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Effect of Two Types of Methionine Supplement on Performance of Finisher Broiler.

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Target Audience: Poultry Farmers Animal nutritionist and scientist, Feed millers,

Abstract

An experiment was carried out to determine the effect of two types of synthetic methionine supplement (Dl methionine and MHA FA; Methionine Hydroxyl Analogue Free Acid, also known as Alimet) on performance of finisher broiler. Two hundred and thirty four (234) day old Hubbard Flex broilerschicks were allotted to six dietary treatments and replicated three times using a 2 x 3 factorial arrangement in a complete randomized design which lasted four weeks for the starter. A diet devoid of methionine was formulated with subsequent addition of three graded levels (0.15, 0.20 and 0.25 %) of each type of synthetic methionine to constitute the following dietary treatment: 0.15% DL methionine (T1), 0.20% DL methionine (T2), 0.25% DL methionine (T3), 0.15% MHA FA (T4), 0.20%MHA FA (T5) and 0.25%MHA FA(T6). Parameters measured included body weight gain and feed intake. Also, blood samples were collected from the wings for blood chemical analysis. Result obtained from this study shows that methionine type had significant (P<0.05) effect on growth performance parameters. On the other hand, methionine levels had no significant (P>0.05) effect on growth performance and blood chemistry. There was no interaction between methionine type and level of methionine during the study. It was concluded that, birds fed MHA FA diets had improved growth performance. Birds fed MHA FA at 0.25% level of inclusion had the best result for weight gain. Although, feeding DL methionine at 0.15% gave higher feed efficiency economical. Broiler birds can be fed with diets up to 0.25% MHA FA supplements.

Key words: Methionine, performance, blood chemistry, broiler.

Description of Problem

Theprominence of poultry production in Nigeria today is primarily due to the short generation interval and relatively quick turn over on investment and high quality protein from poultry products. It is generally accepted as the fastest way of increasing animal protein consumption in developing countries of the world (1). The rapid growth of broilers demands that they are supplied with high quality diets to sufficiently cater for their nutrients requirements. Protein required by broiler depends primarily on the amount needed for maintenance, tissue growth and productive purposes. Although availability of cheap and good quality protein sources remains the single most important limiting factor in poultry production in Nigeria (2 ; 3).

Protein is a key nutrient in poultry nutrition and has a significant share in the cost of diet formulation, directly influencing feed conversion, carcass quality, and weight gain of animals. However, birds have requirements of amino acid met but not of crude protein (4). And a better understanding of the nutritional requirements of individual amino acids allows a more precise nutrition. Thus, offering the possibility to formulate partially to replace the requirement of at least minimum levels of crude protein by essential amino acids requirement. This will generate lower costs for the producer and lower emissions to the environment (5). Some amino acids cannot be produced by animals and must therefore be supplied in their diet. These amino acids are referred to as essential amino acids. In avian species, methionine is one of the essential amino acid needed to improve performance and is considered to be the first-limiting amino acid in poultry diet. It is classified as the first limiting amino acid because it is limited in plant protein sources and there is strong requirement for it to support feather growth and protein synthesis.

Methionine is commonly supplemented as DL-Methionine (DLM) or liquid Methionine Hydroxyl Analogue-Free Acid (MHA-FA) also known as HMTBA (DL-2-hydroxyl-4-(methylthio) butanoic acid; supplied as ALIMET® feed supplement, a product of Novus International, Incorporation, St. Louis, MO, USA). DL-methionine is a blend of 50:50 D- and L-Met with 99% purity (pure substance) produced by Degussa AG, Hanau, Germany while MHA-FA is L-Met precursor containing 88% active substance produced by Novus International. Liquid MHA-FA is claimed to have better performance because it is absorbed into cells by a different mechanism (diffusion) than DL-methionine (6). (7) reported differences in the mechanism of absorption for Liquid MHA-FA and DLM, although these two compounds are absorbed at quite similar rates, which vary according to the location in the small intestine. Moreover, they reported that Liquid MHA-FA is absorbed rapidly in the proximal loop of duodenum and mid-jejunum, whereas DL-methionine is absorbed rapidly in the ileum.

