (2000) and water holding capacity (Wardlaw *et al.* 1973). For Sensory attributes Standard sensory evaluation method using

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8-point descriptive (hedonic) scale with set perform were followed where 8=excellent; 1=extremely poor (Keeton, 1983). Appearance/colour, flavour, juiciness, connective tissue residue, tenderness and overall acceptability parameter were evaluated under standard procedure. In lipid profile the method of Folch *et al.* (1957) was used to extract lipids from the cooked sausage samples. Samples were analyzed for total cholesterol (Tschugaeff reaction as modified by Hanel and Dam 1955) and direct and simple method of O'Fallon *et al.* (2007) was followed for fat extraction and fatty acid profile was estimated by Gas Chromatography.

Statistical analysis
The data was analyzed statistically (SAS, USA) using analysis of variance (ANOVA) for single factor. The F test is used to determine the P values ($P < 0.05$) significant difference between the means of different treatments was determined using Critical Difference (CD) method at 5 per-cent level of significance (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSSION

Growth performance
The results for final body weight, total feed consumption and mean FCR are presented in Table 1. There was no significant difference in the final body weight, total feed consumption and mean FCR, however the values for mean FCR were numerically better in treated groups (1.86 in T2 and 1.86 in T1) as compared to untreated group T0 (1.87). No mortality was observed in any of the group throughout the experiment. The results are in accordance with the findings of Abdel, 2006 and Meraj, 1998, who reported increase in feed conversion efficiency of broiler chicken when fed with *Trigonella foenum graecum* and *Allium sativum* supplemented diet respectively. This may be attributed to the efficacy of constituent herbs of AV/LMP/10 namely *Commiphora nukul*, *Trigonella foenum graecum, Allium sativum* & many more which are scientifically well proven for improving growth, productivity & hepatoprotective action (Rahimi et al., 2011).

Effect on Carcass characteristics
The dressed weight of carcass and weight of its various cuts have been presented in table 2. The dressing percentage was better in high dose AV/LMP/10 supplemented group (T2) (65.4%) followed by T0 (65.2%) and lowest in T1 (63.8%). Significantly higher ($P<0.01$) total lean meat content (breast and thigh muscle) was obtained in treated group T2 (740.14 g), followed by T1 (710.57 g) and lowest in untreated control group (675 g). The meat: bone ratio was significantly high ($P<0.01$) in T2 (1.43), followed by T0 (1.36) and T1 (1.34). The increase in the carcass yield of the broiler chicken was also observed by Abdel, 2006 and Azoua, 2001 in case of *Trigonella foenum graecum*, Sultana et al., 2009 and Ahmad, 2005 in case of A*llium sativum*.

Effect on Physico-chemical parameters and proximate analysis
The results if proximate analysis of meat is given in table 3. There was no difference in the mean pH of meat sample among all the groups and it was within the normal range (6.03 to 6.12). Regarding proximate composition of meat, moisture and ash content of meat were not influenced significantly by dietary supplementation of AV/LMP/10, though there was numerical decrease in the moisture content of treated groups and ash content increased numerically in treated groups. However, significant increase in protein content (breast and leg muscles) and significant decrease in fat content (breast and thigh muscle) was observed in treated groups as compared to control groups. The protein percentage (%) of breast and leg muscle was significantly high ($P<0.01$) in T2 (21.11 and 17.57), followed by T1 (20.90 and 17.44) and lowest in untreated control T0 (20.57 and 17.28). The fat content of breast and thigh muscle was significantly high ($P<0.01$) in untreated control T0 (2.57 and 6.17) followed by T1 (2.37 and 5.20) and lowest in T2 (2.20 and 5.12). The water holding capacity of the treated group T2 was significantly high (38.41), followed by T1 (37.01) and lowest in T0 (34.65). The cooking loss (%) was also significantly low ($P<0.01$) in treated groups (20.23 in T2 and 21.76 in T1) as compared to T0 (24.61).

