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EFFECT OF SUPPLEMENTING TWO TYPES OF METHIONINE ON CARCASS CHARACTERISTICS OF FINISHER BROILER CHICKEN

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ABSTRACT

An experiment was carried out to determine the effect of two types of methionine supplement (Dl-methionine and liquid 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 broiler chicks were allotted to six dietary treatments and replicated three times using a 2 x 3 factorial arrangement in a completely randomized design which lasted four weeks. A diet devoid of methionine was formulated then three graded levels of methionine inclusions at 0.15, 0.20, and 0.25% respectively were added for each type of methionine supplement. Methionine type significantly ($P<0.05$) affected live weight, but breast yield, thigh percentage and abdominal fat were not affected. Again, levels of methionine supplementation had no significant ($P>0.05$) effect on live weight, breast yield, thigh percentage and abdominal fat. Furthermore, dietary DL-methionine or MHA-FA had significant ($P<0.05$) effect on carcass characteristics of broiler chicken. Birds fed dietary MHA-FA diets had higher protein content recorded for both breast, liver parts and had lower liver fat content compared with those fed DL-methionine diets. On the other hand, methionine source had significant ($P<0.05$) effect on breast protein, liver protein and liver fat content. However, there was no significant ($P>0.05$) effect observed on breast fat content. Methionine levels had no significant ($P>0.05$) effect on breast protein, liver protein and liver fat content. However, there was significant ($P<0.05$) effect observed on breast fat content. It was concluded that up to 0.25% MHA-FA was appropriate for optimum performance.

Key words: DL-methionine, Liquid MHA-FA, Carcass characteristics.

INTRODUCTION

Broiler production is a source of income, it is a good source of protein and quick returns on investment (Kekocha, 1994). However, the industry in the developing countries is facing some challenges; these challenges include high feed to gain ratio and increase in the cost of feed because of high prices of feed ingredients (Abbas, 2013). 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. The two methionine supplements are both used in poultry diets for optimum growth performance. Methionine is the most important donor of methyl radical in the body and it is required for the biosynthesis of many important substances involved in growth, such as creatine, carnitine, polyamines, epinephrine, melatonin and choline (Baker *et al.*, 1996). Addition of methionine to poultry diet has been associated with the tendency to have less total body fat (Rostagno *et*

al., 1995), improve growth performance both for meat and egg laying birds and reduce odor-related compounds in excreta (Chavez *et al*., 2004). The objective of this study was to evaluate the efficacy of DL-methionine and Liquid Methionine hydroxyl analogue (MHA-FA) on carcass characteristics of finisher broiler chicken.

MATERIALS AND METHOD

Experimental Site

This study was carried out at the Poultry Unit, Department of Animal Science Teaching and Research Farm, Faculty of Agriculture, Ahmadu Bello University, Zaria. Zaria is located on latitude 11˚11' N and longitude 07˚38' E. it is situated at an altitude of 686m above sea level. The mean maximum temperature varies between 26˚C to 35˚C depending on the season, while the mean relative humidity during the wet and dry (harmattan) seasons are 72% and 21% respectively (Ovimap 2015). The area has an average annual rainfall of 1080mm as reported by IAR (2016).

Source of Experimental Birds

Two hundred and thirty four unsexed day old Hubbard Flex broiler chicks were purchased from Zarm hatchery farm, Ilemona Kwara State for this experiment.

Experimental Diets (5-8wks)

A diet devoid of methionine was formulated to meet the requirements of broiler starter chicks. DL-methionine and liquid Methionine hydroxyl analog free acid were then supplemented in feed at three graded levels (0.15, 0.20, and 0.25%) each respectively, as shown on Table 1.

Table 1: Percentage (%) of Broiler Finisher Diets Containing Graded Levels of DL-methionine or Methionine Hydroxyl Analogue-Free Acid Supplementation (5-8weeks)

Type of methionine	**DL-Methionine**			**Liquid MHA-FA**		
Level of methionine inclusion	**0.15%**	**0.20%**	**0.25%**	**0.15%**	**0.20%**	**0.25%**
Ingredients						
Maize	52.00	52.00	52.00	52.00	52.00	52.00
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						
Metabolizable Energy (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, MHA-FA= Methionine Hydroxyl Analog-Free Acid,

** Biomix premix supplied per kg of diet: Vit. A, 10,000iu; Vit. D_3, 2000iu; Vit.E, 23mg; Vit. K, 2mg; Vit.B_1,1.8mg; Vit.B_2, 5.5mg; Niacin, 27.5mg; Pantothenic acid, 7.5mg; Vit. B_{12}, 0.015mg; Folic acid, 0.75mg;Biotin, 0.06mg; Choline chloride, 3000mg; Cobalt, 0.2mg; Copper, 3mg; Iodine, 1mg; Iron, 20mg; Manganese, 40mg; Selenium, 0.2mg; Zinc, 30mg.

