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Performance characteristics, biochemical and haematologcal profiles of broiler chickens fed synthetic and herbal methionine supplemented diets

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This study was conducted to compare the efficacy of herbal methionine (HM) to synthetic methionine (SM) in broiler chickens. The herbal methionine (Meth-o-Tasr®) was supplied by Intas Pharmaceutical Limited, India. The HM and SM were added to standard diets at 0, 0.5, 1.0 and 1.5 kg/ton of finished feed and fed to 168 Arbor Acre broiler chickens. After seven days pre-experimental period, the birds were randomly allocated to seven isonitrogenous and isocaloric dietary treatments in a completely randomized experimental design with factorial arrangement of treatments. Each treatment was replicated four times with six birds per replicate. The trial lasted for 56 days and was divided into two phases; the starter phase and the finisher phase. The final body weight, body weight gain, feed intake and feed conversion ratio (FCR) of the birds were determined on a weekly basis. At the end of the feeding trial, two birds per replicate were randomly selected and slaughtered for the determination of carcass quality traits and biochemical and haematological profiles. The average final body weight, body weight gain and average feed intake of the birds fed on diets supplemented with SM were significantly different ($P \leq 0.05$) from those fed on diets supplemented with HM at both starter and finisher phases. The birds on SM supplemented diets gained more body weight and consumed more feed than those on HM supplemented diets. Feed conversion efficiency was not affected ($P \geq 0.05$) by the dietary methionine source. Birds on SM supplemented diets had better ($P \leq 0.05$) carcass yield than those on HM and control diets. Dietary HM supplementation did no significant ($P \geq 0.05$) effect on any of the biochemical or haematological variables determined. It can be concluded from this study that, though no detrimental health effects, were detected, dietary HM is not an effective substitute for synthetic methionine for optimum production performance.

Key words: broiler chickens, herbal methionine, performance, synthetic methionine.

INTRODUCTION

Despite the advances made in poultry nutrition in the last few decades, a lot of nutritional problems still remain unresolved. One of the most critical areas is amino acid nutrition. Of the essential amino acids required for poultry, methionine is usually the first to be limiting in diets based on maize and soybean meal (Fancher and Jensen, 1989). Methionine plays a significant role in energy production and protein synthesis. It enhances production and the size of the eggs, overall growth of the birds, feed conversion efficiency, and livability of broilers and layers (Binder, 2003 and Aerni et al., 2005). Methionine is a potent donor of methyl groups, which

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contributes to the synthesis of many important substances including epinephrine, choline, and creatinine (Bender, 1975). The increase in demand for cheap meat has given rise to the use of synthetic compounds in animal feeds. Recently, the safety of such practice has been questioned and their use is becoming restricted in many regions of the world. Therefore, there is renewed interest in developing natural alternative supplements to maintain animal performance and well being. Herbal methionine premixes, manufactured in India, have recently found their way into the animal feed industry. Methiorep® and Meth-o-Tas® are herbal methionine premixes that are available in the animal feed market. They are phyto-additives containing herbal ingredients that mimic the activity of methionine rations (Chattopadhyay et al., 2006). Under Indian conditions, herbal methionine (Methiorep®) has been found to replace DL-methionine very effectively when used in broiler rations (Chattopadhyay et al., 2006; Kalbande et al., 2009). Using Methiorep®, within the Nigerian environment, Itoe et al. (2010) reported that broilers fed herbal methionine performed below optimal levels and concluded that herbal methionine is an ineffective substitute for synthetic methionine for optimum production performance. Our recent study (Igbasan et al., 2012) with laying hens also revealed that birds fed on diets supplemented with herbal methionine (Meth-o-Tas®) produced less eggs, had a lower egg mass output and final body weight, and poorer feed conversion efficiency compared with those fed on synthetic methionine. The present study was conducted to compare the efficacy of herbal methionine (Meth-o-Tas®) with synthetic methionine in the diets of broiler chickens.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of the Federal University of Technology, Akure, Nigeria. The herbal methionine (HM) premix (Meth-o-Tas®) used for the study was supplied by Intas Pharmaceutical Ltd. India. The composition of the HM as specified by the manufacturer includes the following: *Andrographic paniculata*, 35%; *Zea mays*, 25%; *Ocimum sanctum*, 30%; *Asparagus racemosus*, 10%. The recommended inclusion rate is 1 kg/ton of finished feed.

Two corn-soybean meal basal diets were formulated to meet the nutrient requirements (NRC, 1994). The compositions of the diets are presented in Table 1. The methionine sources (SM and HM) were included in the basal diets at 0, 0.5, 1.0 and 1.5 kg/ton of finished feed. Therefore, there were seven isonitrogenous and isocaloric diets at the starter or finisher phase of the experiment.

