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Effect of methionine type and levels on performance of broiler chicken

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Target Audience*:* Animal Nutritionists, Poultry Farmers, Feed millers and Scientists.

Abstract

The experiment was conducted at Hybrid Farms, Kaukau, Kaduna State on one hundred and ninety eight 7-day old broiler chicks to determine the effect of methionine type and levels on performance of broiler starter chickens. The DL-Methionine and L-Methionine were supplemented at 0.15, 0.20 and 0.25% levels of inclusion respectively. The birds were divided into six treatments and replicated three times with eleven birds per replicate in a 2 x 3 factorial arrangement using a completely randomized design (CRD). Feed and water were given ad libitum. Data collected were analysed using GLM procedure of SAS. Differences between means were compared for significance (P<0.05) using Duncan Multiple Range Test. Methionine type, inclusion levels and interaction had significant (P<0.05) effects on the growth performance. Birds fed dietary L-Methionine type performed better than those fed on DL-methionine. Birds fed dietary methionine at 0.20% inclusion levels performed significantly (P<0.05) better than those on 0.15 and similar with those on 0.25. It was concluded that type and levels of methionine had influence on the growth performance of broiler chicken.

Keywords: DL-Methionine; L-Methionine; Broiler; Starter; Chicken.

Description of Problem

There is rapid population increase in Africa without corresponding increase in food production (1). The inadequate supply and intake of animal protein in developing countries is due to high cost of feeding with the accompanying high cost of production. The population of developing countries has continued to increase resulting in increased-demand for protein of animal sources. Nigeria has the highest population in Africa of about 150 million, and there is also high maternal-child mortality due to under nutrition. The acute shortage of animal protein in the diet of average Nigerians requires a logical solution like increasing the production and consumption of poultry (2).

Some amino acid cannot be synthesized by the animals themselves and must therefore be supplied in their diet; they are called essential amino acid. In avian specie, methionine is one of the essential amino acid needed to improve performance and is considered to be the first-limiting amino acid in corn-soybean meal-based poultry diets (3).

Methionine is primarily produced by either chemical synthesis or hydrolyzing proteins. The product by chemical synthesis is DL-mixture of the amino acid (4). It is commonly supplemented in diets as dry DL-methionine (DL-met; 99% pure) or as liquid DL-met

hydroxyl analog-free acid (MHA-FA, containing 88% of active substance). However, both the DL-Methionine and MHA-FA have to be converted to L-Methionine before animals can use it, and L-Methionine is the only form used for protein synthesis and metabolism (5). The study was aimed at comparing the performance of broiler chicken fed DL- or L-Methionine and the optimum level of inclusion of DL- or L-Methionine for optimum performance.

Materials and Methods

Experimental site

The experiment was carried out at Hybrid Farms, Farm A, along Kaduna–Abuja Express way, Kaukau, Kaduna State. Kaduna is located at latitude 1031'23.160"N and longitude 726'25.008"E, at an altitude of 704m above sea level. The annual rainfall ranges between 617–1365mm with an average of 1041mm between July and September (6).

Table 1: Ingredients composition (%) of broiler starter (1-4 weeks) diets containing graded levels of DL-methionine or L-methionine supplementation

	Dietary Treatments (%)					
	DLM			LM		
Ingredients	0.15	0.20	0.25	0.15	0.20	0.25
Maize	51.17	51.17	51.17	51.57	51.57	51.57
Soybean meal	31.29	31.34	31.29	31.39	31.34	31.29
Groundnut cake	10.00	10.00	10.00	10.00	10.00	10.00
Maize offal	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Dicalcium phosphate	0.20	0.20	0.20	0.20	0.20	0.20
Limestone	0.80	0.80	0.80	0.80	0.80	0.80
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Mycotoxin binder	0.04	0.04	0.04	0.04	0.04	0.04
Lysine	0.20	0.20	0.20	0.20	0.20	0.20
DL-methionine	0.15	0.20	0.25	0.00	0.00	0.00
L-methionine	0.00	0.00	0.00	0.15	0.20	0.25
Total	100	100	100	100	100	100
Calculated Analysis						
Met Energy (Kcal/kg)	3072	3070	3068	3072	3070	3068
Crude protein (%)	21.29	21.32	21.35	21.29	21.32	21.35
Crude fibre (%)	3.75	3.75	3.75	3.75	3.75	3.75
Ether extract (%)	6.40	6.40	6.39	6.40	6.40	6.39
Calcium (%)	1.05	1.05	1.05	1.05	1.05	1.05
Lysine (%)	1.24	1.24	1.24	1.24	1.24	1.24
Available Phosphorous (%)	0.49	0.49	0.49	0.49	0.49	0.49
Methionine+Cysteine (%)	0.78	0.83	0.87	0.78	0.83	0.87
Feed cost/kg (₦)	99.91	100.84	101.78	99.91	100.84	101.78

