International Journal of

Agricultural Research

ISSN 1816-4897

Academic
Journals Inc.

www.academicjournals.com

International Journal of Agricultural Research 2 (12): 987-996, 2007
ISSN 1816-4897

Effect of Herbal or Synthetic Methionine on Performance, Cost Benefit Ratio, Meat and Feather Quality of Broiler Chicken

G. Halder and B. Roy
Department of Animal Nutrition, W.B. University of Animal and Fishery Sciences, 37, K. B. Sarani, Belgachia, Kolkata-700 037, India

Abstract: An experiment was conducted for comparative study on the performance of commercial broiler chickens fed ration with DL-methionine or with herbal methionine. A-day old, 180 Ven Cobb broiler chicks were randomly divided into three experimental groups, comprising three replicates. Each replicate was consisted of 20 birds. The birds were fed basal diet without methionine supplementation (C), diet with DL-methionine at 1.2 kg ton^{-1} of feed (T_1) and diet with herbal-methionine at 1.2 kg ton^{-1} of feed (T_2). Superior performance ($p<0.05$) in body weight gain and Feed Conversion Ratio (FCR) were found in methionine supplemented group in either synthetic or herbal form. The cumulative feed and protein consumption were varied significantly ($p<0.01$) among the groups due to dietary treatments. Protein and energy utilization percentage was also varied significantly ($p<0.01$) among the groups. Liver protein, lipid and triglyceride varied ($p<0.01$) due to supplementation of DL-methionine or herbal methionine. Though methionine supplemented groups had little effect on meat quality but had supper effect on feather quality of broiler chicken. Statistical analysis revealed that cost benefit ratio was found significantly and economically viable in T_1 and T_2 groups than control. In terms of body weight gain, FCR, protein and energy utilization ability, feather quality, the superior performances were found in methionine (both form) supplemented group than control group where no methionine either synthetic or herbal form was supplemented form external source.

Key words: Performance, herbal methionine, DL-methionine, broiler, FCR, weight gain, meat and feather quality, cost benefit ratio

INTRODUCTION

Poultry nutrition has improved a lot for past few decades. In spite of advances made on the nutritional aspects, a lot many nutritional problems are still remaining unsolved and serve as a challenge to investigators in this field worldwide. Genetic potentiality of broiler chickens is increasing day-by-day; hence reassessment of nutrient requirements is essential to bridge the gap between the genetic improvement and nutritional requirements. One of the most important areas is amino acid nutrition. Of the essential amino acids required for poultry methionine is usually first limiting in diets based on maize and soybean meal (Fancher and Jensen, 1989). One cause of methionine deficiency is the fact that large amounts of vegetable protein supplements are now used in feeds, plus low levels of animal and fish proteins (North and Bell, 1990). It is more economical to add methionine than more soybean meal or other natural protein to meet the requirement.

Methionine, an indispensable amino acid, must be supplied in the diet of the chicken, as the poultry birds are unable to synthesize it in the amounts necessary to sustain life and growth. Methionine is required at higher level than normal level to comply with the increased tissue demands

Corresponding Author: B. Roy, Department of Animal Nutrition, W.B. University of Animal and Fishery Sciences, 37, K.B. Sarani, Belgachia, Kolkata-700 037, India Tel: +919830420154

when bird is predisposed to fast growth along with high production performance. The increase in demand for cheap meat has given rise to the use of synthetic compounds in feed. Recently the safety of such practices has been questioned and their use is becoming restricted in many regions of the world. Therefore, there is great renewed interest in developing natural alternative supplements to maintain animal performance and well being. When more synthetic amino acids are used, not only the crude protein supply is reduced but excess of limiting amino acids are usually minimized. In a normal diet the supply of non-essential nitrogen arises from dietary non-essential amino acids plus any excess of essential amino acids. Limited supply of non-essential nitrogen is often quoted as a cause for poorer performance of birds fed low protein-amino acid fortified diets. The growth rate of birds is often inferior when regardless of amino acid balance, the ratio of crude protein: synthetic amino acid is much less than 16: 1 (Leeson and Summer, 2001). Methionine may act as a lipotropic agent through its role as an amino acid in balancing protein or through its role as a methyl donor and involvement in choline, betaine, folic acid and vitamin B_{12} metabolism (March and Biely, 1956; Chen *et al*., 1993). Methionine serves as an integral portion of body protein, is a precursor for cystine and an important source of dietary sulfur. S-adenosyl methionine is a potent donor of methyl groups, which contributes to the synthesis of many important substances including epinephrine, choline and creatine (Bender, 1975). Fancher and Jensen (1989) set methionine in the first position among amino acids limiting chicken growth.