Effect on lipid profile
The lipid profile of the birds is represented in table 4. Significant difference was observed in cholesterol content of control and treated groups. The herbal formulation was found to be effective in the lowering cholesterol content in the breast and thigh muscle tissue. The cholesterol content of breast and thigh muscle was highest in untreated control group T0 (59.13 and 134.57), followed by T1 (53.48 and 119.15) and lowest in T2 (52.04 and 116.30). There are evidence from randomized clinical trials that *Trigonella foenum-graecum* (Joanna et al., 2003) and *Allium sativum* preparations (Andrianova et al., 2004 and Chetty et al., 2003) reduces cholesterol levels. Studies indicated reduction in triglycerides and cholesterol (including both LDL and VLDL) and a raise in HDL cholesterol after regular use of *Commiphora mukkul* (Mahmood et al. 2010). HDL is good cholesterol which prevents atherosclerosis as compared to LDL which is responsible for causing atherosclerosis and heart diseases (Badimon, 2012).

Total lipid profile is represented in table 5. The percentage of saturated fatty acids decreased significantly in treated groups as compared to untreated control. The percentage of saturated fatty acids (%) was significantly high ($P<0.01$) in T0 (26.85), followed by T1 (25.24) and lowest in T2 (24.45). Saturated fatty acids are generally considered harmful as they are responsible for atherosclerosis and many heart diseases and their percentage should be kept low in the diet (Department of health, 1994). The percentage (%) of mono unsaturated fatty acids (MUFA) was highest in T2 (42.91), followed by T1 (42.71) and lowest in untreated control T0 (42.53). Linoleic acid concentration was significantly increased with rising level of AV/LMP/10 and found highest in T2 (26.06%) followed by T2 (25.62%) and lowest in control (24.69%) whereas the oleic acid concentration was not significantly influenced by dietary supplementation though there was numerical increase in the values. Similar trend was observed in Poly unsaturated fatty acid (PUFA) percentage with highest in T2 (32.65), followed by T1 (32.06) and lowest in T0 (30.62). The ratio of omega-6-fatty acid and omega-3-fatty acids was significantly ($P<0.01$) low in T2 (10.32), followed by T1 (10.61) and highest in T0 (10.80). The dietary-influenced tissue ratios of n-3 to n-6 PUFA are important in their contribution to health and disease (Hibbeln et al. 2006). Excessive amounts of omega-6 polyunsaturated fatty acids (PUFA) and a very high omega-6/omega-3 ratio promotes the pathogenesis of many diseases, including cardiovascular disease, cancer and inflammatory and autoimmune diseases (Department of health, 1994, Simopoulos, 2008). These results may be attributed to hypolipidaemic properties of constituent herbs viz. *Trigonella foenum-graecum* (Prasanna et al., 2000), *Allium sativum* (Chetty et al., 2003) and *Commiphora mukkul* (Mahmood et al. 2010).

Effect on sensory attributes of meat
The sensory scores pertaining to appearance, flavour, juiciness and texture of raw chicken meat are presented in table 5. There was significant difference in the flavour, tenderness and juiciness in between T0 and T1 with T2 The flavour, tenderness and juiciness of T2 (7.27, 6.62 and 6.81) were significantly ($P<0.01$) better than T1 (6.90, 6.86 and 6.89) and T0 (6.90, 6.99 and 7.08). The overall acceptability score of T2 (7.10) samples was significantly ($P<0.05$) higher than T1 (7.02) and control (6.94). Overall the treated chicken chunks were preferred over control.

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Table 1: Effect of AV/LMP/10 on growth performance parameters of birds

Group	Feed Intake per bird (g)	Initial body weight (g)	Final Body weight (g)	Body weight gain (g)	FCR
T0	3373.6	44.88±0.53	1841.20±42.40	1796.32	1.87
T1	3358.4	42.88±0.53	1839.00± 46.21	1796.12	1.86
T2	3315.6	43.92±0.67	1825.80± 43.76	1781.88	1.86

Table 2: Effect of AV/LMP/10 on carcass characteristics and composition

Parameters	T0	T1	T2
Live weight (g) (before slaughter)	1912.14±77.50	1936.43±96.13	1905.71±57.72
Dressed weight (g)	1248.00±66.51	1236.00±81.28	1246.71±46.44
Dressing %	65.26±1.23	63.82±1.28	65.41±63.74
Total Lean Meat (g) (breast and thigh muscle)	675.00±26.13^{a}	710.57±57.09^{b}	740.14±28.60^{c}
Meat: bone ratio	1.36±0.20^{a}	1.34±0.42^{a}	1.43±0.37^{b}

