Journal of Animal Research: v.8 n.2, p. 297-301. April 2018
DOI: 10.30954/2277-940X.04.2018.20

Effect of Partial Replacement of Dietary DL-methionine with Herbal Methionine Replacers on the Growth and Performance of Broilers

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Received: 30 Jan., 2018 **Revised:** 27 March, 2018 **Accepted:** 29 March, 2018

ABSTRACT

Increases in the cost of chemically produced DL-methionine and preference for organic alternatives are pressing for herbal methionine replacers. Here, we report the effects of partial replacement of dietary DL-methionine with herbal methionine replacers upon the growth and performance of broilers. One hundred and sixty Vencobb broilers, fed a corn-soy based diet, were divided into four groups i.e. (T_1) control, deficient in methionine; (T_2) 0.2% DL-methionine; (T_3) DL-methionine 0.1% + herbal methionine powder 0.1%; and (T_4) DL-Methionine 0.1% + liquid herbal methionine at 5 ml/day/100 birds till 21 days, 10 ml/day/100 birds from 21 to 35 days, and 20 ml/day/100 birds during 35 to 42 days of age. Body weight gain, feed intake, feed conversion ratio, carcass characteristics, and serum biochemical parameters were studied. Partial replacement of DL-methionine with herbal methionine allowed greater body weight gain, better feed conversion ratio, higher dressing percentage, and lesser stress in broilers. It could be concluded that partial replacement of at least half, if not more, of the dietary DL-methionine requirement with herbal methionine can be practiced for improving broiler growth and performance.

Keywords: Broilers, growth, methionine, Methiorep, performance

Methionine, commonly supplemented as DL-methionine in animal feeds, acts as a lipotropic agent and plays important roles as a methyl donor, and in choline, betaine, folic acid, and vitamin B metabolism (Young *et al.*, 1955). Methionine is usually the first limiting essential amino acid in poultry nutrition (Kim *et al.*, 2006). It plays critical roles in protein synthesis within the avian body, including those involved in the formation of feathers, organs and muscle (Fanatico, 2010). Broilers not supplemented with required dietary methionine have been found to exhibit decreased feed intake, feed conversion efficiency, uniformity, gain, and increased thigh, wing, and fat pad percentage (Leclercq, 1983; Carew *et al.*, 2003). Methionine is also involved in immune response, as increased dietary methionine improved antibody production in broilers (Rao *et al.*, 2003), and as an endogenous antioxidant in defending cells against oxidative stress (Luo and Levine, 2009).

The use of synthetic methionine in organic feed for increasing growth rather than the health of the birds has been criticized by the National Organic Standards Board of USA. The inclusion of synthetic methionine in organic poultry is restricted to 5 lbs /ton of feed for broilers in the USA (USDA, 2011). Further, DL-methionine is produced chemically from acrolein, methyl mercaptan, and hydrogen cyanide (Figge *et al.*, 2010), and the risk of chemical residues and the increasing prices of petrol-derived precursors are pressing for organic sources of methionine (Hadinia *et al.*, 2014). As the complete replacement of synthetic methionine is not possible, therefore its gradual replacement with herbal methionine provides an opportunity for decreasing its use in poultry diet. Hence, the present study was undertaken to evaluate the effect of partial replacement of DL-Methionine with herbal methionine replacers upon the growth and performance of broiler chicken.

MATERIAL AND METHODS

One hundred and sixty day-old Vencobb broiler chicks were randomly divided into four equal groups (n = 40) comprising of two replicates of twenty birds each: control (T_1) and three treatments (T_2, T_3, and T_4). A corn-soybean meal-based diet, complete in all ingredients except methionine, (Tables 1 and 2) was prepared and fed to the four groups.

Table 1: The ingredient composition of diet (%) of broiler diets as per BIS, 1992

Feed ingredients	Starter parts per 100 Kg	Finisher parts per 100 Kg
Maize	55	65
Soybean meal	42	32
DCP	2	2
Trace Min. Mix	0.1	0.1
Salt	0.5	0.5
Lysine	0.16	0.16
DL-Methionine	0	0
Vit AB2D3	0.02	0.02
Choline chloride	0.2	0.2
Coccidiostat	0.01	0.01
Antibiotic	0.01	0.01
Total	**100**	**100**

Table 2: Chemical composition* (%) of broiler starter & finisher feeds

Constituents	Starter feed	Finisher feed
Dry matter	88.76	89.84
Crude protein	23.32	19.98
Ether extract	2.23	2.66
Crude fiber	6.08	7.53
Total ash	10.56	11.13
Nitrogen free extract	59.62	61.11
Acid insoluble ash	3.73	3.84
Calcium	1.13	1.17
Phosphorus	0.92	0.98
Lysine calculated	1.42	1.17
Neutral detergent fiber	20.85	22.03
Acid detergent fiber	13.39	13.65
ME calculated kcal/kg	2852	2912

*On dry matter basis, except DM

The control group, T_1, was offered only the basal diet, T_2 was supplemented with 0.2% DL-methionine, T_3 was supplemented with 0.1% DL-methionine + 0.1% powdered herbal methionine replacer (Methiorep®, Ayurvet Limited, India), T_4 was supplemented with 0.1% DL-methionine + liquid herbal methionine replacer (AV/BMP/65, Ayurvet Limited, India) @ 5 ml/day/100 birds till 21 days, 10 ml/day/100 birds from 21 to 35 days, and 20 ml/day/100 birds during 35 to 42 days of age.