A total of 200 day-old Arbor Acre male broiler chicks were purchased from a reputable commercial hatchery (Chi Hatchery, Ajanla Farms, Ibadan, Nigeria). The birds were fed on a commercial broiler starter ration for seven days and starved for 4 h before they were randomly allocated to seven treatment groups based on body weight. Out of these 200 chicks, 168 healthy ones were randomly assigned to seven dietary treatment groups with 24 birds per treatment group and six birds per replicate. There were four replicates per treatment group and the experiment lasted for eight weeks, four weeks for starter phase and another four weeks for finisher phase. The experimental design was completely randomized with factorial arrangement of treatments.

The growth performance data were determined for both starter and finisher phases. During each phase, weekly body weight and feed consumption were recorded. Feed conversion ratio was calculated from the body weight and feed consumption data.

At the end of the fattening period (56 days), eight birds were randomly chosen per treatment group, weighed, and slaughtered. Slaughtering was performed by severing the jugular vein with sharp surgical knife without anaesthetizing. The slaughtered birds were de-feathered using hot water, and the dressing weights were recorded. After removal of viscera, the eviscerated weights were recorded and organs (liver, heart, kidney, spleen, lung, bursa, gizzard, and pancreas) were removed and weighed. Carcasses were cut into basic parts (breasts, thighs, drumsticks, wings, sharks, heads, chests, backs, and necks) and weighed. Blood samples were also collected from the birds for the biochemical and haematological analyses. For haematological determinations, blood samples were collected into sample tubes containing anticoagulant as described by Lamb (1981). Plasma was harvested by centrifuging the blood samples at 3000 rpm for 15 min in centrifuge machine. The heparinized plasma samples were stored at -20°C in sample tubes until further analysis. Haematological parameters determined to include erythrocyte sedimentation rate, packed cell volume, red blood cell, haemoglobin, leucocyte, neutrophill, monocyte, basophil and eosinophil.

Plasma samples were analyzed for proteins (total proteins and albumin) and enzymes {alanine transferase (ALT), aspartate transferase (AST). Total protein, albumin, ALT and AST activities were determined in the Autoanalyzer, Microlab 200 using commercial kits (Randox Laboratories Ltd., Ardmore Diamond Road, Crumlin, Co. Antrim, United Kingdom, BT29 4QY). The globulin fraction was calculated by subtraction of albumin level from total protein level.

The proximate composition of the basal diets was determined according to the method of AOAC (2005). The data collected were subjected to one way analysis of variance (ANOVA) according to the General Linear Model Procedures of SAS (2008). When analysis of variance indicated a significant treatment effect, Duncan's multiple range test (Duncan, 1955) was used to compare treatment means. The model included main effects of methionine source, methionine level, and their interaction.

RESULTS

The initial body weight, final body weight, body weight gain, feed intake and feed conversion ratio for both starter and finisher phases are presented in Tables 2 and 3. There was a significant ($P \leq 0.05$) effect of methionine source on average final body weight, average body weight gain and average feed intake of birds at both starter and finisher phases. Dietary methionine level had no significant ($P \geq 0.05$) effect on any of the performance parameters determined. A source by level interaction was observed in average final body weight, average body weight gain, and average feed intake. There was no significant ($P \geq 0.05$) effect of methionine source, level or source by level interaction on the feed conversion ratio of the birds. Average body weight decreased by about 10% while that of feed intake decreased by 8% when HM was included in broiler starter diets up to 1.5 kg/ton of finished feed. The same trend was also followed for average body weight (11%) and average feed intake (10%) at the finisher phase. A closer look at the performance data (Table 2) also revealed that average body weights decreased with increasing the level of HM in broiler

Table 1. Composition of the basal diets.

Ingredient	Composition (Kg/ton)			
	Starter diet	Finisher diet		
Maize	600.0	600.0		
Wheat offal	-	108.5		
Groundnut cake	180.0	120.0		
Soybean meal	150.0	146.0		
Fish meal	40.0	-		
Bone meal	20.0	22.0		
Lysine	2.5	0.5		
Methionine[a]	0.5	0.5		
Premix[b]	4.0	4.0		
Salt	3.5	3.5		
Total	1000.0	1000.0		
	Calculated analysis (%)		**Proximate analysis (%)**	
	Starter	Finisher	Starter	Finisher
Crude protein	23.0	18.8	22.8	18.9
Crude fibre	3.63	3.63	2.15	3.06
Calcium	1.02	0.84	-	-
Crude Fat	-	-	15.5	18.7
Avail. P.	0.54	0.46	-	-
Moisture	-	-	6.5	6.8
Ash	-	-	9.6	6.8
Lysine	1.29	0.88	-	-
Methionine	0.35	0.43	-	-
Metabolizable energy (Kcal/kg)	3011.8	2917.7	-	-