Experimental Design

Broiler chicks were randomly alloted to five treatments with three replicates containing 13 birds per pen replicate using a 2 x 3 factorial arrangement in a complete randomized design

Management of Birds

Birds were raised in a deep litter poultry house with feed and water provided *ad libitum.* Heat and light were provided throughout the brooding period using kerosene stoves, electric bulbs and charcoal. Routine vaccines (Gumboro and Lasota) were administered adequately as at when due using the vaccination schedule of Faculty of Veterinary Medicine, Ahmadu Bello University. Birds were fed daily, feed intake was calculated as amount of feed given minus feed left over and recorded on daily basis per gram per bird. Birds were weighed weekly; weight gain was calculated as initial weight subtracted from final weight and recorded as daily weight gain by dividing with 7 (number of days in a week). Other performance parameters recorded were; weekly weights and final weight, while feed conversion ratio (FCR) and feed cost /per kg gain were calculated. FCR was calculated by taking the ratio of feed intake by weight gain (feed intake / weight gain), while feed cost per kg gain was calculated by taking the ratio of feed cost by kg of gain (Feed cost per kg gain = Feed cost / kg of gain)

Carcass Analysis

At the end of the feeding trial, 4 birds per replicate with weight closest to the average mean body weight of the replicate were used for carcass analysis. Birds were starved of feed for 12 hours before slaughter to clear the gut so that a clean carcass may be obtained with little or no contamination. These birds were taken to the Meat Laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria for slaughter via the jugular vein using the procedure for slaughtering as described by Odunsi *et al*. (1999).

Statistical Analysis

Data obtained from the trial was subjected to analysis of variance (ANOVA) using the General Linear Model procedure of statistical analysis system (SAS, 2002). Significant differences among treatment means were separated using the Duncan's Multiple Range Test. Model for the experiment is as shown below;

$Y_{ijkl} = \mu + S_i + L_j + (S_i \times L_j) + D_k + e_{ijkl}$

Where:

Y_{ijkl} = All Observations recorded

μ = Overall mean

Si = ith effect of Methionine type (i =DL-methionine and Liquid MHA-FA)

Lj = jth effect of Methionine levels (j=0.15, 0.20 and 0.25 respectively)

$(S_i \times L_j)$ = Interaction between Methionine type and Methionine levels

D_k = kth effect of dietary level of methionine

e_{ijkl}= Random error effect

RESULTS AND DISCUSSION

Effect of Type and Level of Methionine on Carcass Characteristics of Broiler Chickens (5-8weeks)

Result on effect of methionine types and level of methionine on carcass characteristics of broiler finisher chicks (5-8weeks) is shown on Table 2. Live weight was significantly ($P<0.05$) affected by methionine type but was not affected by levels of methionine supplementation. Breast yield, thigh percentage and abdominal fat were not significantly ($P>0.05$) affected by methionine type. This result supports the findings of Emad *et al*. (2004) who reported no significant difference in breast muscle and thigh percentage between broilers fed HMTBA and DLM. Again, levels of

methionine supplementation did not significantly (P>0.05) affect breast yield, thigh percentage and abdominal fat. Birds fed MHA-FA supplements performed better than those fed DL-methionine supplements in terms of live weight performance. However, birds fed DL-methionine diet had higher breast yield and thigh percentage than those fed MHA-FA diet. Increase in breast yield may be as a result of high deposition of protein on the breast muscle from thigh and other parts. This result does not concur with the findings of Mandal *et al*. (2004) who observed that broilers fed HMTBA had higher breast yield than birds fed DLM. These inconsistent results may be due to differences in chick breed and TSAA (total sulphur amino acid) level between HMTBA and DLM supplemented diets.