Standard methods of proximate analysis (AOAC, 1995) were used to determine nutrient content of experimental diets. General body weight gain, feed intake, and feed conversion ratio were recorded throughout the study. At the end of the study, 12 birds per group were sacrificed and carcass characteristics and serum biochemical parameters were recorded as per standard methods.

The trial was conducted from 20.12.2016. to 01.02.2017 at the poultry experimental station of NTR College of Veterinary Science, Gannavaram, India, latitude N 16° 32’ 3”, longitude E 80° 47’ 34”, approx. 22 meters above mean sea level. The average daily temperature and relative humidity during this period were 19°C and 72%, respectively. All procedures involving animal handling and experimentation were approved by the Institutional Animal Ethics Committee *vide* approval no. 05/IAEC/NTRCVSc/16, dated 25.10.2016.

Statistical analyses

The data were subjected to one-way analysis of variance and the means were compared by Duncan’s multiple range test using SPSS 17.0.

RESULTS AND DISCUSSION

The results of the study are shown in Figs 1-5. The final body weights (Fig. 1) were significantly ($p<0.05$) better among the treatments containing various forms of methionine, with the Methiorep-supplemented group showing the best ($p>0.05$) response.

The results are similar to those of Chattopadhyay *et al.* (2006) and Kalbande *et al.* (2009) wherein no significant difference in total body weight was observed between herbal methionine and synthetic methionine supplemented birds.

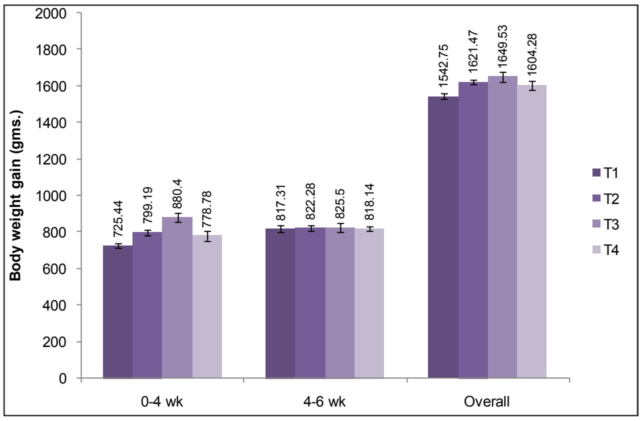

Fig. 1: Effect of partial replacement of dietary DL-methionine with herbal methionine replacers on the body weight gain of broilers; the body weight gain is shown separately for 0-4 weeks and 4-6 weeks of age as well as for the overall duration (0-6 weeks of age) of the study

There were no significant differences (p>0.05) between the treatments for feed intake (data not shown). However, the feed conversion ratio (FCR) (Fig. 2) during the starter and grower period (0-4 weeks) improved significantly in all the treatments; further, the FCR for the overall 6 weeks period in the Methiorep-supplemented group was significantly better than in the control. Similar results were obtained by Kalbande *et al.* (2009) with no significant effect of herbal or DL-Methionine supplementation on feed consumption of birds.

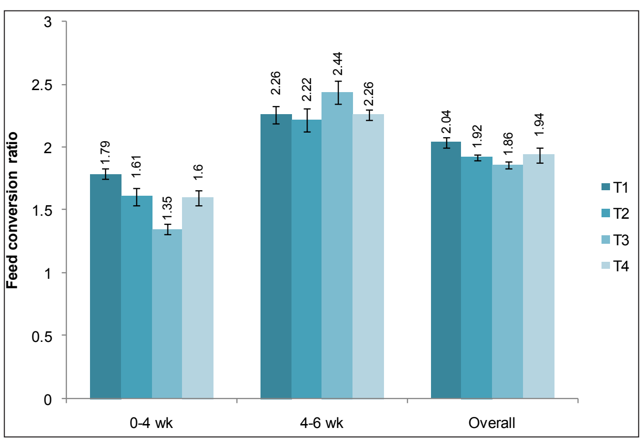

Fig. 2: Effect of partial replacement of dietary DL-methionine with herbal methionine replacers on the feed conversion ratio of broilers; the feed conversion ratio is shown separately for 0-4 weeks and 4-6 weeks of age as well as for the overall duration (0-6 weeks of age) of the study

However, Chattopadhyay *et al.* (2006) could report significantly greater diet consumption in control group as compared to methionine-fed birds, where feed conversion ratio was also significantly better than the control group. The results were in agreement with those of Manwar *et al.* (2016) and Kumari *et al.* (2012) where herbal methionine improved the feed efficiency in the birds.