The values with different superscripts differ significantly at P<0.01

Table 3: Effect of AV/LMP/10 on proximate analysis of meat

Parameter		T0	T1	T2
pH		6.03±0.03	6.09±0.03	6.12±0.03
Moisture (%)	Breast	75.08±0.26	74.79±0.10	74.79±0.12
	Leg	74.12±0.23	74.12±0.23	74.63±0.13
Protein (%)	Breast	20.57±0.08^{b}	20.90±0.05^{ab}	21.11±0.21^{a}
	Leg	17.28±0.11	17.44±0.10	17.57±0.08
Fat (%)	Breast	2.57±0.14^{a}	2.37±0.15^{b}	2.20±0.11^{b}
	Leg	6.17±0.25^{a}	5.20±0.08^{b}	5.12±0.07^{b}
Ash	Breast	1.73±0.03	1.84±0.04	1.86±0.06
	Leg	1.84±0.05	1.90±0.04	1.89±0.05
WHC		34.65±0.97^{b}	37.01±0.94^{ab}	38.41±0.58^{a}
Cooking Loss (%)		24.61±0.36^{a}	21.76±0.49^{b}	20.23±0.47^{c}

The values with different superscripts differ significantly at P<0.01

Table 4: Effect of AV/LMP/10 on cholesterol and lipid profile of broilers

Parameters	T0	T1	T2
Cholesterol content (breast)	59.13±1.13^{a}	53.48±0.85^{b}	52.04±0.48^{b}
Cholesterol content (thigh)	134.57±2.11^{a}	119.15±1.26^{b}	116.30±1.24^{b}
Saturated fatty acids	26.85±0.67^{a}	25.24±0.36^{b}	24.45±0.53^{b,c}
Oleic acid (g/100g of fat from muscle)	39.01±1.01	40.03±0.24	40.24±0.53
Mono unsaturated fatty acids (MUFA)	42.53±0.96^{a}	42.71±0.33^{a}	42.91±0.51^{a}
Linoleic acid (g/100g of fat from muscle)	24.69±0.67	25.62±0.12	26.06±0.38
Polyunsaturated fatty acids (PUFA)	30.62±0.68^{a}	32.06±0.15^{b}	32.65±0.15^{b}
Omega n-6/n-3 ratio	10.80±0.56^{a}	10.61±0.00^{b}	10.29±0.12^{b}

The values with different superscripts differ significantly at P<0.01

Table 5: Effect of AV/LMP/10 on sensory attributes of meat

Parameter	T0	T1	T2
Appearance	7.20±0.09	7.17±0.08	7.29±0.07
Flavour	6.90±0.05^{b}	6.90±0.05^{b}	7.27±0.05^{a}
Tenderness/texture	6.99±0.06^{a}	6.86±0.06^{a}	6.62±0.06^{b}
Juiciness	7.08±0.06^{a}	6.89±0.06^{b}	6.81±0.07^{b}
Overall Acceptability	6.94±0.52^{b}	7.02±0.44^{ab}	7.10±0.51^{a}

The values with different superscripts differ significantly at P<0.01

CONCLUSION

Finally it can be concluded from the present study that the herbal formulation AV/LMP/10 at both the inclusion rates was found to be effective in production of lean meat though better results were evident at 1 Kg/tonnes. However, addition of AV/LMP/10 @500g /tonne also brought significant differences in various fat & cholesterol related parameters as compared to untreated control. Addition of AV/LMP/10 also improved the overall acceptability of the meat in terms of sensory attributes. These results may be attributed to hypolipidaemic and hypocholesterolemic properties of constituent herbs viz. *Commiphora mukul*, *Allium sativum* & *Trigonella foenum graecum* and many more in fixed concentration.

ACKNOWLEGDEMENT

The Author is thankful to Dean College of veterinary & animal sciences, Palampur, Himachal Pradesh, India for providing all the necessary facilities for the successful conduct of the trial and Ayurvet Ltd. Baddi for providing necessary samples.

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