The use of plant protein sources and byproducts of oil seeds has drastically increased recently as a result of the decline in fish meal production and the prohibition of using animal protein sources (meat and bone meal) as feed ingredient due to risk of pathogenic and toxic substance contamination (8). There are controversies in literature about the efficiency of MHA-FA as source of methionine arising from the fact that when ingested, it is fundamentally different from methionine. The challenge of organic producers and nutritionist has been to find alternative methionine precursors from natural sources. MHA-FA (Alimet feed supplement) is a naturally occurring methionine precursor and is chemically different from Dl-methionine products. It is found in yeast, plant, chicks and other organism. It also has 100% equivalency as Dl-methionine. Therefore, the aim of this study was to evaluate the efficacy of Methionine hydroxyl analogue (MHA-FA) and DL-methionine on performance and blood chemistry of broiler starter chicken.

Materials and Methods.

Theexperimentwascarried outatthe Poultry Unit, Department of Animal Science Teaching and Research Farm, Faculty of Agriculture, Ahmadu Bello University, Zaria. DL-methionine and liquid Methionine hydroxyl analog free acid were purchased from Hybrid Feed Ltd opposite total filling station along Kachia road, Kaduna State. A Diet was formulated to meet the requirements of broiler starter chicks but devoid of synthetic methionine as shown on Table 1. Three graded levels (0.15, 0.20, and 0.25%) each of DL-methionine and MHA-FA, respectively were added as synthetic methionine supplement in the deficient diet to constitute six dietary treatments as shown in Table 1. Two hundred and thirty four day old Hubbard Flex broilers chicks were allotted to six treatment groups with three replicate which consisted of 13 birds per replicate using a 2 x 3 factorial arrangement in a complete randomized design. Birds were housed in a deep litter system with clean water and feed provided *adlibitum for the four weeks study period*. Vaccinations and medications were carried out adequately as at when due. Data was collected on weekly body weight which was used to calculate the weight gain. Data on feed offered and feed left over were recorded to determine feed intake. At the end of the study period blood samples was collected from six birds per treatment and taken to Department of Pathology and Microbiology, Faculty of Veterinary Medicine, ABU Zaria to determination packed cell volume (PCV), white blood cell (WBC) count, Red blood cell(RBC) count, total protein, haemoglobin and serum cholesterol. Blood samples were collected into two separate sterile bottles one containing anti-coagulant (Ethylene Di-amine Tetra Acetic Acids; EDTA) and the other devoid of EDTA. 1mg of Ethylene Di-amine Tetra Acetic Acids (EDTA) was used per 1ml of blood as anti-coagulant. These samples were analyzed within two hours of blood collection according to the routine available for clinical methods expounded by (9). Data collected during the study were analyzed using GLM Procedure of (10). Differences between means were separated using Duncan's Multiple Range Test by (11).

Results and Discussion

Effect of type and level of methionine on performance of finisher broiler chicken is shown in Table 3. Final weight, weight gain, daily feed intake, feed conversion ratio, and feed cost per kg gain were significantly ($P<0.05$) affected by methionine type. Birds fed MHA-FA supplemented diets performed better than those fed DL-methionine. There was improved performance in terms of weight gain, feed conversion ratio and feed gain ratio with supplementation of MHA-FA than with DL-methionine. This could be attributed to increase feed intake and sex ratio. Also, better performance of MHA-FA over DL-Methionine could be as a result of site of absorption and mechanism of transport through diffusion as opposed to DL-Methionine which is through active transport whereby a carrier is needed for

Table 1: Percentage Composition of Broiler Starter and Finisher D iets Synthetic Methionine Deficient

Ingredients	Starter Diet	Finisher Diet
Maize	47.90	52.00
Soya bean cake	38..70	18.30
Full fat soya bean	0.00	18.30
Maize offal	10.00	8.00
Bone meal	2.50	2.50
Limestone	0.30	0.30
Salt	0.25	0.25
Premix**	0.25	0.25
Lysine	0.10	0.10
Methionine	0.00	0.00
Total	100	100
Calculated Analysis		
Metabolizable Energy, (Kcal/kg)	2840	3040
Crude protein (%)	23.12	21.08
Crude fibre (%)	4.86	4.35
Ether extract (%)	3.34	6.15
Calcium (%)	1.10	1.11
Available Phosphorus (%)	0.79	0.75
Lysine (%)	1.26	1.14
Methionine (%)	0.35	0.31
Methionine + Cysteine (%)	0.66	0.62
Feed Cost /kg diet (₦)	92.83	91.58