[a]Methionine content varies depending on the inclusion level of the herbal and synthetic methionine. [b]Broiler premix per 1 kg used in the composition of the basal diets consist of the following: vit A (500,000 iu), vit D3 (1000,000 iu), vit E (1,400 iu), vit K (0.8 g), thiamine B1 (0.8 g) riboflavin B2 (2 g), nicacin B3 (16 g), D-calpan B5 (4.4 g), pyridoxine B6 (1.6 g), biotin (0.04 g), folic acid (vit B12) (0.006 g), manganese (28 g), copper (2.4 g), Iron (16 g), Iodine (0.4g), cobalt (0.1 g), selenium (0.06 g), sodium chloride (200 g), BHT (200g, BHT (50g) per kg.

starter diets and these were not significantly different (P ≥ 0.05) from the control. However, at the finisher phase (Table 3), though not significantly different (P ≥ 0.05) from the control, average body weights increased with increasing level of HM in the diets. Although not significant (P ≥ 0.05), those birds fed on SM supplemented diets utilized feed better than their counterparts fed to the control and HM supplemented diets.

The carcass characteristics of broiler chickens fed on diets supplemented with SM and HM are presented in Table 4. There was a significant (P ≤ 0.05) effect of methionine source on the dressed and eviscerated weights. The head, shank, back, neck, chest, and wing, as gram per kg live weight, were also influenced (P ≤ 0.05) by methionine source. Birds fed on diets supplemented with SM had a better carcass yield than their counterparts on HM and control diets. Carcass yield decreased by 8.8 and 11.8% for dressing and eviscerated weights respectively, for birds fed HM supplemented diets compared with those birds fed on SM supplemented diets. There was no effect (P ≥ 0.05) of methionine level, and source by level interaction on any of the carcass traits except for eviscerated weights. Statistical analysis of the organs (Table 5) showed that there was no significant (P ≥ 0.05) effect of methionine source, level, and source by level interaction on any of the parameters determined except for gizzard which was affected (P ≤ 0.05). The gizzards of broilers fed the SM supplemented were heavier than those of broilers fed HM supplemented diets (2.01±0.11 versus 1.63±0.07 g/kg live weight).

Table 6 shows the plasma biochemical profiles of the broiler chickens as influenced by SM and HM supplementation. Plasma concentrations of proteins and enzymes were similar (P ≥ 0.05) between the dietary treatments. Feeding diets containing HM did not significantly (P ≥ 0.05)alterthehaematologicalvariables(Table7)determined.

DISCUSSION

The results of the present experiment showed that

Table 2. Performance characteristics of broiler chickens at the starter phase fed diets supplemented with synthetic and herbal methionine.

Source	Level	Initial live weight (g/bird)	Final live weight (g/bird)	Total weight gain (g/bird)	Daily weight gain (g/bird)	Total feed intake (g/bird)	Daily feed intake (g/bird)	Feed conversion ratio
Control	0	128.33±0.00	1154.33±63.28[b]	1030.0±63.28[b]	36.79±2.26[b]	2082.5±74.49[ab]	74.38±2.66[ab]	2.04±0.08
SM	0.5	128.33±0.00	1262.50±39.89[ab]	1134.2±39.89[ab]	40.51±1.43[ab]	2155.8±80.28[ab]	76.99±2.87[ab]	1.90±0.03
SM	1.0	128.33±0.00	1329.20±23.93[a]	1200.8±23.93[a]	42.89±0.85[a]	2221.8±37.92[ab]	79.35±1.35[ab]	1.85±0.01
SM	1.5	128.33±0.00	1350.00±48.59[a]	1221.7±48.59[a]	43.63±1.73[a]	2295.8±107.11[a]	81.99±3.82[a]	1.88±0.02
HM	0.5	128.75±3.07	1229.20±25.80[ab]	1100.4±22.93[ab]	39.30±0.82[ab]	2108.5±59.57[ab]	75.31±2.13[ab]	1.92±0.07
HM	1.0	128.75±3.07	1162.50±43.77[b]	1033.8±44.23[b]	36.92±1.58[b]	2004.0±60.83[b]	71.57±2.17[b]	1.94±0.05
HM	1.5	128.75±3.07	1158.30±47.87[b]	1030.0±47.87[b]	36.79±1.29[b]	2026.5±57.09[b]	72.38±2.04[b]	1.99±0.15
Source								
SM		128.33±0.0	1313.9±23.19[a]	1185.6±23.19[a]	42.34±0.83[a]	2224.4±45.35[a]	79.44±1.62[a]	1.88±0.01
HM		128.61±1.31	1183.3±23.21[b]	1054.7±23.0[b]	37.67±0.82[b]	2046.3±33.74[b]	73.09±1.21[b]	1.95±0.05
Level								
0.5		128.54±1.42	1245.8±22.88	1117.3±22.23	39.90±0.79	2131.1±47.13	76.15±1.68	1.91±0.04
1.0		128.54±1.42	1245.8±39.05	1117.3±39.23	39.91±1.40	2112.0±52.86	75.46±1.89	1.90±0.03
1.5		128.33±0.0	1254.2±40.05	1125.8±48.05	40.21±1.72	2161.0±75.80	77.18±2.71	1.93±0.07
Significance								
Source		NS	**	**	**	**	**	NS
Level		NS	NS	NS	NS	NS	NS	NS
Source*Level		NS	*	*	*	*	*	NS