Nature has provided natural plants with methionine in dipeptide and oligopeptide forms in readily digestible composition. When nature provided methionine to the plants for sustaining life and growth, it also concomitantly provided the enzymes required for conversion of methionine into L-isomer of active form (SAM) for its optimum utilization. Herbal methionine (HerboMethione®) as a source of Active Methionine is claimed to be effective in its optimum activity for proper protein accretion and other functions in poultry birds so that they can reach better growth and performance potential. In this perspective a study was conducted to evaluate the effects of herbal methionine in commercial broiler chicken in comparison with synthetic methionine.

MATERIALS AND METHODS

One hundred and eighty day-old, commercial broiler chicks (Ven Cobb) were randomly divided into three experimental groups, each of which comprised three replicates. Each replicate consisted of 20 birds. Groups were control (C) - Basal diet without methionine supplementation, treatment 1 (T_1) - Diet with synthetic DL-methionine at 1.2 kg ton^{-1} of feed and treatment 2 (T_2) - Diet with HerboMethione as a herbal-methionine at 1.2 kg ton^{-1} of feed. The rations were isonitrogenic in control and treatment groups and formulated according to BIS (1992). The research was carried out on June 2004-July 2004 at the department of Animal Nutrition, West Bengal University of Animal and Fishery Sciences, Kolkata, India.

Management

Both broiler starter and broiler finisher rations were offered to the birds in mash form. Starter mash was fed from second day of experiment to 28th day of experiment. After that finisher ration was provided up to the end of experiment. Birds were maintained on a 24 h constant light schedule. Feed and water were offered for consumption *ad libitum*. The brooding temperature was maintained close to the requirement. Vaccination of birds was done time to time (Table 1).

Body Weight

Daily body weight of individual bird was recorded to evaluate the growth rate. On the basis of this daily body weight, cumulative body weight (weekly) of birds of each replicate was measured.

Table 1: Ingredients and chemical composition of starter and finisher diet

Ingredients (kg/1000 kg) as air dried basis	Starter	Finisher
Maize	554.60	615.00
Rice polish	40.00	50.50
Soyabean	335.00	250.40
Fish meal	50.00	50.00
Calcite	4.20	5.50
DCP	11.00	11.00
Soyabean oil	--	12.00
Salt	0.20	0.95
Trace mineral mixture†	1.00	1.00
Vitamin premix ‡	0.30	0.45
Choline chloride	0.80	0.80
Maduramycin	0.50	0.50
Sodium bicarbonate	1.00	1.00
Zn oxide	0.20	0.20
Mn sulfate	0.20	0.20
Natuzyme¶	0.50	0.50
Lincomycin (1%)	0.50	0.40
Total amount	1000.00	1000.00
Chemical composition		
Dry matter (%)[a]	89.23	89.76
CP (%)[a]	22.87	20.00
ME (kcal kg^{-1})[b]	2850.00	2960.00
Calorie: Protein[c]	125.00	148.00
Calcium (%)[a]	0.92	0.90
Av. phosphorus (%)[b]	0.46	0.45
Crude fiber (%)[a]	2.91	2.75
Methionine (%)[b]	0.42	0.29
Lysine (%)[c]	1.20	1.06

†: Composition of each kg trace mineral mixture : Cu, 15 g; Co, 02 g; Fe, 60 g; Zn, 80 g; Mn, 80 g; I, 02 g; Se, 0.3 g; Mo, 0.1 g, ‡: Each kg contains : Vitamin A 80 MIU; Vitamin D_3 12 MIU; Vitamin E -70 g; Vitamin K_3-8 g; Vitamin B_1-6.4 g; Vitamin B_2-40 g; Vitamin B_6-12.8 g; Vitamin B_{12}-160 mg; Nicotinic acid-80 g; Vitamin B_5-115 g; Folic acid-4 g; Biotin-24 mg, ¶: Each kg contains: Cellulase-6,000,000 U; Xylanase-10,000,000 U; β-glucanase-700,000 U; α-amylase-700,000 U; Pectinase-70,000 U; Protease-3,000,000 U; Phytase-400,000 U, [a]: Assayed value, [b]: Calculated value

Feed Consumption

The feed consumption in each replicate was recorded daily by subtracting the weight of residual feed from the total quantity offered. After that, cumulative feed consumption was measured on cumulative basis for each replicate.