Table 2: Percentage (%) of Broiler Finisher Diets Containing Graded Levels of DL -methionine or Methionine Hydroxyl Analogue-Free Acid Supplementation (5-8weeks)

	Level of methionine inclusion					
Ingredients	0.15% DLM	0.20% DLM	0.25% DLM	0.15% MHA-FA	0.20% MHA-FA	0.25% MHA-FA
Maize	52	52	52	52	52	52
Soya bean meal	18.25	18.20	18.15	18.25	18.20	18.15
Full fat soya	18.20	18.20	18.20	18.20	18.20	18.20
Maize offal	8.00	8.00	8.00	8.00	8.00	8.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50
Limestone	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Premix**	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
DL-methionine	0.15	0.20	0.25	0.00	0.00	0.00
MHA-FA	0.00	0.00	0.00	0.15	0.20	0.25
Total	100	100	100	100	100	100
Calculated Analysis						
MetabolizableEnergy(Kcal/kg)	3041	3039	3038	3041	3039	3038
Crude protein (%)	21.17	21.20	21.23	21.17	21.20	21.23
Crude fibre(%)	4.34	4.34	4.34	4.34	4.34	4.34
Ether extract (%)	6.13	6.13	6.13	6.13	6.13	6.13
Calcium (%)	1.11	1.11	1.11	1.11	1.11	1.11
Lysine (%)	1.14	1.14	1.14	1.14	1.14	1.14
Methionine (%)	0.46	0.51	0.56	0.46	0.51	0.56
Available Phosphorus (%)	0.75	0.75	0.75	0.75	0.75	0.75
Methionine + Cysteine (%)	0.77	0.82	0.86	0.77	0.82	0.86
Feed cost/kg (₦)	93.66	94.31	94.96	93.96	94.71	95.46

DLM= DL-methionine and MHA-FA =Methionine Hydroxyl Analogue -Free Acid the transportation of nutrients thereby energy available for growth is reduced. This result supported the findings of (12), (13) and (14) who reported that birds fed HMTBA had better weight gain and conversion ratio than birds fed diets supplemented with DL-methionine. This result however disagreed with the findings of (15) who reported that birds supplemented with DL-methionine displayed better feed efficiency than those supplemented with HTMBA under heat stress. (16) reported no significant (P>0.05) difference on growth performance for broilers supplemented with either compound. Differences in performance may be attributed to the differences in absorption process and mechanism of transport of methionine type. Methionine levels had no significant (P>0.05) effect on Final body weight, weight gain, feed intake, feed conversion ratio, and feed cost per kg gain. There was improved performance in terms of weight gain with increased levels of methionine. This could be attributed to increased consumption and sex ratio. This result agreed with the report of (17) who reported an increased body weight gain with increased levels of methionine. There was no specific pattern for improved feed conversion ratio with increased levels of methionine. This result disagreed with the report of (17) who reported low feed conversion ratio with increased levels of methionine. Feed intake increased with increased level of methionine and was highest with birds fed 0.25% methionine although it was not significant (P>0.05) due to level of methionine supplementation. This result disagreed with the findings of (18) who reported a significant (P<0.05) difference in feed intake due to level of methionine supplementation which was highest in the un-supplemented group

Table 3: Effect of Type and Level of Methionine on the Growth Performance of Finisher Broiler (5-8weeks)