[abc]Means with different superscript are significantly. SM, synthetic methionine; HM, herbal methionine; NS, not significant at P ≥ 0.05; *significant at P ≤ 0.05; **significant at P ≤ 0.01.

Table 3. Performance characteristics of broiler chickens at the finisher phase fed diets supplemented with synthetic and herbal methionine.

Source	Level	Final weight (g/bird)	Total weight gain (g/bird)	Daily weight gain (g/bird)	Total feed intake (g/bird)	Daily feed intake (g/bird)	Feed conversion ratio
Control	0	2227.5±48.85[bc]	1069.17±48.08[ab]	38.18±1.72[ab]	4064.3±129.91[ab]	145.15±4.64[ab]	3.82±0.13
SM	0.5	2370.8±72.13[ab]	1108.30±43.30[a]	39.59±1.55[a]	4265.0±137.28[a]	152.32±4.90[a]	3.88±0.19
SM	1.0	2375.0±79.79[ab]	1045.80±73.71[ab]	37.35±2.63[ab]	4192.5±168.52[a]	149.73±6.02[a]	4.07±0.30
SM	1.5	2508.3±122.95[a]	1158.30±75.92[a]	41.37±2.71[a]	4256.3±144.15[a]	152.01±5.15[a]	3.70±0.14
HM	0.5	2107.5±61.02[c]	878.34±45.71[b]	31.37±1.63[b]	3591.5±196.25[b]	128.27±7.01[b]	4.11±0.23
HM	1.0	2172.9±27.51[bc]	1010.40±50.16[ab]	36.09±1.79[ab]	3719.5±111.64[ab]	132.84±3.99[ab]	3.71±0.23

Table 3. Contd.

HM	1.5	2191.7±98.48^{bc}	1033.30±89.24^{ab}	36.91±3.19^{ab}	4135.8±246.89^{a}	147.71±8.82^{a}	4.04±0.14
Source							
SM		2418.1±52.88^{a}	1104.2±37.16^{a}	39.44±1.33^{a}	4237.9±79.24^{a}	151.35±2.83^{a}	3.88±0.12
HM		2157.4±37.51^{b}	974.03±39.58^{b}	34.79±1.41^{b}	3815.6±122.8^{b}	136.27±4.39^{b}	3.95±0.12
Level							
0.5		2239.2±66.25	993.33±52.33	35.48±1.89	3928.3±168.79	140.29±6.03	3.99±0.15
1.0		2274.0±54.63	1028.1±41.81	36.72±1.49	3956.0±129.41	141.29±4.62	3.89±0.19
1.5		2350.0±94.33	1095.8±59.16	39.14±2.11	4196.0±134.29	149.86±4.8	3.87±0.11
Significance							
Source		***	*	*	*	**	NS
Level		NS	NS	NS	NS	NS	NS
Source * Level		*	NS	NS	*	*	NS

^{abc}Means with different superscript are significantly (p≤0.05) different. SM, Synthetic methionine; HM, herbal methionine; NS, not significant at P p≤0.05. *Significant at P≤0.05; **significant at P ≤0.01.

Table 4. Carcass characteristics of broiler chickens fed diets supplemented with synthetic and herbal methionine (g/kg live weight).