Feed Conversion Ratio

The weekly feed conversion ratio was calculated on cumulative basis for each replicate.

Cumulative Energy and Protein Consumption

Cumulative energy and protein consumption were calculated from cumulative feed consumption.

Energy and Protein Utilization

To evaluate the energy and protein utilization efficiency of birds, a 5 day metabolic trial was conducted starting from 38th day of experiment. At first energy and protein value of the feed consumed by the birds were calculated. After that faecal energy value by bomb calorimeter and protein value by standard method of AOAC (1995) were estimated. Thereby, energy and protein utilization percentage were calculated.

Meat Quality

At 42 days of age, 4 birds from each replicate were sacrificed as per standard procedure of evaluation of carcass characteristics. Then the carcasses were defeathered, eviscerated and evaluated for dressing, bleeding, thigh muscle, breast muscle and abdominal fat percentage. Water holding capacity of meat samples was determined (Offer and Knight, 1988). The pH of the finely minced meat was also determined (Gillespie, 1960) by using digital pH meter (Systronics, model 335).

Liver Lipid, Liver Protein and Liver Triglyceride Concentration

Livers were collected from the birds by careful removal of gall bladder, thoroughly washed in running tap water and immediately stored at -20°C in individual sample bags until analyzed further. Liver protein was estimated according to AOAC (1995). Total liver lipid was determined by the method of Folch *et al.* (1957). Liver triglyceride was estimated as per the standard method described by Fletcher (1968).

DNA and RNA Ratio of Liver

DNA and RNA of liver were estimated as per the standard method described by Clark (1964) in Experimental Biochemistry.

Blood Collection

Collection of blood was done at 42nd day of the trial. So for doing this 10 birds from each replicate were randomly taken and approximately 5 mL of blood was collected from the wing vein and kept in properly labeled tubes. By centrifuging the whole blood plasma was collected separately in plasma vials.

Total Protein, Albumin, Globulin, AST and ALT

Total plasma protein in each sample was determined with the help of UV visible Spectrophotometer as per the method described in diagnostic kit (Keller, 1991). Plasma albumin in each sample was determined with the help of autoanalyzer, Microlab 200 as per the method described in diagnostic kit (Tietz, 1994). The globulin fraction in the plasma samples was calculated by subtractions of plasma albumin from total plasma protein. The plasma AST and ALT were measured as per the method suggested by Schlebusch *et al.* (1974) as described in diagnostic Kit with the help of Microlab 200.

Cost Benefit Ratio

Cost benefit ratio was calculated. Cost of starter ration was Rs. 10.38, 10.55 and 10.53 for group C, T_1 and T_2, respectively. Cost of finisher ration was Rs. 10.30, 10.47 and 10.52 for group C, T_1 and T_2, respectively. Fixed cost estimated for different groups with the cost of chick (Rs. 15.00 chick^{-1}) + Transportation cost (Rs. 5.00 chick^{-1}) + Medicine and Vaccination (Rs. 2.00 bird^{-1}) + Labour charge (Rs. 10.00 bird^{-1}) + Losses due to mortality (Rs. 2.00, 3.00 and 1.50 per bird, respectively for C, T_1 and T_2+ Depreciation of equipments (Rs. 1.00 bird^{-1}). So, fixed cost for C, T_1 and T_2 group was Rs. 38.00, 39.00 and 38.50, respectively. Birds were sold at the rate of Rs. 48.00 per kg gross weight.

Statistical Analysis

The data obtained in all the experiments were subjected to statistical analysis by the software SPSS 10 (SPSS, 1997). Levels of significance were calculated as per the standard method described by Duncan (1995) whenever any effect was found significant.