	Type			Level			
Parameters	DLM	MHA-FA	SEM	0.15	0.20	0.25	SEM
Initial weight (g/bird)	1163.36	1162.84	1.30^{NS}	1163.73	1162.87	1162.73	1.63 ^{NS}
Final weight (g/bird)	2573.50	2766.67	32.93*	2657.05	2659.62	2693.59	59.54 ^{NS}
Total weight gain (g)	1410.14	1603.82	33.19*	1493.33	1496.74	1530.87	59.84 ^{NS}
Daily weight gain (g/bird)	67.15	76.37	1.58*	71.11	71.27	72.90	2.85 ^{NS}
Daily feed intake (g/day)	191.62	196.52	2.36*	190.05	195.60	196.55	2.91 ^{NS}
Feed conversion ratio	2.86	2.58	0.05*	2.70	2.76	2.71	0.09 ^{NS}
Feed cost/kg gain (₦)	269.78	244.70	5.50*	252.84	260.97	257.91	8.81 ^{NS}
Mortality (%)	0	0	-	0	0	0	-

Interaction between type and level of methionine on the growth performance of finisher broiler chickens is shown in Table 4. There was no level of interaction between type and levels of methionine supplementation for final body weight, weight gain, feed conversion ratio and feed cost per kg gain. This result concord with the findings of (19) who reported no significant interaction among methionine source, methionine supplementation level and sex for growth performance throughout the experimental period regardless of growth phase. Though, there was significant interaction among methionine type, but no significant interaction among methionine supplementation levels. The performance of finisher broiler chicken fed diets with graded levels of DL-methionine and liquid MHA-FA are shown in Table 5. Final weights, weights gain, daily feed intake, feed conversion ratio, and feed cost per kg gain were significantly (P<0.05) affected by dietary treatments. Generally, birds fed diets containing graded levels of MHA-FA performed better than those fed DL-methionine diets. Birds fed 0.25% MHA-FA diet had significantly (P<0.05) better performance in all the parameters measured. There was increased feed efficiency as the level of MHA-FA increased across the dietary treatments. Also, chicks fed MHA-FA diets had higher feed intake than those fed DL-methionine. This result agreed with the report of (20) that inclusion of methionine in the diet led to increased body weight, weight gain and reduced feed cost per kg gain. Birds fed diets supplemented with MHA-FA had lower feed conversion ratio than those supplemented DL-methionine. There was improved feed conversion ratio with increased level of MHA-FA in the diet. Increased in performance for weight gain and low feed conversion supported the findings of (17) who reported increased body weight gain and low feed conversion ratio with increased levels of methionine. This result however disagreed with the findings of (15) who observed that birds supplemented with DL-methionine displayed better feed efficiency than those supplemented with HTMBA under heat stress.

Table 4 Interaction between Type and Levels of Methionine on the Performance of Finisher Broiler (5-8weeks)

Parameters	Type		Level			LOS	
	DL-M	MHA-FA	0.15%	0.20%	0.25%	Type	Level
Final weight (g/bird)	2573.50	2766.67	2657.05	2659.62	2693.59	*	NS
Total weight gain (g)	1410.14	1603.82	1493.33	1496.74	1530.87	*	NS
Daily weight gain (g/bird)	67.15	76.37	71.11	71.27	72.90	*	NS
Daily feed intake (g/day)	191.62	196.52	190.05	195.60	196.55	*	NS
Feed conversion ratio	2.86	2.58	2.70	2.76	2.71	*	NS
Feed cost/kg gain (₦)	269.78	244.70	252.84	260.97	257.91	*	NS

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DLM=DL-Methionine, MHA-FA=Methionine Hydroxyl Analog -Free Acid, SEM=Standard Error of Means, LOS=Level of Significance
NS=Not Significant

Effect of methionine type and methionine levels on some hematological (packed cell volume, red blood Cell, white blood cell and haemaglobin count) and serum biochemical (total protein and serum cholesterol) parameters of finisher broiler birds (5-8weeks) are shown in Table 6. Result revealed that methionine type had no significant (P>0.05) effect on PCV, RBC, WBC, total protein and cholesterol. However, there was significant (P<0.05) difference on haemoglobin. Methionine levels on the other hand had significant (P<0.05) effect on PCV, RBC and haemoglobin. However, there were no significant (P>0.05) differences on WBC, total protein and cholesterol. Birds fed MHA-FA had higher PCV concentration than those fed DL-Methionine. This could probably be attributed to the acid nature of MHA-FA. This result disagreed with the report of (21) who suggested that birds fed DL-Methionine had higher plasma concentration than those fed MHA-FA. This might be associated with lower feed consumption and weight gain. Birds fed DL-Methionine supplement had low RBC compared to those fed MHA-FA supplement. This could be as a result of low PCV count. Again, birds fed MHA-FA diets had higher cholesterol level than those fed DL-Methionine. This could probably be associated with increased in body weight which is said to be directly proportional to fat deposit. Birds fed MHA-FA supplement had low WBC compared to those fed supplemental DL-Methionine. WBCshelp the body to fight infection and disease. Since white blood cells to fight infection, therefore, having lower WBC means the birds have higher risk or increase risk of infection.