Source	Level	Dressed weight	Eviscerated weight	Head	Shank	Drum stick	Chest	Breast muscle	Back	Neck	Thigh	Wings
Control	0	2003±64.50	1645±11.2	2.96±0.19	4.90±0.46	12.28±0.95	23.79±1.46	8.420.38	19.50±1.37	5.64±0.50	14.23±1.20	9.83±0.85
SM	0.5	2250±101.77	1925±88.14	2.80±0.06	4.89±0.16	14.82±1.45	24.84±0.48	8.90±0.34	17.50±0.68	5.90±0.13	14.12±0.18	10.02±0.21
SM	1.0	2300±118.02	1937.5±90.51	2.95±0.15	4.78±0.27	12.56±0.3	25.47±1.02	8.94±0.40	19.24±0.71	6.29±0.51	13.95±0.48	9.85±0.28
SM	1.5	2437.5±178.02	2051±146.39	2.70±0.12	4.57±0.22	12.86±0.37	25.73±0.71	9.01±0.61	19.44±0.45	5.53±0.26	14.90±0.83	9.73±0.32
HM	0.5	2150±84.32	1762.5±84.38	2.97±0.12	4.92±0.24	13.33±0.33	23.86±0.71	8.70±0.50	20.00±0.45	5.08±0.34	15.12±0.42	10.76±0.26
HM	1.0	2162.5±56.5	1775±70.08	3.09±0.07	5.59±0.21	13.52±0.30	23.08±0.64	7.78±0.34	19.80±0.36	5.27±0.3	14.40±0.98	11.32±0.29
HM	1.5	2062.5±154.62	1675±122.11	2.94±0.13	5.15±0.30	13.00±0.37	23.74±0.92	8.58±0.56	19.69±0.99	5.28±0.35	13.31±0.37	10.56±0.32
Source												
SM		2329.2±77.17	1970.8±62.69	2.82±0.07^{a}	4.74±0.13^{b}	13.41±0.53	25.35±0.43^{a}	8.95±0.26	18.72±0.34^{b}	5.91±0.20^{a}	14.32±0.32	9.87±0.15^{b}
HM		2125±59.68	1737.5±53.1	3.00±0.06^{a}	5.22±0.15^{a}	13.29±0.19	23.54±0.43^{b}	8.35±0.28	19.83±0.32^{a}	5.21±0.18^{b}	14.28±0.39	10.88±0.17^{a}
Level												
0.5		2200±65.19	1843.8±62.56	2.89±0.07	4.90±0.14	14.07±0.74	24.35±0.43	8.80±0.29	18.76±0.51	5.49±0.21	14.62±0.23	10.39±0.19

Table 4. Contd.

1.0	2231.3±65.65	1856.3±57.14	3.02±0.08	5.18±0.19	13.04±0.24	24.25±0.66	8.36±0.30	19.52±0.39	5.78±0.31	14.17±0.53	10.58±0.27
1.5	2250±123.83	1862.5±104.03	2.82±0.09	4.86±0.20	12.93±0.25	24.74±0.61	8.30±0.41	19.55±0.53	5.41±0.21	14.10±0.49	10.15±
Significance											
Source	**	**	*	*	NS	**	NS	*	*	NS	***
Level	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Source*Level	NS	**	NS	NS	NS	NS	NS	NS	NS	NS	NS

[abc]Means with different superscript are significantly (P ≤ 0.05) different. SM, Synthetic methionine; HM, herbal methionine. NS, not significant at P ≤ 0.05; *significant P ≤0.05; **significant at P ≤ 0.01.

Table 5. Relative organ weight of broiler chickens fed diets supplemented with synthetic and herbal methionine (g/kg live weight).

