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Broiler performance in response to different methionine levels

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The effect of different levels of Met on performance and carcass quality of broilers was investigated. Based on a completely randomized design, three treatments including T1 (+10% NRC requirement of Met), T2 (NRC requirement of Met), and T3 (-10% NRC requirement of Met) were used. Feed intake (FI) , body weight (BW) and feed conversion ratio (FCR) were measured weekly. The effects of treatments on BW and FCR were not significant. Birds fed T1 had the highest FI among treatments, as the difference between T1 and T2 was significant. Significantly, carcass yield of T3 was lower than others. Birds fed control diet decreaes abdominal fat, significantly. The effects of treatments on other parameters (thigh, breast and liver percentages) were not significant. It can be concluded that diet formulation based on low Met level (-10% NRC) results in negative effects on broiler chickens.

Keywords: Methionine, performance, broiler.

Introduction

Methionine (Met) is most often the first limiting amino acid in poultry feedstuffs and frequently, therefore, must be added as a supplement in many dietary formulations, thereby improving the amino acid balance and subsequent Nutilisation (Huyghebaert, 1993). In addition, Met is an essential nutrient for poultry, this amino acid may provide methyl groups, which are needed for several metabolic reactions such as the synthesis of carnithine and creatine (Schutte *et al*., 1997).

Many study have been investigated the response of poultry to inclusion of Methionine supplements in different amounts and forms into diets (Acar *et al*., 2001; Bunchasak and Keawarun, 2006; Huyghebaert, 1993; Kalinowski *et al*., 2003; Maenz and Engele-Schaan, 1996; Mandal *et al*., 2004; Neto *et al*., 2000; Ojano-Dirain and Waldroup, 2002; Zhan *et al*., 2006). In the mentioned

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researches, unfortunately, a little importance have been allocated to deteremination of suitable level of methionine supplementation to broiler chichens diets.

Zhan *et al.* (2006) investigated the effects of methionine and betaine supplementation on growth performance, carcass composition and lipid metabolism in growing broilers. Their finding indicated that methionine and betaine supplementation significantly improved weight gain and feed conversion and also significantly increased breast muscle yield and decreased abdominal fat content. Bunchasak and Keawarun (2006) determined the effects of liquid DL-methionine hydroxy analog-free acid (LMA) and dry DL-methionine (DLM) on growth performance, carcass quality. The weight gain, feed intake and feed conversion ratio of chicks fed LMA or DLM were significantly greater than those in chicks receiving the methionine-deficient diet. In this study it has been shown that breast meat yields were significantly improved and abdominal fat was significantly decreased when methionine sources were added.

So, the aim of this experiment is determination of the best level of Met in order to attain better performance and carcass quality at 42 days of age in broiler chicks.

Materials and methods

Based on a completely randomized design, one hundred eighty day-old Arian male broiler chicks were randomly assigned to 3 treatments with 6 replicates and 10 chicks per each replicate pen in a 42-d study. Birds were raised on floor pens. They received feed and water ad libitum. Light was provided continuously (24 h) throughout the experimental period and the initial room temperature was set at approximately 32°C and then gradually reduced based on normal management practices until reaching 22°C. Compositions of diets are shown in table 1. The nutrient specifications were recommended by national research council (NRC, 1994) for broiler starter (0 to 21 d) and growing (22 to 42 d) diets. Therefore, the following treatments were applied:

Diet with high Met requirement level (+10% NRC)
Diet with standard Met requirement level (NRC)
Diet with low Met requirement level (-10% NRC)

Feed intake, BW and FCR were measured weekly during experimental period. At the end of the experiment, 12 birds (two chicks per replicate) from each treatment were randomly selected, weighed, and killed by cervical dislocation. The liver, abdominal fat and thigh and breast muscles were harvested and weighed individually. The organ weights were expressed as a percentage of live weight. Carcass yield, also, was expresses as live weight percentage.

Data were subjected to analysis of variance in a completely randomized design using the General Linear Models (GLM) procedure of SAS® (SAS, 2004), and when treatment means were significant (P<0.05), Duncan's multiple range test (Duncan, 1955) was used.

Results

The effects of experimental treatments on performance of broiler chickens have shown in table 2. Based on these results, birds fed T1 had the highest FI among treatments, as the difference between T1 and T2 was significant (P<0.05). The effects of treatments on BW were not significant (P>0.05), although numerically, birds fed high Met level (+10% NRC requirement of Met) were heavier than others. Also, significant FCR were not found by treatments (P>0.05). Significantly, carcass yield of T3 was lower than others (P<0.05).

The effects of experimental treatments on carcass composition of broiler chickens at 42 days of age have shown in table 3. Significantly, carcass yield was decreased by diet containing low Met level (P<0.05). Results have shown that control diet decrease abdominal fat, significantly (P<0.05). The effects of treatments on other parameters (thigh, breast and liver percentages) were not significant (P>0.05).

Table 1. Formulation of rations and diet composition (%)

Ingredients	**Starter**			**Grower**		
	T1	T2	T3	T1	T2	T3
Corn, Grain	56.32	55.00	60.10	65.00	66.00	67.00
Soybean Meal	36.00	35.56	32.00	29.30	28.72	27.00
Soybean Oil	3.00	3.03	1.75	3.24	3.00	3.22
Fish Meal	1.50	3.00	3.00	0.00	0.00	0.00
Oyster Shells	1.88	1.80	1.83	1.70	1.60	1.80
Dical. Phos.	0.45	0.45	0.50	0.20	0.10	0.20
Common Salt	0.20	0.20	0.20	0.20	0.20	0.25
Vitamin Premix*	0.25	0.25	0.25	0.15	0.10	0.25
Mineral Premix*	0.25	0.25	0.25	0.15	0.10	0.25
DL-Methionine	0.10	0.18	0.07	0.06	0.10	0.03
L-Lysine HCl	0.05	0.28	0.05	0.00	0.08	0.00
Total	100	100	100	100	100	100
Calculated						
MEn (Mcal/Kg)	3.10	3.10	3.10	2.80	2.80	2.80

