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Effect of replacing synthetic DL-methionine with herbal methionine on the production performance of commercial broilers

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Abstract
A biological experiment was carried out for 6 weeks at the Poultry Research Station, TANUVAS, Chennai, India to investigate the effect of replacing synthetic DL-methionine by herbal methionine at different levels on the production performance of commercial broilers. 300 day-old broiler chicks (Cobb-400) were assigned randomly in to five treatment groups each with six replicates of 10 birds each and fed with one of the following experimental diets viz., Control basal diet (T1), basal diet was supplemented with DL Methionine @ 2 Kg/tonne of feed (T2), DL Methionine1.33 Kg + herbal methionine @ 0.67 Kg/tonne of feed (T3), DL-methionine1Kg + herbal methionine 1Kg/tonne of feed (T4), DL-methionine 0.67 Kg + herbal methionine @ 1.33 Kg/tonne of feed (T5). The birds were provided with feed (BIS 2007) and water *ad libitum*. Data were recorded and analyzed by one-way ANOVA procedure of SPSS software. Results revealed that the body weight was significantly ($P \leq 0.01$) increased at 50 and 67% replacement of DL–Methionine. Feed consumption was significantly affected by the herbal methionine. DL-methionine at 67% replacement by herbal methionine significantly ($P \leq 0.05$) improved feed conversion ratio in broilers. Serum methionine and cysteine levels were significantly ($P \leq 0.05$) increased in groups in which DL-methionine was replaced by herbal methionine 50 and 67% level. Supplementation of herbal methionine had significant ($P \leq 0.05$) effect on relative weight of liver, gizzard, and heart however the length of intestine was not affected. Similarly carcass traits and sensory quality of the meat were not affected by dietary treatments. Herbal methionine at 50 and 67% replacement levels improved livability and reduced cost of production per kg of live weight in broilers.

Keywords: Herbal methionine, DL-methionine, production performance, serum methionine and cysteine, broilers

Introduction
Mordern broilers are efficient converters of feed in to protein of high biological value with capable of attaining average body weight of 2.2 kg with the feed conversion ratio of 1.6 to 1.8 within 35 to 42 days of age. To tap up this genetic potential the broilers has to be fed with properly balanced diet and it should provide all the nutrients with high bioavailability. One of the most important nutrient is protein balanced with all essential amino acids. The most critical amino acids in broiler diets are lysine, methionine, cystein, tryptophan and threonine. Out of this methionine is the first limiting amino acid in broiler diet, hence, it has to be supplemented to practical broiler diets. In addition, rapid growth of broilers demands higher requirement of methionine in their diet.

The most common source of methionine in broiler diet is DL-Methionine which is produced by chemical method from petro chemicals like acrolein, methyl mercaptan and hydrogen cyanide. Increasing prices for synthetic DL-methionine coupled with the increasing demand for organic methionine have provoked the interest of poultry nutritionist to use herbal methionine in broiler diet. Under Indian conditions, there are several herbal methionine products are available in the market and has been found to replace DL-methionine very effectively in broiler diets (Chattopadhyay *et al.*, 2006 and Kalbande *et al*., 2009) [1, 2]. However, Itoe *et al.*, 2010 [3] reported that herbal methionine is not found to be substitute for DL-methionine in broiler diets under Nigerian environment. Hence, the present study was conducted to investigate the effect of replacing synthetic DL-methionine by herbal methionine at different levels on the production performance of commercial broilers.

Materials and methods

A total of 300 day-old broiler chicks (Cobb 400) were randomly assigned to five treatments each with six replicates of ten chicks each based on a Completely Randomized Design. The birds were fed with one of the following experimental diets viz., Control basal diet (T1), basal diet was supplemented with DL Methionine @ 2 Kg/tonne of feed (T2), DL Methionine1.33 Kg + herbal methionine @ 0.67 Kg/tonne of feed (T3), DL-methionine1Kg + herbal methionine 1Kg/tonne of feed (T4), DL-methionine 0.67 Kg + herbal methionine @ 1.33 Kg/tonne of feed (T5). The herbal methionine used in this study is a polyherb formulation contains *Mucuna pruriens*, *Trigonella foenumgraecum*, *Azadirachta indica* and *Boerhaavia diffusa which mim*ics the activity like that of methionine in free & conjugated form. The birds were provided with experimental feed (BIS 2007) [4] and water *ad libitum*. Standard scientific managemental practices were followed throughout the experimental period of 6 weeks.