Table 2: Effect of Types and Levels of Methionine on Carcass Characteristics of Broiler Chickens (5-8weeks)

	Type			Level			
Parameters	**DLM**	**MHA-FA**	**SEM**	**0.15**	**0.20**	**0.25**	**SEM**
Live Weight (g)	2455.56	2633.33	29.27 *	2550.00	2516.67	2566.67	60.09 NS
Breast yield (%)	20.14	19.41	0.94 NS	19.31	21.14	18.78	1.08 NS
Thigh (%)	10.49	9.89	0.30 NS	10.22	9.90	10.45	0.40 NS
Abdominal fat (%)	0.01	0.01	0.01 NS	0.02	0.02	0.01	0.01 NS

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

Results on carcass characteristics of broiler finisher birds (5-8weeks) fed dietary supplementation of DL-methionine or MHA-FA is presented in Table 3. Dietary treatments had significant (P<0.05) effects on live weights and carcass weights as well as drum sticks, back, wings and liver expressed as percentage of live weights. Dressing percentage was not affected (P>0.05) by dietary inclusion of DL-methionine or MHA-FA. This disagrees with the findings of Chattopadhyay *et al.* (2006) who reported significant difference in dressing percentage of birds fed supplemental (synthetic) methionine as well as those fed un-supplemental methionine diets. Dressing percentage was improved for birds fed MHA-FA (with increased MHA-FA level in the diet) when compared to those fed DL-methionine diets. Fat deposition was not affected (P>0.05) by dietary inclusion of DL-methionine or MHA-FA and was found to be very low ranging from 0.01-0.02%.

This study agrees with the reports of Wallis (1999) and Bunchasak and Keawarun (2006), who found that supplementation of methionine in methionine-deficient diets significantly reduced fat deposition in broiler carcass. Also, addition of DL-methionine or MHA-FA to the methionine deficient diet had positive effect on breast meat, as this promoted higher breast meat yield. This agrees with the findings of Moran (1994) and Wallis (1999) who reported that the growth of breast meat (pectoralis major) is more sensitive to DL-methionine supplementation than other edible meat components.

Table 3: Effect of Dietary Supplementation of DL-methionine or Liquid MHA-FA on Carcass Characteristics of Broiler Chickens (5-8weeks)

	Dietary Treatments						
	1	**2**	**3**	**4**	**5**	**6**	
Parameter	**0.15%DLM**	**0.20%DLM**	**0.25%DLM**	**0.15%MHA-FA**	**0.20%MHA-FA**	**0.25%MHA-FA**	**SEM**
Live weight(g)	2500.00^{bc}	2400.00^{c}	2466.67^{c}	2600.00^{ab}	2633.33^{a}	2666.67^{a}	40.82
Carcass weight(g)	1550.00	1483.33	1550.00	1600	1633.33	1666.67	44.10
Dressing percentage	62.00	61.81	62.77	61.55	62.06	62.51	1.37
Organ weights and Prime cuts (% Live weight) :							
Heart	0.41	0.49	0.51	0.56	0.41	0.41	0.05
Liver	2.25^{ab}	1.88^{bc}	1.82^{c}	2.51^{a}	2.23^{ab}	1.91^{bc}	0.10
Kidney	0.44	0.42	0.30	0.35	0.32	0.35	0.05
Lungs	0.53	0.65	0.62	0.59	0.49	0.46	0.10
Spleen	0.19	0.13	0.18	0.19	0.13	0.11	0.04
Intestine	5.21	5.81	5.62	6.00	5.40	5.40	0.33
Gizzard	3.27	3.28	3.07	3.39	2.91	2.97	0.17
Abdominal fat	0.02	0.01	0.01	0.02	0.02	0.01	0.04
Breast	19.53	20.76	20.12	19.09	21.52	17.62	1.28
Thigh	10.63	9.89	10.96	9.82	9.91	9.94	0.44
Drumsticks	10.07	10.07	10.91	9.65	9.11	9.40	0.44
Back	14.11	13.67	12.06	12.39	13.63	10.99	0.70
Wings	7.85^{ab}	7.99^{a}	7.85^{ab}	7.26^{bc}	7.28^{bc}	7.10^{c}	0.20

a, b, c= means with different superscripts on the same row differ significantly (P<0.05), SEM =Standard Error of Means, MHA-FA= Methionine Hydroxyl Analog-Free Acid.