Crude Protein (%)	23.00	23.00	23.00	19.00	19.00	19.00
Calcium (%)	1.00	1.00	1.00	0.85	0.85	0.85
Avail. Phosphorus (%)	0.50	0.50	0.50	0.42	0.42	0.42
Sodium (%)	0.16	0.16	0.16	0.16	0.16	0.16
Lys (%)	1.10	1.10	1.10	0.90	0.90	0.90
Met (%)	0.56	0.51	0.46	0.42	0.38	0.35

T1= Diet based on +10% NRC requirements for Methionine, T2= Diet based on NRC requirements for Methionine, T3= Diet based on -10% NRC requirements for Methionine.
*Provides per kg of diet. vitamin A (7,000 IU), vitamin D3 (1,400 IU), vitamin E (16.65 mg), vitamin K (1.5 mg), vitamin B1 (0.6 mg), vitamin B2 (2.36 mg), vitamin B6 (0.6 mg), vitamin B12 (0.013 mg), biotin (0.15 mg), choline (1.54 g), pantothenic acid (9.32 mg), niacin (30.12 mg), folic acid (1.42 mg), selenium (0.65 mg), iodine (0.35 mg), iron (57.72 mg), copper (12.30 mg), zinc (141.48 mg), manganese (173 mg).

Table 2. Effects of experimental treatments on performance of broiler chickens.

Treatments *	**Body Weight, g**			**Feed Intake, g**			**Feed Conversion Ratio, g/g**		
	0-21d	22-42d	0-42d	0-21d	22-42d	0-42d	0-21d	22-42d	0-42d
T1	494.3	1229.8	1724.1	1175.6^{a}	2924.0^{a}	4099.6^{a}	2.38	2.38	2.38
T2	447.1	1122.6	1569.7	1068.9^{b}	2661.8^{b}	3730.8^{b}	2.39	2.37	2.38
T3	456.4	1152.2	1608.68	1099.4^{ab}	2793.6^{ab}	3893.0^{ab}	2.41	2.42	2.42
P-value	0.141	0.300	0.107	0.046	0.041	0.022	0.989	0.910	0.887
SEM	17.28	49.44	51.66	29.73	69.39	88.86	0.08	0.08	0.06

$^{a–c}$ Means followed by different superscript letters are significantly different ($P< 0.05$).
* T1= Diet based on +10% NRC requirements for Methionine, T2= Diet based on NRC requirements for Methionine, T3= Diet based on -10% NRC requirements for Methionine.

Table 3. Effects of treatments on carcass composition of broiler chickens

Treatments*	Carcass (%)	Thigh (%)	Breast (%)	Liver (%)	Abdominal Fat (g)
T1	64.37^{a}	33.50	29.43	2.81	28.69^{a}
T2	63.98^{a}	34.06	29.85	2.80	12.87^{b}
T3	59.26^{b}	33.94	27.97	2.56	26.44^{a}
P-value	0.0006	0.879	0.089	0.615	0.008
SEM	0.816	0.756	0.558	0.178	3.519

$^{a–c}$ Means followed by different superscript letters are significantly different ($P< 0.05$).
* T1= Diet based on +10% NRC requirements for Methionine, T2= Diet based on NRC requirements for Methionine, T3= Diet based on -10% NRC requirements for Methionine.

Discussion

Based on our results, birds fed T1 had the highest FI among treatments, as the difference between T1 and T2 was significant. In this regard, results of current experiment agreed with finding of other studies (Bunchasak and Keawarun, 2006; Zhan *et al.*, 2006), who stated that adding supplemental Met to diet increase feed consumption of birds. But results with respect to feed intake are not in accordance with those of Esteve-Garcia and Llaurado (1997), who reported that supplemental Met reduced feed intake compared with a diet deficient in sulphur amino acids. The effects of treatments on BW were not significant (P>0.05), although numerically, birds fed high Met level (+10% NRC requirement of Met) were heavier than others. Also, significant FCR were not found by treatments (P>0.05). Significantly, carcass yield of T3 was lower than others (P<0.05). Our results about BW and FCR disagreed with some researches (Bunchasak and Keawarun, 2006; Zhan *et al*., 2006) who reported improved weight gain and feed conversion ratio in response to supplemental Met. Finding of other experiments have shown that increases in methionine levels resulted in an increase of approximately 12–14% in weight gain when compared with animals receiving the methionine-deficient diet (Garlich, 1985; Huyghebaert, 1993; Rostagno and Barbosa, 1995). Possibly reseaon for this contrast are the level of added supplemental Met to diets, source of used met and nutrients concentration in the used diets.

Significantly, carcass yield was decreased by diet containing low Met level. Results have shown that control diet decrease abdominal fat, significantly. Results regards to carcass yield in accordance with Bunchasak and Keawarun (2006); Hickling *et al.* (1990); Mandal *et al.* (2004); Meirelles *et al.* (2003), who reported that diet deficient in Met resulted in decreased carcass yield. The effects of treatments on other parameters (thigh, breast and liver percentages) were not significant. Our results about abdominal fat and breast yield disagreed with finding of Bunchasak and Keawarun (2006) who have shown the decreasing abdominal fat in response to supplemental Met sources. As it is mentioned previously, level of supplemental Met, source and type of used Met and etc. may be the probably reasons for these disagreements.

Conclusion

It can be concluded that diet formulation based on low Met level (-10% NRC) results in the negative effects on broiler chickens performance.

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