Source	Level	Liver	Heart	Kidney	Spleen	Lung	Bursa	Gizzard	Pancreas
Control	0	1.77±0.15	0.43±0.03	0.37±0.04	0.10±0.01	0.57±0.05	0.87±0.09	2.03±0.13	0.18±0.02
SM	0.5	1.89±0.09	0.43±0.02	0.45±0.06	0.1±0.02	0.53±0.03	0.86±0.04	2.06±0.17	0.16±0.02
SM	1.0	1.72±0.12	0.39±0.01	0.48±0.06	0.09±0.01	0.47±0.04	0.83±0.04	2.22±0.18	0.24±0.04
SM	1.5	1.81±0.10	0.46±0.05	0.48±0.05	0.11±0.02	0.58±0.02	0.96±0.06	1.74±0.2	0.17±0.02
HM	0.5	1.92±0.15	0.43±0.02	0.47±0.05	0.08±0.01	0.55±0.03	0.9±0.09	1.65±0.11	0.18±0.02
HM	1.0	1.74±0.11	0.44±0.03	0.47±0.07	0.08±0.01	0.54±0.04	0.91±0.08	1.72±0.13	0.16±0.01
HM	1.5	1.61±0.15	0.46±0.03	0.48±0.05	0.09±0.01	0.58±0.06	0.89±0.05	1.52±0.1	0.19±0.02
Source									
SM		1.80±0.06	0.43±0.02	0.47±0.03	0.10±0.01	0.53±0.02	0.88±0.03	2.01±0.11^{a}	0.19±0.02
HM		1.76±0.08	0.44±0.02	0.47±0.03	0.09±0.01	0.56±0.02	0.90±0.04	1.63±0.07^{b}	0.18±0.01
Level									
0.5		1.90±0.09	0.43±0.01	0.46±0.04	0.09±0.01	0.54±0.02	0.88±0.05	1.85±0.11^{ab}	0.17±0.01
1.0		1.73±0.08	0.42±0.02	0.48±0.04	0.09±0.01	0.50±0.03	0.87±0.04	1.97±0.13^{a}	0.20±0.02
1.5		1.71±0.09	0.46±0.03	0.48±0.03	0.10±0.01	0.58±0.03	0.92±0.04	1.63±0.11^{b}	0.18±0.01
Significance									
Source		NS	NS	NS	NS	NS	NS	**	NS
Level		NS	NS	NS	NS	NS	NS	NS	NS
Source*Level		NS	NS	NS	NS	NS	NS	*	NS

[abc]Means with different superscript are significantly (P ≤ 0.01) different. SM, Synthetic methionine; HM, herbal methionine. NS, not significant at P ≥ 0.05; *significant at P ≤ 0.05; **significant at P ≤ 0.01.

Table 6. Haematoloicgal Profiles of broiler chickens fed diets supplemented with synthetic and herbal methionine.

Source	Level	ESR (mm/hr)	PCV (%)	RBC ($10^6 mm^3$)	HB (g/100ml)	Lymphocyte (%)	NEU	Monocyte (%)	Basophil (%)	EOS
Control	0	3.75±0.62	27.13±1.13	207.13±12.69	9.04±0.37	60.13±0.95	24.75±0.80	11.38±0.60	2.50±0.27	1.25±0.25
SM	0.5	3.25±0.25	27.38±0.63	198.75±9.52	9.14±0.20	59.13±0.97	26.50±0.46	10.75±0.75	2.63±0.26	1.00±0.27
SM	1.0	2.75±0.59	29.25±1.18	225.13±13.90	9.74±0.39	58.38±0.71	26.13±0.52	11.63±0.75	2.50±0.19	1.38±0.26
SM	1.5	2.88±0.35	28.25±0.80	210.13±11.07	9.46±0.27	59.38±1.28	25.75±0.82	10.63±0.53	3.13±0.30	1.13±0.23
HM	0.5	3.00±0.33	28.25±0.92	212.63±11.27	9.41±0.30	58.38±1.08	25.75±0.75	12.00±0.96	2.50±0.27	1.38±0.26
HM	1.0	3.13±0.48	28.25±0.94	211.25±12.70	9.43±0.31	60.25±0.88	25.25±0.65	11.00±0.71	2.63±0.26	0.88±0.23
HM	1.5	2.88±0.13	28.00±0.63	207.63±9.54	9.39±0.20	59.63±0.42	25.25±0.67	11.63±0.86	2.5±0.27	1.00±0.19
Source										
SM		2.94±0.24	28.29±0.52	211.33±6.80	9.45±0.17	58.96±0.57	26.13±0.35	11.00±0.39	2.75±0.15	1.17±0.14
HM		3.00±0.19	28.17±0.46	210.50±6.22	9.41±0.15	59.42±0.49	25.42±0.39	11.54±0.48	2.54±0.15	1.08±0.13
Level										
0.5		3.13±0.20	27.81±0.55	205.69±7.35	9.28±0.18	58.75±0.71	26.13±0.44	11.38±0.61	2.56±0.18	1.19±0.19
1.0		2.94±0.37	28.75±0.74	218.19±9.27	9.58±0.24	59.31±0.60	25.69±0.42	11.31±0.51	2.56±0.16	1.13±0.18
1.5		2.88±0.18	28.13±0.49	208.88±7.07	9.43±0.16	59.50±0.65	25.50±0.52	11.13±0.51	2.81±0.21	1.06±0.14
Significance										
Source		NS	NS	NS	NS	NS	NS	NS	NS	NS
Level		NS	NS	NS	NS	NS	NS	NS	NS	NS
Source*Level		NS	NS	NS	NS	NS	NS	NS	NS	NS