The experimental diets were formulated as per BIS (2007) [4] in mash form. The chemical composition of the experimental diets was determined by following AOAC (2005) [5]. Calcium, available phosphorus, lysine and metabolizable energy content were calculated. Whereas methionine and cystine were estimated by using HPLC method. Experimental diet and clean, fresh, potable drinking water were provided *ad libitum*. The data on body weight, feed intake, livability were recorded at bi-weekly intervals. Feed conversion ratios (kg feed/kg body weight gain, FCR) were calculated. Sexes of broilers were noted from 4th week of age. Mortality was recorded daily and per cent livability was calculated. At the end of the experiment (6 weeks of age), one male and one female broiler from each replicate were randomly selected, weighed and slaughtered as per BIS (1992) [6] after 12 hour fasting and the carcass characteristics recorded. The carcasses were chilled at 4 ºC for overnight and, then it was cut into different parts, *viz.* breast, back, neck, legs and wings, and their weights were recorded. These data were expressed as percentages to carcass weight. The weight of liver, gizzard, heart were recorded and expressed in relation to body weight. The length of intestine was measured and expressed in relation to body weight. Serum methionine and cysteine levels were estimated by HPLC method. All data were analyzed using the one-way ANOVA procedure of SPSS [7] (Version 16) for analysis of variance. Significant differences among treatments were identified at 5% probability level by Duncan's multiple range tests.

Results and Discussion

The effects of herbal methionine supplementation on body weight, weight gain, feed intake, FCR, livability, relative weight of gizzard, liver, heart, serum methionine, cysteine and length of intestine are presented in table 1. Since the chicks were selected with uniform body weight in order to avoid initial source or variation, there was no significant difference in day-old body weight between the treatment groups. However, the sixth body weight of broilers were significantly (P<0.01) increased in groups in which 67% and 50% of DL methionine was replaced with herbal methionine followed by 37% replacement level when compared with other treatments and control. Similar trend was also observed in body weight gain. Narayanswamy and Bhagwat (2010) [8] reported similar findings who found that the broilers fed with herbal methionine showed a significant increase in weight gain as compared to control and synthetic methionine group.

Table 1: Effect of DL-methionine replacement with herbal methionine on the production performance of broilers (Mean ± S.E)

	Control	Basal diet + DL Methionine 2kg/tone of feed	Basal diet + 1.33kg DL Methionine + 0.67 kg Herbal methionine/ tone of feed	Basal diet + 1kg DL Methionine + 1 kg Herbal methionine/ tone of feed	Basal diet + 0.67 kg DL Methionine + 1.33 kg Herbal methionine/ tone of feed
	--	0%	33.5%	50%	67%
Day-old weight (g)^{NS}	48.34±0.23	47.98±0.21	48.24±0.30	48.48±0.35	48.41±0.28
Body weight (g)**	2056.35^{c}±42.34	2145.46^{b}±50.12	2156.47^{b}±42.54	2189.23^{a}±54.38	2221.10^{a}±37.98
Weight gain (g)	2008.01^{c}±42.13	2097.48^{b}±49.12	2108.23^{b}±41.67	2140.82^{a}±52.34	2172.69^{a}±38.23
Feed consumption (g)**	3754.49^{a}±39.72	3690.82^{b}±40.37	3689.40^{b}±50.92	3685.62^{b}±49.88	3650.12^{b}±54.70
Feed conversion ratio*	1.85^{a}±0.03	1.76^{b}±0.08	1.75^{b}±0.11	1.72^{b}±0.06	1.68^{b}±0.02
Livability (%)	93.33^{b}±0.01	96.67^{a}±0.03	98.33^{a}±0.03	98.33^{a}±0.03	98.33^{a}±0.03
Serum methionine (mole/ml)**	125.34^{c}±1.34	174.23^{a}±2.35	157.34^{b}±3.01	168.34^{a}±2.47	169.42^{a}±3.12
Serum cysteine (mole/ml) **	5.51^{c}±0.14	7.13^{a}± 0.13	6.43^{b}±0.12	7.01^{a}±0.22	6.51^{b}±0.21
Relative weight of liver (% of live weight) *	1.70 ^{b}±0.01	2.12^{a}±0.03	2.02^{a}±0.05	2.25^{a}± 0.03	2.27^{a}±0.02
Relative weight of gizzard (% of live weight) *	2.11^{b}±0.02	2.43^{a}±0.02	2.47^{a}±0.03	2.50^{a}±0.02	2.48^{a}± 0.04
Relative weight of heart (% of live weight) *	0.54 ^{b}±0.002	0.65^{a}±0.002	0.63^{a}±0.001	0.70^{a}±0.002	0.69^{a}±0.001
Length of intestine (Cm)^{NS}	170.34±6.52	171.23± 8.13	172.34±7.34	170.92±6.17	171.13±7.15
Net profit/kg of live wt (Rs)	6.74	7.13	8.73	8.20	9.54