** Biomix premix supplied per kg of diet: Vit. A, 10,000iu; Vit. D3, 2000iu; Vit. E, 23mg; Vit. K, 2mg; Vit. B1, 1.8mg; Niacin, 27.5mg; Pantothenic acid, 7.5mg; Vit. B12 0.015mg; Folic acid, 0.75mg; Biotin, 0.06mg; Choline chloride, 3000mg; Cobalt, 0.2mg; Coppper, 3mg; Iodine, 1mg; Iron, 20mg; Manganese, 40mg; Selenium, 0.2mg; Zinc, 30mg; Antioxidant, 1.25mg. **Dicalcium phosphate supplied per kg of diet: water, 0.2g; Ash, 74.2g; Calcium, 23300mg; Phosphorus, 18100mg; Iron, 2000mg; Sodium, 25mg; Magnesium, 60mg.

Experimental birds, diets and management

One hundred and ninety-eight Ross 308 day old chicks purchased from Agriculture International Tyrade Limited (Agrited), Ibadan, Oyo state, were used for the experiment.

Three graded levels (0.15, 0.20, and 0.25%) each of DL-methionine and L-methionine were added as synthetic methionine supplement in the diet of broiler chicken to constitute six dietary treatments. The diets were formulated to be isocaloric (2800 Kcal/Kg Metabolizable Energy) and isonitrogenous (23% crude protein). Eleven birds were randomly allotted to each pen. Birds in Treatment 1, 2 and 3 were fed diets containing graded levels of DL-methionine (0.15, 0.20 and 0.25%) while those in treatment 4, 5 and 6 were fed diets containing graded levels of L-methionine (0.15, 0.20 and 0.25%).

Chicks were brooded together for one week. Light (electricity) and heat (charcoal stove) were provided throughout the brooding period. After brooding, birds were allotted into six treatment groups and replicated three times. Birds were housed in a deep litter system with water, and feed was provided *ad libitum* and vaccinations and medications were carried out adequately as at when due. The drinkers were washed on a daily basis and water changed twice a day.

Table 2: Proximate composition of the diet (Starter diet)

	DLM			LM		
Nutrient %	0.15	0.20	0.25	0.15	0.20	0.25
Dry matter	92.49	92.05	93.33	91.72	92.49	92.49
Crude protein	23.19	23.06	23.56	23.80	23.38	23.85
Crude fibre	5.73	4.00	6.58	5.76	6.15	5.29
Ether extracts	5.44	5.06	5.39	6.12	5.72	6.48
Ash	8.59	7.02	8.15	7.54	7.89	7.72
NFE	57.05	60.86	56.32	56.78	56.86	56.66

NFE = Nitrogen free extract; DL = DL-Methionine; LM = L-Methionine

Table 3: Effect of dietary methionine types on broiler starter chickens

	Types of Methionine			
Parameters	DLM	LM	SEM	LOS
Initial weight (g/bird)	119.89	120.52	1.24	NS
Final weight (g/bird)	719.89^{b}	750.89^{a}	9.60	*
Total weight gain (g/bird)	600.01^{b}	630.37^{a}	9.03	*
Daily weight gain (g/bird)	28.57^{b}	30.01^{a}	0.44	*
Daily feed intake (g/day/bird	67.01^{b}	69.60^{a}	0.44	*
Feed Conversion Ratio	2.34	2.31	0.03	NS
Feed cost/kg gain (₦)	236.39^{b}	233.01^{a}	2.98	*

^{ab} Means in the same row having different superscripts are significantly different (P<0.05); NS = Not significant (P<0.05); * = Significant difference (P<0.05); SEM = Standard error of mean; LOS = Level of significance; DL= DL-Methionine; LM= L-Methionine.