Mean ± standard deviation; SM, synthetic methionine; HM, herbal methionine; NS, not significant ($P > 0.05$); ESR, erythrocyte sedimentation; PCV, packed cell volume; RBC, red blood cell; HB, haemoglobin; NEU, neutrophils; EOS, eosinophils.

broiler chickens fed diets supplemented with synthetic methionine had better performance in terms of weight gain and feed consumption than those fed herbal methionine supplemented diets. Earlier studies by Chattopadhyay et al. (2006), Halder and Roy (2007) and Kalbande et al. (2009) demonstrated that broiler chickens fed diets supplemented with herbal methionine (Methiorep®) had similar performance in terms of body weight gain and feed conversion efficiency compared with those birds fed DL-methionine. In fact, the feed conversion ratio of broilers fed 15 g herbal methionine/kg diet was significantly better than that of broilers fed on 10 g DL-methionine/kg diet (Chattopadhyay et al. 2006). However, using the same herbal methionine (Methiorep®) and dietary inclusion levels, Itoe et al. (2010) showed that broiler chickens fed supplemental herbal methionine were inferior in weight gain and feed conversion efficiency to those birds fed supplemental DL-methionine.

A post-mortem measurement of the birds in the treatments shows that average carcass yields were significantly influenced by the dietary methionine source. Those birds fed on DL-methionine had better carcass yields than their counterparts on herbal methionine supplemented diets. This finding is not in agreement with that of Chattopadhyay et al. (2006) who reported that broilers given herbal methionine had a similar dressing yield but higher breast and thigh yields at herbal 15 g herbal methionine per kg feed than 10 g DL-methionine/kg diet.

Little information has been published on the effects of herbal methionine supplements on the biochemical profiles of domestic chickens (Prabhakaran et al., 1996). Non-significant differences were observed in virtually all the haematological variables determined for birds fed

Table 7. Biochemical profiles of broiler chickens fed diets supplemented with synthetic and herbal amethionine.

Source	Level	Total protein (mg/100ml)	Albumin (mg/100ml)	Globulin (mg/100ml)	AST (IU/L)	ALT (IU/L)
Control	0	92.59 ±9.31	33.02±3.63^{b}	59.58±8.10^{ab}	28.63±3.74^{ab}	43.45±12.04^{ab}
SM	0.5	96.77 ±13.35	39.88±3.00^{ab}	56.89±12.18^{ab}	33.78±3.07^{a}	48.95±12.73^{a}
SM	1.0	96.77 ±8.74	30.97±2.71^{b}	65.80±7.42^{ab}	21.30±3.02^{b}	16.20±8.94^{b}
SM	1.5	90.33 ±4.71	46.46±6.18^{a}	43.87±9.69^{b}	23.51±2.90^{ab}	30.20±7.69^{ab}
HM	0.5	107.56±9.02	39.74±3.37^{ab}	67.82±6.78^{ab}	25.03±4.33^{ab}	30.45±13.19^{ab}
HM	1.0	112.26±9.68	38.28±1.75^{ab}	73.98±8.63^{a}	32.14±2.84^{ab}	49.17±7.21^{a}
HM	1.5	93.99 ±6.88	34.62±4.53^{ab}	59.36±6.26^{ab}	28.60±3.87^{ab}	14.2±7.57^{b}
Source						
SM		94.62±5.34	39.10±2.70	55.52±5.80	26.20±2.0	31.78±6.19
HM		104.60±5.02	37.55±1.94	67.06±4.21	28.59±2.15	31.45±6.16
Level						
0.5		102.17±7.91	39.81±2.18	62.36±6.88^{ab}	29.40±2.80	39.70±9.17
1.0		104.52±6.61	34.62±1.82	69.89±5.60^{a}	26.72±2.44	32.95±7.03
1.5		92.16 ±.4.05	40.54±4.0	51.62±5.92^{b}	26.05±2.43	22.20±5.61
Significance						
Source		NS	NS	NS	NS	NS
Level		NS	NS	NS	NS	NS
Source*Level		NS	NS	NS	NS	NS

Mean ± standard deviation; SM, synthetic methionine; HM, herbal methionine; AST, aspartate transferase; ALT, alanine transferase.

diets supplemented with both SM and HM. This is in agreement with the results of Rekhatel et al. (2010) who showed that herbal methionine had no significant effect on haematological profiles of broiler chickens. Also, our recent study (Igbasan et al., 2012) revealed that herbal methionine did not affect the haematological profiles of domestic laying hens. The implication is that dietary herbal methionine has no detrimental effect on survivability of chickens. Rajurker et al. (2009) also reported that herbal methio-nine supplement (Methiorep®) is totally safe and has no adverse effect even when used at the highest limit dose of 5 g/kg body weight of male Wistar rats. Total plasma protein, albumin, and globulin concentrations observed are within the normal range reported for chickens (Prabhakaran et al., 1996). There were no differences in total plasma protein and albumin concentrations. These results are in agreement with those of Halder and Roy (2007) and Rekhatel et al. (2010) who did not observe any significant effect of HM supplementation on total protein and albumin concentrations of broiler chickens.