Means with at least one common superscript in the same row do not differ significantly * (P<0.05), ** (P<0.01)

The cumulative feed consumption up to 6 week of age was significantly (P<0.01) higher in control compared to methionine supplemented groups irrespective of source. However, feed intake was numerically lower in group in which 67% of DL methionine was replaced with herbal methionine. This finding was in agreement with the findings of Halder and Roy (2007) [9] who reported that the feed intake was significantly higher on the control treatment over methionine supplemented diets.Whereas Ahmed and Abbas (2015) [10] reported contrarily that the feed intake was not significantly (P≥0.05) affected by different sources and levels of methionine as compared to the control. The lower feed consumption in control group may be due to Methionine deficiency as it depressed the feed intake of broiler chicks due to amino acid imbalances (Bunchasak and Keawarun, 2006) [11]. Similar trend was observed in FCR in this study. FCR was

significantly improved (P<0.05) in methionine supplemented groups. Numerically superior FCR was recorded in herbal methionine fed groups compared to synthetic methionine groups. This positive response in feed conversion ratio was observed earlier by Ahmed and Abbas (2015) [10], who reported that FCR was significantly improved (P<0.05) by the herbal methionine at 0.06% level in broilers. Livability was significantly (P<0.05) influenced by herbal methionine supplementation in broilers in this study. The livability percent varied from 93.33 (control) to 98.33 in herbal methionine (1.33 kg/tone of feed) fed group. As the herbal methionine level increased the livability was improved. Similar findings were reported by Itoe *et al.,* 2010 [3] who reported that viability of chicks was improved by herbal methionine supplementation.

Serum methionine and cysteine levels were significantly (P≤0.05) increased in DL-methionine, 50 and 67% DL-methionine methionine replaced groups by herbal methionine**.** Serum methionine levels were significantly (P<0.01) increased by the replacement of DL methionine by herbal methionine at 50 and 67% level followed by 33.5% level as compared to control and other treatment groups. The serum cysteine concentration was significantly (P<0.01) higher in synthetic, 50 and 67% replacement group when compared to other treatment groups and control. On perusal of literature no previous work could be traced to support these findings. However, broilers with higher body weight gains showed a higher concentration of serum total protein compared to the lighter broilers possibly due to higher demand for lean tissue maintenance and turnover (Adeyemo *et al.,* 2010) [12]. Carcass traits such as ready-to-cook yield, breast, wings, thighs, legs, drumstick percentages were not affected by the replacement of DL-methionine by herbal methionine in this study. Similarly the length of the intestine was also not affected in this study. The sensory quality of the meat was not affected by the supplementation of herbal methionine. In contrarily Kiran *et al*., 2012 [13] reported that breast meat bone ratio of broilers fed 0.15% DL-methionine or 0.15% herbal methionine was higher by 35.7% and 59.0%, respectively, versus control. Similarly, percentage of breast yield was more when DL-methionine and herbal methionine was added in the diet.

Data revealed that supplementation of either synthetic or herbal methionine had significant (P≤0.05) effect on relative weight of liver, relative weight of gizzard, relative weight of heart whereas it did not affect the length of intestine. This findings are supported by Kiran *et al.,* 2012 [13] who reported that the relative weight of liver of broilers fed 0.15% DL-methionine or 0.15% herbal methionine was significantly (P≤0.05) lower compared to control. The net profit per kg of live weight was improved in methionine supplemented groups irrespective of source. However there was increase in net profit in herbal methionine supplemented groups from INR1.07 to 2.41 over that of synthetic methionine groups. The net profit was comparatively lower in control groups (INR.6.74) that may be due to poor production performance as a result of methionine deficiency as witnessed by low serum level.

Conclusion

From the results obtained from this study it can be concluded that the DL-methionine can be replaced with herbal methionine at 50 and 67% levels. Further herbal methionine could able to improve the growth performance, livability and reduced the cost of production per kg of live weight in broilers.

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