RESULTS AND DISCUSSION

Performance

Cumulative body weight (Table 2) of experimental birds of different ages except at 4th week of age showed significant variation among different experimental groups due to dietary treatments. The

Table 2: Week wise effect of herbal or synthetic methionine on body weight changes, feed consumption and feed conversion ratio

Group	C	T_1	T_2	p-value
Cumulative body weight changes (g)				
1st week	97.47±2.98^{a}	94.53±2.18^{a}	100.73±1.09^{ab}	*
2nd week	260.13±9.19^{ab}	245.73±0.27^{b}	266.67±2.27^{a}	*
3rd week	470.67±11.72^{BC}	452.27±8.83^{C}	489.07±4.94^{AB}	**
4th week	846.67±3.53	850.33±2.33	864.67±29.04	NS
5th week	1303.00±20.21^{b}	1285.67±15.98^{b}	1324.00±21.00^{ab}	*
6th week	1761.00±5.57^{B}	1758.67±18.65^{B}	1801.33±10.73^{A}	**
Cumulative feed consumption (g)				
1st week	112.30±1.57^{A}	101.54±1.16^{C}	108.50±0.78^{B}	**
2nd week	447.29±14.66^{a}	411.90±6.14^{b}	425.35±3.74^{ab}	*
3rd week	878.78±5.10^{A}	804.52±8.62^{C}	847.08±5.84^{B}	**
4th week	1589.87±3.90^{a}	1534.95±18.93^{ab}	1505.32±28.26^{b}	*
5th week	2478.55±40.29	2328.27±41.36	2339.01±43.75	NS
6th week	3494.48±57.47^{A}	3220.89±54.23^{B}	3232.80±77.71^{B}	**
Cumulative feed conversion ratio				
1st week	1.15±0.02^{A}	1.07±0.02^{B}	1.08±0.02^{B}	**
2nd week	1.72±0.01^{A}	1.63±0.00^{B}	1.59±0.02^{B}	**
3rd week	1.87±0.04^{A}	1.78±0.05^{B}	1.73±0.03^{B}	**
4th week	1.87±0.01^{A}	1.80±0.02^{B}	1.74±0.02^{C}	**
5th week	1.90±0.01^{B}	1.84±0.02^{A}	1.76±0.00^{C}	**
6th week	1.98±0.04^{A}	1.83±0.02^{B}	1.80±0.04^{B}	**

Similar alphabets at superscript denote homogenous means due to Duncan's test at 5% level of significance, *: $p<0.05$, **: $p<0.01$, NS: Non Significant

live weight of T_2 was higher throughout the experimental period. At the end of 6th week birds under T_2 gained the highest live weight which was significantly ($p<0.01$) differed from others. Body weight of C and T_1 at the end of 6 weeks was comparable. There was no significant ($p>0.05$) variation between C and T_1 group in terms of body weight changes. The present findings indicated that supplementation of herbal-methionine (HerboMethione) at 1.2 kg ton^{-1} of feed showed better performance in terms of live weight gain compared to supplementation of DL-methionine at 1.2 kg ton^{-1} of feed. This finding is correlated with the findings of Wang *et al*. (2004) who reported significant response of birds to methionine supplementation in terms of weight gain in 21 days and 42 days. Bertram *et al*. (1991) also reported that the highest level of DL-methionine supplementation (0.15%) the growth was improved by 8.3% than the unsupplemented control group.

Statistical analysis revealed that cumulative feed consumption (Table 2) was varied significantly among the experimental group due to dietary treatments throughout the experimental period except 5th week. At the end of starter period feed intake were found to be varied significantly among the groups. At the end of finishing period total feed intake by control group showed significantly ($p<0.01$) higher value than other groups. This result was in close agreement with the finding of Garlich (1985) who reported that feed intake differed significantly due to methionine supplementation. Findings from cumulative feed intake indicated that supplementation of herbal methionine did not improve the feed intake compared to DL-methionine supplementation.

Supplementation of herbal methionine and DL-methionine significantly ($p<0.01$) improved feed conversion ration (Table 2) than control. Final Feed Conversion Ratio (FCR) at the end of sixth week was higher in T_2 compared to C and T_1. FCR of T_1 significantly differed ($p<0.01$) from C but no significant difference between T_1 and T_2 was observed. This finding is correlated with the findings of Garlich (1985) and Bertram *et al*. (1991) who found that feed conversion was better when methionine was supplemented in the diet. A similar result was also described by Huyghebaert (1993), Schutte and Pack (1995) and Rostagno and Barbosa (1995). But Wang *et al*. (2004) were not agreed with above findings. So it can be concluded that the addition of Herbomethione at 1.2 kg ton^{-1} improved feed conversion ratio of commercial broiler birds, which was beneficial to the farmers and the FCR was comparable to DL-methionine.