Chemical analysis

Feed samples were analysed for chemical composition according to the method as described by (7) at the Animal Science Biochemical Laboratory, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna State

Data collection

The initial weight of the birds was taken and weight of birds was monitored on weekly basis. The diets were weighed before the birds were fed and the left over feeds were weighed on weekly basis to determine the feed intake.

The statistical model

$Y_{ijk} = \mu + S_i + Lj + (S_i \times L_j) + e_{ijk}$

Where; Y_{ijk}= overall observation

μ = overall mean

$S_i = i^{th}$ effect of Methionine type

$L_j = j^{th}$ effect of Methionine levels

$(S_i \times L_j)$ = interaction between the i^{th} effect of methionine type and j^{th} effect of methionine levels

e_{ij}= random error

Statistical Analysis

There were eleven birds per replicate and 33 birds per treatment in a 2 x 3 factorial arrangement in a completely randomized design.

Data generated during the study were analysed using GLM procedure of (8). Differences between means were tested for significance ($P<0.05$) using Duncan's Multiple Range Test.

Results and Discussion

Effect of dietary methionine types on broiler starters is shown in Table 3. Methionine type had significant ($P<0.05$) effect on the parameters. The results obtained shows that L-methionine significantly ($P<0.05$) performed higher than DL-methionine in all the parameters (final weight, total weight gain, daily weight gain, daily feed intake and feed cost/kg gain) except for initial weight and feed conversion ratio which had no significant ($P>0.05$) difference. This result does not concord with the findings of (9) who reported no significant ($P>0.05$) effect on feed intake irrespective of source of methionine supplementation. Chicks fed L-Methionine supplemented diet had higher weight gain than those fed DL-Methionine. The improved performance of birds on L-Methionine based diet over those birds fed on DL-methionine could be as a result of L-Methionine mechanism of digestion where the L-form is utilized directly by the chicks without conversion as opposed to DL-Methionine where it will be transformed to the L-form before utilization by the chicks. Chicks fed L-Methionine supplemented diet also had the least feed cost/kg gain.

Main effect of varying levels of dietary methionine in broiler starter is presented in Table 4. Varying levels of methionine had significant ($P<0.05$) effect on final body weight, weight gain, feed intake, feed conversion ratio and feed cost per kg gain. The results obtained in this study for 0.20 and 0.25 were similar and significantly ($P<0.05$) higher than 0.15 except for daily weight gain where 0.20 did better than 0.25. This result agreed with the findings of (6) who reported an increased body weight gain and low feed conversion ratio with increasing levels of methionine. This result disagreed with the findings of (9) who reported no significant ($P>0.05$) effect on feed intake irrespective of level of methionine supplementation. As the level of methionine increases there was improvement in body weight gain but at the level of 0.25%, a decline in body weight gain was observed. The results disagreed with the findings of (10) who reported no significant ($P>0.05$) effect of level of methionine on final body weight, weight gain, feed intake, feed

conversion ratio and feed cost per kg gain. The feed intake followed the same pattern with that of body weight. Chicks fed 0.20% inclusion level of methionine had higher weight gain than chicks fed 0.15% but similar with those fed on 0.25% respectively. This could be attributed to increased feed intake. Feed conversion ratio was better for chicks fed on 0.25% and 0.20% levels of methionine inclusion. Chicks fed on 0.20% level of methionine showed the lowest feed cost per kg gain.