Effect of Types and Levels of Methionine on Fat Deposit and Crude Protein content of Broiler Chickens

Result on the effect of type and levels of methionine on fat deposit and crude protein content for breast muscle and liver parts of broiler finisher chicken (5-8weeks) is shown on Table 4. Methionine source had significant (P<0.05) effect on breast protein, liver protein and liver fat content. However, there was no significant (P>0.05) effect observed on breast fat content. Birds fed supplemental MHA-FA diets had higher protein content in breast and liver and also had lower liver fat content. Increase in crude protein content and decrease in fat with MHA-FA supplement in the diet agrees with the report of Sun et al. (2008) who reported that supplementation of

Betaine at the level of replacing 25% of total methionine increased (P<0.05) breast meat yield and protein content of breast meat, but decreased (P>0.05) abdominal fat yield. Methionine levels had non-significant (P>0.05) effect on breast protein, liver protein and liver fat content. However, there was significant (P<0.05) effect observed on breast fat content. As methionine levels increased breast fat content reduced, therefore birds fed 0.25% MHA-FA supplements had the lowest breast fat content.

Table 4: Effect of Type and Level of Methionine supplement on fat deposit and crude protein content in breast and liver of Broiler Chickens (5-8weeks)

	Type			Level			
Parameters	**DLM**	**MHA-FA**	**SEM**	**0.15**	**0.20**	**0.25**	**SEM**
Breast protein (%)	27.85^{b}	31.35^{a}	0.36 *	28.62	30.22	29.76	0.91 ^{NS}
Breast fat (%)	12.13	12.42	0.33 ^{NS}	12.96^{a}	12.49^{ab}	11.37^{b}	0.31 *
Liver protein (%)	36.19^{b}	48.78^{a}	0.40 *	43.24	42.90	41.32	2.99 ^{NS}
Liver fat (%)	7.96^{a}	6.41^{b}	0.36 *	6.67	7.57	7.32	0.57 ^{NS}

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

Result on fat deposit and crude protein content of breast muscle and liver parts of broiler finisher (5-8weeks) birds fed diets containing dietary levels of DL-methionine or MHA-FA supplements are shown on Table 5. Dietary treatments had significant (P<0.05) effect on fat and crude protein content of breast meat as well as fat and crude protein content of liver. Treatment 6 (0.25% MHA-FA) had the lowest fat content in breast muscle (11.04%) and liver (5.36%) but had high protein content of breast muscle compared to other treatments. The range of breast muscles fat content (11.04 - 13.36%) obtained in this study of birds fed supplemental DL-methionine or MHA-FA fell above the fat content of breast muscle as reported by Leenstra (1989) which ranges from 3.9 to 8.4%. The value of liver fat in this study ranges from 5.36 – 9.28%. Birds fed supplemental DL-methionine had increased fat content in the liver while those fed supplemental MHA-FA had decreased fat content in the liver. Supplementation of up to 0.25% MHA-FA in broiler diets improved crude protein content of breast meat. This supports the findings of Sun *et al*. (2008) who reported that supplementation of Betaine at the level of replacing 25% of total methionine increased (P<0.05) breast meat yield and protein content of breast meat, but decreased (P>0.05) abdominal fat yield.

Table 5: Effect of Dietary Supplementation of DL-methionine or Liquid MHA-FA on Fat Deposit and Crude Protein content in breast and liver of Broiler Chickens (5-8weeks)

	Dietary Treatments						
	1	**2**	**3**	**4**	**5**	**6**	
Parameter	**0.15%DLM**	**0.20%DLM**	**0.25%DLM**	**0.15%MHA-FA**	**0.20%MHA-FA**	**0.25%MHA-FA**	**SEM**
Breast Protein (%)	27.83^{c}	28.41^{bc}	27.30^{c}	29.81^{b}	32.03^{a}	32.22^{a}	0.55
Breast Fat (%)	12.57^{ab}	12.11^{ab}	11.71^{ab}	13.36^{a}	12.87^{ab}	11.04^{b}	0.55
Liver Crude Protein (%)	36.51^{c}	36.55^{c}	35.51^{c}	49.97^{a}	49.26^{a}	47.13^{b}	0.62
Liver Fat (%)	6.81^{b}	7.79^{b}	9.28^{a}	6.53^{bc}	7.36^{b}	5.36^{c}	0.36

a, b, c= means with different superscripts on the same row differ significantly, SEM =Standard Error of Means, MHA-FA = Methionine Hydroxyl Analog-Free acid.

CONCLUSION

The results of this study show that supplementation with MHA-FA in the diets had better results than those supplemented with DL-Methionine. Also, inclusion level of MHA-FA up to 0.25% had no adverse effect on carcass characteristics of broiler birds. Furthermore, as MHA-FA levels increased in the diets, carcass weight and the dressing percentage were also increased. Therefore, it was concluded that MHA-FA has the potential to be used as methionine source in broiler diets with up to 0.25% level of inclusion.

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