Protein and Energy Consumption and Their Utilization

Though protein consumption (Table 3) in T_2 and T_1 group was lower than control group, but protein utilization ability of T_2 and T_1 group was found significantly ($p<0.01$) higher than control group. Statistical analysis revealed that energy utilization capacity of birds differed significantly ($p<0.01$) among experimental groups showing the highest value in T_2 group followed by T_1 and C groups, respectively. From the above result, it can be concluded that supplementation of Herboruthione in broiler ration elevated the efficiency of protein and energy utilization of commercial broiler birds.

Liver and Plasma Biochemical Profiles

Liver protein and lipid (Table 4) were differed significantly ($p<0.01$) among experimental groups. But there was no significant variation in herbal methionine and DL-methionine supplemented group. Therefore, it can be concluded that supplementation of HerboMethione in broiler rations elevate protein concentration in liver and lower per cent liver lipid which have beneficial effects to the birds. This finding indicates that supplementation of HerboMethione facilitates efficient lipid metabolism in the liver and its transportation to body tissues and consequently, it may reduce the incidence of fatty liver in birds. Statistical analysis confirmed that liver triglyceride (Table 4) varied significantly ($p<0.01$) among various experimental groups showing the least value (g kg^{-1}) in T_2 group followed by T_1 and C groups, respectively. Though liver lipid concentration did not varied significantly between T_1 and T_2 groups, but liver triglyceride concentration varied significantly ($p<0.01$) between T_1 and T_2 groups. So supplementation of HerboMethione® in diets decreased liver triglyceride markedly when compared to bird fed DL-methionine (synthetic) supplemented diets.

Table 3: Effect of herbal or synthetic methionine on protein and energy consumption and their utilization

Group	C	T_1	T_2	p-value
Cumulative protein consumption (g)				
1st week	25.65 ± 0.36^{A}	23.19 ± 0.26^{C}	24.78 ± 0.18^{B}	**
2nd week	102.16 ± 3.35^{a}	94.08 ± 1.40^{b}	97.15 ± 0.85^{ab}	*
3rd week	200.71 ± 1.17^{A}	183.75 ± 1.97^{C}	193.47 ± 1.33^{B}	**
4th week	340.55 ± 0.83^{a}	328.79 ± 4.06^{ab}	322.44 ± 6.05^{b}	*
5th week	495.71 ± 8.06	465.65 ± 8.27	467.80 ± 8.75	NS
6th week	698.90 ± 11.49^{a}	644.18 ± 10.85^{b}	646.56 ± 15.54^{b}	*
Cumulative energy consumption (kcal)				
1st week	323.42 ± 4.52^{A}	292.44 ± 3.34^{C}	312.48 ± 2.25^{B}	**
2nd week	1288.20 ± 42.22^{a}	1186.28 ± 17.67^{b}	1225.02 ± 10.77^{ab}	*
3rd week	2530.90 ± 14.69^{A}	2317.03 ± 24.84^{B}	2439.59 ± 16.81^{C}	**
4th week	4693.31 ± 11.50^{a}	4531.16 ± 55.89^{ab}	4443.69 ± 83.41^{b}	*
5th week	7495.13 ± 121.85	7040.69 ± 125.08	7073.16 ± 132.29	NS
6th week	10567.32 ± 173.80^{a}	9739.97 ± 164.00^{b}	9775.10 ± 234.98^{b}	*
Protein and energy utilization (%)				
Protein	60.73 ± 0.12^{B}	65.80 ± 0.47^{A}	66.23 ± 0.52^{A}	**
Energy	63.07 ± 0.09^{C}	69.13 ± 0.23^{B}	69.83 ± 0.20^{A}	**

Similar alphabets at superscript denote homogenous means due to Duncan's test at 5% level of significance, *: $p<0.05$, **: $p<0.01$, NS: Non Significant

Table 4: Effect of herbal or synthetic methionine on liver and plasma biochemical profiles