Table 4: Main effect of varying levels of dietary methionine in broiler starters

	Varying levels of Methionine (%)				
Parameter	0.15	0.20	0.25	SEM	LOS
Initial weight (g/bird)	119.95	120.92	119.73	1.24	NS
Final weight (g/bird)	712.00^{b}	751.50^{a}	742.67^{a}	9.60	*
Total weight gain (g/bird)	592.05^{b}	630.58^{a}	622.94^{a}	9.03	*
Daily weight gain (g/bird)	28.19^{b}	30.03^{a}	29.66^{a}	0.44	*
Daily feed intake(g/bird	67.50^{b}	69.62^{a}	67.80^{b}	0.44	*
Feed Conversion Ratio	2.39^{b}	2.30^{a}	2.29^{a}	0.03	*
Feed cost/kg gain(₦)	239.78^{b}	231.93^{a}	232.40^{a}	2.98	*

^{ab} Means in the same row having different superscript are significantly different (P<0.05); NS = Not significant (P<0.05); * =Significant difference (P<0.05); SEM = Standard error of mean; LOS = Level of significance; DL= DL-Methionine; LM= L-Methionine.

Table 5: Effect of interaction between types and levels of dietary methionine on broiler starters

	DLM (%)			LM (%)				
Parameters	0.15	0.20	0.25	0.15	0.20	0.25	SEM	LOS
Initial weight (g/bird)	121.77	120.90	121.27	122.13	121.23	121.20	1.24	NS
Final weight (g/bird)	690.67^{d}	743.33^{b}	725.67^{c}	733.33^{c}	759.67^{a}	759.67^{a}	9.60	*
Total weight gain (g/bird)	568.90^{d}	622.43^{b}	604.40^{c}	611.20^{c}	638.43^{a}	638.47^{a}	9.03	*
Daily weight gain (g/bird)	27.09^{d}	29.64^{b}	28.78^{c}	29.10^{c}	30.40^{a}	30.40^{a}	0.44	*
Daily feed intake (g/bird	66.23^{d}	67.60^{c}	67.20^{c}	68.77^{b}	71.63^{a}	68.40^{b}	0.44	*
Feed Conversion Ratio	2.44^{d}	2.27^{a}	2.33^{b}	2.37^{c}	2.33^{b}	2.24^{a}	0.03	*
Feed cost/kg gain(₦)	243.78^{c}	228.91^{a}	237.15^{b}	236.45^{b}	235.29^{b}	227.99^{a}	2.98	*

^{abcd} Means in the same row having different superscript are significantly different (P<0.05); NS = Not significant (P<0.05); *=Significant difference (P<0.05); SEM = Standard error of mean; LOS = Level of significance; DL=DL-Methionine; LM= L-Methionine.

Table 5 shows the effect of interaction of dietary methionine on broiler starter. There were significant (P<0.05) differences in the interaction between types and levels of methionine supplementation in all the parameters (final body weight, weight gain, feed conversion ratio and feed cost per kg gain) except for initial. There were similar and higher values in L-methionine at 0.20 and 0.25 levels for final weight, total weight gain and daily weight gain than others while higher performance found in L-methionine at 0.20 for daily feed intake. This result agreed with the findings of (11) who reported no significant interaction among methionine source, methionine supplementation levels regardless of the growth phase but disagreed with the findings of (12) who reported no level of interaction between methionine type and levels supplementation for final body weight, weight gain, feed conversion ratio and feed cost per kg gain. Chicks fed 0.20% and 0.25% L-methionine supplemented diet had higher weight gain. This could be due to higher feed

intake. This was followed by birds on DL-Methionine supplemented diet at 0.20%. Birds fed L-Methionine supplemented diet at 0.25% had the best feed conversion ratio followed by birds on DL-Methionine supplemented at 0.20% and birds on L-Methionine at 0.20% supplemented diet. The same trend followed also for feed cost per kg gain.

Conclusion and Applications

1. It was concluded that birds fed supplemented L-Methionine type performed better than those fed supplemented DL-Methionine type.
2. Birds fed dietary methionine at 0.20% inclusion levels performed significantly better than those on 0.15 and similar with those on 0.25. This means that 0.25 inclusions will lead to better performance of broiler.

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