Generally, the activities of plasma AST and ALT observed are within the normal range for chickens (Marjanovic et al., 1975). This suggests that supplemen-tation of broiler chicken diets with herbal methionine did not inhibit the activities of plasma enzymes or cause any liver dystrophy or other vital organs abnormalities where these enzymes are secreted. These results corroborate those of Halder and Roy (2007), Kalbande et al. (2009), Rekhatel et al. (2010), and Igbasan et al. (2012) who reported that the plasma concentrations of ALT, AST, and ALP were not affected by supplementation of broiler and laying hen diets with herbal methionine.

The current experiment shows that broiler chickens fed diets supplemented with synthetic methionine had better performance in terms of weight gain, feed consumption and carcass yield than those fed herbal methionine supplemented diets. Since the primary objective of poultry farmers is to maximize profit, it can be concluded that based on the results of this trial, that herbal methionine is not a substitute for DL-methionine for optimum performance of broiler chickens.

REFERENCES

Aerni V, Brinkhof MWG, Oester WH, Frohlich E (2005). Productivity and mortality of laying hens in aviaries: a systematic review. World Poult. Sci. J. 61: 130-142.

AOAC International Official Methods of Analysis (2005). 18th ed. AOAC International, Gaithersburg, MD.

Bender DA (1975). Amino Acid Metabolism. 1st ed. John Wiley and Sons Ltd. New York, USA. pp. 112-142.

Binder M (2003). Life cycle analysis of DL-methionine in broiler meat production. In: Information for the feed industry. Degussa feed additives, Hanau-Wolfgang, Germany. pp. 1-8.

Chattopadhyay K, Mondal MK, Roy B (2006). Comparative efficacy of DL-methionine and herbal methionine on performance of broiler chicken. Int. J. Poult. Sci. 5: 1034-1039.

Duncan DB (1955). Multiple range test and multiple *F*-tests. Biometrics

11:1-42.
Fancher BI, Jensen LS (1989). Influence on performance of three to six week old broilers of varying dietary protein contents with supplementation of essential amino acid requirements. Poult. Sci. 68:113-123.
Halder G, Roy B (2007). Effect of herbal or synthetic methionine on performance, cost benefit ratio, meat and feather quality of broiler chicken. Int. J. Agric. Res. 2: 987-996.
Igbasan FA. Ibrahim AM, Osho IB (2012). Comparative efficacy of herbal and synthetic methionine on performance, some haematological and biochemical parameters in domestic laying hens. Afr.J. Biotech. 11:10617-10625.
Itoe S Dafwang II Bawa GS (2010). Evaluation of Methiorep as a Substitute for Methionine in Broiler Diets. Int. J. Poult. Sci. 9: 809-812.
Kalbande VH, Ravikanth K, Maini S, Rekhe DS (2009). Methionine supplementation options in poultry. Int. J. Poult. Sci. 8: 588-591.
Lamb GN (1981). Manual of Veterinary Laboratory Technique, 5th ed. CIBA-GEIGY, Kenya. pp. 96-107.
Marjanovic D, Kozic L, Petrovic M, Polic T, Latricin V (1975). Serum transaminase activities in fowls. Poult. Sci. 35:550-551.
NRC National Research Council, Nutrient Requirements of Poultry (1994). 9th edn. National Academy Press, Washington DC.
Prabhakaran V, Chihravel V, Prabhakaran SK, Saravanan CS (1996). Haematological and biochemical profile of white leghorn chickens. Indian J. Anim. Health 35:11-15.
Rajurker S, Rekhe DS, Maini S, Ravikanth K (2009). Acute toxicity studies of poly herbal formulation (Methiorep premix). Vet. World 2: 58-59.
Rekhatel DH, Maini S, Pathak VP, Ther SV, Mahajan N, Datir DK, Kale M, Hardas RP (2010). Haemobiochemical profile study in commercial broilers fed on diet supplemented with herbal methionine (Methiorep) and DL-methionine. Indian J. Agric. Res. 44: 197-203.
SAS (2008). SAS User's Guide, 8th ed. SAS Institute Inc. Cary, NC, USA.