Groups	C	T_1	T_2	p-value
Liver protein (g kg^{-1})	164.90 ± 2.60^{B}	177.56 ± 1.10^{A}	178.85 ± 0.32^{A}	**
Liver lipid (g kg^{-1})	49.34 ± 1.03^{B}	40.42 ± 0.37^{A}	38.72 ± 0.09^{A}	**
Liver triglyceride (g kg^{-1})	21.01 ± 0.07^{C}	16.54 ± 0.18^{B}	15.94 ± 0.03^{B}	**
Liver RNA: DNA	6.07 ± 0.09^{C}	8.10 ± 0.06^{B}	8.50 ± 0.06^{A}	**
Total protein (g dL^{-1})	3.70 ± 0.63	3.22 ± 0.36	3.25 ± 0.36	NS
Albumin (g dL^{-1})	1.30 ± 0.25	0.90 ± 0.35	1.30 ± 0.12	NS
AST (IU L^{-1})	143.33 ± 12.17	146.67 ± 4.41	155.33 ± 9.84	NS
ALT (IU L^{-1})	6.00 ± 0.58	5.00 ± 0.58	7.67 ± 0.33	NS

Similar alphabets at superscript denote homogenous means due to Duncan's test at 5% level of significance, **: $p<0.01$, NS: Non Significucant

Statistical analysis revealed that RNA and DNA ratio of liver (Table 4) also differed significantly ($p<0.01$) among various experimental groups showing the highest ratio in T_2 group followed by T_1 and C, respectively. There was also significant difference in RNA and DNA ratio between T_1 and T_2 groups. So supplementation of HerboMethione in diets increased RNA and DNA ratio significantly when compared to bird fed DL-methionine supplemented diets. Increased RNA and DNA ratio in liver due to supplementation of herbal-methionine in diets indicates increased carcass production with better meat quality.

Statistical analysis revealed that total plasma protein, albumin, aspartate amino transferase (AST) and alanine amino transferase (ALT) did not vary significantly among experimental groups due to dietary treatments. Total protein, albumin and globulin concentration in plasma were in the normal range throughout the experiment (Prabhakaran *et al*., 1996). The concentration of AST and ALT also was in normal range throughout the experimental period (Marjanovic *et al*., 1975).

Mortality

Birds were died mainly due to accidents (like falling of chicks from brooder cages) and heat stoke. One chick of T_1 group was died due to gout. The least mortality (Table 5) was found to be in T_2 group followed by C and T_1 groups, respectively. However, on post mortem examination of birds fed diet without methionine supplementation showed moderate increase in liver size and also liver was pale. But birds fed HerboMethionine at 1.2 kg ton^{-1} feed showed relatively decrease in liver size compared to DL-methionine at 1.2 kg ton^{-1} feed.

Meat Quality and Feather Quality

Though dressing percentage did not differ significantly among various experimental groups, but showing the highest value in T_2 followed by T_1 and C, respectively. Dressing percentage was found to be slightly higher in HerboMethione supplemented groups than DL-methionine supplemented group. So supplementation of HerboMethionine in diets increased dressing percentage slightly. Abdominal fat and breast percentage did not also varied significantly due to supplementation of herbal methionine or synthetic methionine. But the thigh muscle percentage varied significantly ($p<0.01$) among various experimental groups showing the highest value in T_2 followed by T_1 and C, respectively. These results were not agreed with the results of Ojano-Dirain and Waldroup (2002) who observed significant improvement ($p<0.05$) in dressing percentage and breast meat yield between the broilers fed NRC Methionine level and those fed higher levels. Earlier studies reported that DL-methionine supplementation decreased fat deposition (Huyghebaert *et al*., 1994; Jeroch and Pack, 1995; Schutte and Pack, 1995; Virtanen and Rosi, 1995) which was also found in present study. It can

Table 5: Effect of herbal or synthetic methionine on mortality meat and feather quality in commercial broilers

Group	C	T_1	T_2	p-value
Mortality (%)	5.00	8.33	6.67	-
Meat quality				
Dressing (%)	70.43±0.25	69.90±0.55	70.90±1.14	NS
Abdominal fat (%)	1.64±0.01	1.62±0.01	1.61±0.01	NS
Breast muscle (%)	16.62±0.09	16.94±0.05	17.09±0.27	NS
Thigh muscle (%)	9.84 ± 0.09^{B}	10.57 ± 0.16^{A}	10.58 ± 0.11^{A}	**
pH of meat	6.43±0.03	6.33±0.03	6.37±0.07	NS
Water holding capacity (%)	64.48±0.64	65.33±0.09	65.12±0.82	NS
Feather quality				
Colour of feather	Whitish with black spot	White	White	-
Molting	Normal	Optimum	Optimum	-
Feather pecking	Increased	Reduced	Reduced	-
Grade of feather	Poor or rough	Good	Good	-