Carcass characteristics (Figs 3 and 4) showed no significant difference across the treatments for heart, liver, kidney, and spleen weight and dressing percentage although live weight, dressed weight, total dressed weight, and the weights of thigh, breast and gizzard were significantly increased in the treated groups.

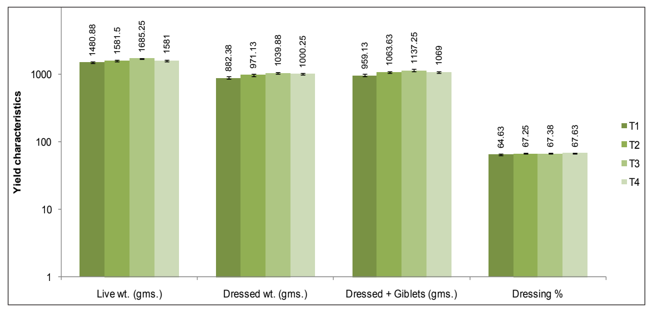

Fig. 3: Effect of partial replacement of dietary DL-methionine with herbal methionine replacers on the carcass yield characteristics of broilers

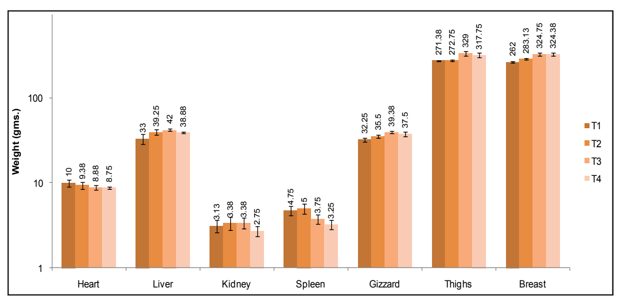

Fig. 4: Effect of partial replacement of dietary DL-methionine with herbal methionine replacers on the organ weight and body parts of broilers

Yuan *et al.* (2012) reported that source or level of methionine had no significant effect on different organ weights when expressed as percentage of body weight, however DL-Methionine-fed birds had numerically lower organ weight as percentage of body weight when compared to herbal methionine-fed groups. Makinde *et al.* (2017) reported that

Table 3: Effect of partial replacement of dietary DL-methionine with herbal methionine replacer on biochemical profiles of broilers

Group	Total protein mg/dl	Albumin mg/dl	Globulin mg/dl	Cholesterol mg/dl	Glucose mg/dl	Calcium mg/dl	Phosphorus mg/dl	SGOT IU/l	SGPT IU/l
T_1	3.24±0.23	1.15±0.12^{b}	2.09±0.25	114.88±5.91^{b}	269.54±8.30^{ab}	12.68±0.70	14.02±0.87	125.76±11.23^{b}	10.13±1.38
T_2	3.51±0.16	1.60±0.03^{a}	1.91±0.16	139.26±9.29^{a}	286.41±11.76^{a}	14.89±1.23	13.51±0.86	169.64±11.64^{a}	14.35±1.62
T_3	3.51±0.15	1.43±0.05^{a}	2.09±0.12	114.88±3.41^{b}	247.12±13.37^{b}	14.51±0.55	14.55±1.27	138.42±11.20^{ab}	15.19±0.97
T_4	3.77±0.13	1.48±0.05^{a}	2.29±0.12	105.06±1.86^{b}	240.67±6.35^{b}	12.92±0.76	11.30±2.29	112.25±8.97^{c}	14.35±1.62

^{ab}Values in column bearing different superscripts differ significantly ($P<0.05$)

carcass characteristics of birds fed synthetic methionine were comparable with those fed herbal methionine diets. Kumari *et al.* (2012) reported significantly lower abdominal fat content in herbal methionine-supplemented birds, implying that both synthetic and herbal methionine are able to meet the nutrient requirements for growth in growing birds efficiently without any adverse effect on the performance of the birds.

Serum biochemical profile (Table 3) showed no significant difference across various dietary treatments in serum total protein, globulin, calcium and phosphorus. Nevertheless, a beneficial effect of herbal methionine could be assumed from the serum cholesterol and glucose values which were higher in synthetic methionine fed group than in herbal methionine fed groups, elevated glucose and cholesterol being important indicators of stress in chicken (Puvadolpirodand Thaxton, 2000), thus, signifying the anti-stress effect of herbal methionine in fast growing birds.

Therefore, partial replacement of DL-methionine with herbal methionine allowed greater body weight gain, better feed conversion ratio, higher dressing percentage, and lesser physiological stress in broilers. In conclusion, the results show that herbal methionine replacers *viz*. Methiorep and AV/BMP/65 can be used to partially replace at least up to half, if not greater, of the dietary DL-methionine in broiler feeds for improved performance and carcass characteristics.

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