Table 5: Effect of Dietary DL-methionine or Liquid MHA-FA supplementation on the growth performance of finisher broiler (5-8weeks)

Parameters	Dietary Treatments 1 0.15% DLM	2 0.20% DLM	3 0.25% DLM	4 0.15% MHA-FA	5 0.20% MHA-FA	6 0.25% MHA-FA	SEM
Initial weight (g/bird)	1164.10	1163.08	1162.92	1163.36	1162.68	1162.51	2.57^{NS}
Final weight (g/bird)	2598.72	2537.18	2584.61	2715.38	2782.05	2802.56	61.79 ^{NS}
Total weight gain (g)	1434.62^{abc}	1374.10^{c}	1421.69^{bc}	1552.03^{abc}	1619.38^{ab}	1640.05^{a}	62.31*
DWG (g/bir)	68.32^{abc}	65.43^{c}	67.70b^{c}	73.91^{abc}	77.11^{ab}	78.10^{a}	2.97*
DFI (g/day)	187.36	194.32	193.16	192.74	196.89	199.94	4.22*
FCR	2.75	2.97	2.86	2.64	2.56	2.55	0.11 ^{NS}
Feed cost/kg gain (₦)	257.91	280.16	271.27	247.76	241.78	244.55	9.93 ^{NS}
Mortality (%)	0	0	0	0	0	0	-

a, b, c, d= means with different superscripts on the same row differ significantly (P<0.05), SEM =Standard Error of Means, MHA-FA= Methionine DFI= Daily feed intake, FCR= Feed conversion ratio, DWG= Daily weight gain
Hydroxyl Analog-Free Acid, NS= Not Significant, * = Significant

Table 6: Effect of Type and Level of Methionine on Blood Chemistry of Finisher Broiler (5-8weeks)

	Type			Level			
Parameters	DLM	MHA-FA	SEM	0.15	0.20	0.25	SEM
Packed Cell Volume (%)	25.86	29.22	1.26 ^{NS}	23.92^{b}	27.50^{ab}	31.25^{a}	1.38*
Red Blood Cell (x10^{12}/L)	4.34	4.94	0.22 ^{NS}	4.10^{b}	4.64^{ab}	5.18^{a}	0.26*
White Blood Cell (x10^{9}/dl)	8.80	7.70	0.44 ^{NS}	7.74	8.49	8.52	0.56 ^{NS}
Haemoglobin count (%)	8.53	9.89	0.43*	8.22^{b}	9.03^{ab}	10.38^{a}	0.50 *
Total Protein (g/dl)	3.43	3.20	0.19 ^{NS}	3.62	3.32	3.02	0.23^{NS}
Cholesterol (g/dl)	4.35	4.83	0.35 ^{NS}	4.69	4.27	4.82	0.44 ^{NS}

a, b = means with different superscripts on the same row differ significantly (P<0.05), NS=Not Significant, * = Significant
DLM=DL- Methionine, MHA-FA=Methionine Hydroxyl Analog -Free Acid, SEM=Standard Error of Means,

Conclusion and Application

1. It was concluded that, birds fed MHA-FA supplements had improved growth performance compared to those fed DL-methionine. Therefore MHA-FA can be supplemented in broiler diets as alternative to DL-methionine without causing any adversed effect on growth performance and blood chemistry
2. Farmers can use up to 0.25% MHA-FA Supplement in the diets of broiler chickens.
3. Broiler diets should be supplemented with 0.15% level of methionine for higher feed efficiency.

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