Similar alphabets at superscript denote homogenous means due to Duncan's test at 5%level of significance, **: $p<0.01$, NS: Non Significant

Table 6: Effect of HerboMethione on cost benefit ratio in commercial broiler production

Parameters	C	T_1	T_2	p-value
Starter feed intake (kg bird^{-1})	1.67±0.07^{A}	1.57±0.02^{B}	1.60±0.01^{B}	**
Cost of starter feed (Rs.)	17.37±0.07^{a}	16.58±0.19^{c}	16.84±0.12^{bc}	*
Finisher feed intake (kg bird^{-1})	1.82±0.05	1.65±0.04	1.63±0.07	NS
Cost of starter feed (Rs.)	18.75±0.54	17.26±0.39	17.05±0.71	NS
Net cost (Rs.)	74.13±0.59	72.85±0.57	72.40±0.82	NS
Net return (Rs.)	84.53±0.27^{B}	84.42±0.90^{B}	86.46±0.52^{A}	**
Profit bird^{-1} (Rs.)	10.40±0.84^{B}	11.57±0.43^{B}	14.07±0.64^{A}	**
Profit kg^{-1} gross weight (Rs.)	5.91±0.45^{B}	6.57±0.17^{B}	7.81±0.36^{A}	**

Similar alphabets at superscript denote homogenous means due to Duncan's test at 5% level of significance, *: $p<0.05$, **: $p<0.01$, NS: Non Significant

be concluded that supplementation of HerboMethione in diets increased deposition of meat in thigh muscles when compared to bird fed DL-methionine supplemented diets. pH of meat did not varied significantly within groups. Statistical analysis confirmed that Water-Holding Capacity (WHC) did not varied significantly due to dietary treatments.

Supplementation of HerboMethione® in broiler diets had very little effect on colour of feather. In this experiment it has been observed that colour of feather of birds of C group showed whitish colour with black spot that was not desirable from marketing point of view. Though white colour of feather was found to be in T_1 and T_2 groups. Supplementation of HerboMethione in broiler diets had no extra influence on rate of feathering and feather pecking in comparison to DL-synthetic methionine. The overall appearance or condition of feather of birds of T_2 group was very good than control group and comparable to T_1 group.

Cost Benefit Ratio

From the Table 6, it was clear that for meat production the least money was expended in HerboMethione supplemented group. Statistical analysis confirmed that the net return (Rs.) was significantly ($p<0.01$) varied among various experimental groups showing the highest return in T_2 group (89.94) followed by C (84.53) and T_1 (84.42) groups, respectively. Net expenditure was varied slightly among experimental groups. This variation occurred mainly due to variation in feed intake, variation in feed cost (per kg) and variation in mortality in different groups. Statistical analysis revealed that net profit was found to be significantly ($p<0.01$) highest in T_2 group followed by T_1 and C groups, respectively.

CONCLUSIONS

From the above results this was evident that for optimum growth and feed conversion HerboMethione (herbal methionine) can be used more efficiently than synthetic DL-methionine in broilers. HerboMethione had a significant effect on body weight gain with numerically lower FCR values compared to control birds without methionine supplementation. Thus, Supplementation of HerboMethione has a positive influence on the performance of broiler chickens, when compared to synthetic DL-methionine. For optimum molting, better feather quality and for reduction of feather pecking HerboMethione and DL-methionine can act efficiently in broilers. Herbomethione facilitates efficient lipid metabolism and transportation in liver and consequently reducing the incidences of fatty liver in broiler chickens. Thus, Supplementation of Herbomethione has a positive influence on the performance of broiler chickens, when compared to synthetic DL-methionine. So it can be concluded that 1.2 kg HerboMethione per ton feed can more efficiently replace 1.2 kg synthetic DL-methionine per ton feed with sustained and higher level of activity.

REFERENCES

AOAC., 1995. Official Methods of Analysis. 16th Edn., Association of Official Analytical Chemists. Washington DC.

Bender, D.A., 1975. Amino Acid Metabolism. John Wiley and Sons Ltd., Great Britain.

Bertram, H.L., E.J. Van Weerden and J.B. Schutte, 1991. DL-methionine and DL-methionine hydroxy analogue compared: There is a difference in biological activity in broiler diets. Misset World Poult., 7: 2, 13, 15.

BIS., 1992. Nutrient Requirements for Poultry. Bureau of Indian Standard, IS: 13574.

Clark, J.M., 1964. Experimental Biochemistry.

Chen, F., S.L. Noll, P.E. Waibel and D.M. Hawkins, 1993. Effect of folate, vitamin B_{12} and choline supplementation on turkey breeder performance. Poult. Sci., 72: 73.

Duncan, D.B., 1995. Multiple range and F-test. Biometrics, 11: 1-42.

Fancher, B.I. and L.S. Jensen, 1989. Influence on performance of three to six weeks old broilers of varying dietary protein contents with supplementation of essential amino acid requirements. Poult. Sci., 68: 113-123.

Fletcher, M.J., 1968. A colorimetric method for estimating serum tryglycerides. Clinica Chimica Acta, 22: 393-397.

Folch, M., M. Less and G.H.S. Stanley, 1957. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem., 226: 497-509.

Garlich, J.D., 1985. Response of broiler to DL-methionine hydroxy analogue-free acid, DL-methionine and L-methionine. Poult. Sci., 64: 1541-1584.

Gillespie, E.L., 1960. Methods of Analysis. The Science of Meat and Meat Product. W.H. Freeman and Company, London, pp: 234.

Huyghebaert, G., 1993. Comparison of DL-methionine and methionine hydroxy analogue-free acid in broilers by using multi-exponential regression model. Br. Poult. Sci., 34: 351-359.

Huyghebaert, G., M. Pack and G.D. Groote, 1994. Influence of protein concentration on the response of broilers to supplemental DL-methionine. Arch. Geflugelk, 58: 23-29.

Jeroch, H. and M. Pack, 1995. Effects of dietary sulphur amino acids and crude protein on the performance of finishing broilers. Arch. Anim. Nutr., 48: 109-118.

Keller, H., 1991. Klinisch-Chemische Labordianostikfun Die Praxis. 2nd Edn., George Thieme Veriag, Stuttgart, pp: 263.

Leeson, S. and J.D. Summers, 2001. Nutrition of the Chicken. 4th Edn., pp: 112-125.

March, B. and J. Biely, 1956. Folic acid supplementation of high protein-high fat diets. Poult. Sci., 35: 550-551.

Marjanovic, D., L. Kozic, M. Petrovic, T. Polic and V. Latricin, 1975. Serum transminase activity in fowls. Vet. Bull., 45: 2890.

North, M.O. and D.D. Bell, 1990. Commercial Chicken Production Manual. 4th Edn.

Offer, G. and P. Knight, 1988. The Structural Basis of Water Holding in Meat. Part 2. Development in Meat Science. Lawrie, R. (Ed.), Elsevier Applied Sci., London, 4: 63-173.

Ojano-Dirain, C.P. and P.W. Waldroup, 2002. Evaluation of lysine, methionine and threonine needs of broilers three to six weeks of age under moderate temperature stress. Int. J. Poult. Sci., 1: 16-21.

Prabhakaran, V., V. Chithravel, S.K. Prabhakaran and C.S. Saravanan, 1996. Haematological and biochemical profile of white leghorn chickens. Indian J. Anim. Health, 35: 11-15.

Rostagno, H.S. and W.A. Barbosa, 1995. Biological efficacy and absorption of DL-methionine hydroxy analogue free-acid compared to DL-methionine in chickens as affected by heat stress. Br. Poult. Sci., 36: 303-312.

Schlebusch, H., W. Rick, H. Lang and M. Knedel, 1974. Dtsch. Med., Wschr., 99: 765.

Schutte, J.B. and M. Pack, 1995. Sulphur amino acid requirement of broiler chicks from fourteen to thirty eight days of age on performance and carcass yield. Poult. Sci., 74: 480-487.

SPSS., 1997. Base Application Guide 7.5 ©. SPSS, USA.

Tietz, N.W., 1994. Textbook of Clinical Chemistry. 2nd Edn., W.B. Saunders and Company, Philadelphia, pp: 703.

Virtanen, E. and L. Rosi, 1995. Effects of betaine on methionine requirement of broilers under various environmental conditions. Proceedings of the Australian Poultry Science Symposium, University of Sydney, Australia, pp: 88-92.

Wang, Y.Z., Z.R. Xu and J. Feng, 2004. The effect of betaine and DL-methionine on growth performance and carcass characteristics in meat ducks. Anim. Feed Sci. Technol., 116: 151-159.