The Effect of Feeding Herbal Methionine Versus DL-methionine Supplemented Diets on Broiler Performance and Carcass Characteristics

Mohamed E. Ahmed[1] and Talha E. Abbas[2]

Abstract— The present experiment was conducted to evaluate the effects of Phytonin herbal natural methionine versus DL-methionine on broiler performance and carcass characteristics. One day old unsexed Ross 308 broiler chicks (N=150) were assigned to 5 dietary treatments, each was replicated 3 times. Diet A was the control without supplementing methionine, Diet B was supplemented with 0.15% DL-methionine, Diet C was supplemented with 0.15% herbal methionine, Diet D was supplemented with 0.20% DL-methionine and Diet E was supplemented with 0.20% herbal methionine. The parameters considered were live body weight, body weight gain, feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and carcass characteristics. Overall feed intake was significantly ($P \leq 0.05$) influenced by the dietary treatments. However, feed intake by birds fed different sources and levels of methionine was not significantly ($P \geq 0.05$) different compared to the control. Birds fed 0.15% herbal methionine diet consumed significantly ($P \leq 0.05$) higher amount of feed versus 0.15% DL-methionine. Overall body weight gain of broilers fed 0.15% herbal methionine diet increased by 9.5% compared to those on 0.15% DL-methionine. The dietary treatments had significant ($P \leq 0.05$) effect on relative weight of liver, relative weight of gizzard, relative weight of heart and length of intestine.

***Keywords*—** Herbal methionine, DL-methionine, performance, carcass.

I. Introduction

METHIONINE is considered to be the first limiting amino acid in broilers fed practical corn-soybean meal diets. Adequate dietary level of this amino acid is needed to support optimum growth and carcass yield of fast-growing commercial broilers [1]. Methionine plays an important role in energy production, protein synthesis; it also helps in enhancing overall growth performance, feed efficiency utilization and livability in broilers [2]. Sulfur-adenosyl methionine provides methyl groups, which are needed for several metabolic reactions such as synthesis of epinephrine, choline, carnithine and creatine [3 and 4].

Synthetic methionine is manufactured as a pure amino acid. Common forms are dry DL-methionine and liquid DL-methionine hydroxy analog-free acid. Raw materials for DL-methionine include oil, natural gas, air, and water which are used to make propene, sulphuric acid (H2S), methanol (CH3OH), and ammonia (NH3) for manufacture of DL-methionine [2]. DL-Methionine (the "DL" refers to the racemic mixture), comes in a crystalline form and is 99% available methionine. Methionine hydroxyl analogue comes in a liquid form and is 88% available methionine. Synthetic methionine is inexpensive, but as the cost of oil goes up, other methods of manufacturing methionine will be increasingly attractive [5].

The increase in demand for poultry meat has given rise to the use of synthetic compounds in feed and the high cost of such compounds like synthetic methionine increases the cost of the finished feeds. Recently, the safety of such practices has been questioned and their use is becoming restricted in many parts of the world. Moreover, Synthetic methionine is listed among the prohibited synthetic substances and its usage has been questioned in organic farming practices [6]. Therefore there is great renewed interest in developing natural alternative supplements to maintain animal performance and wellbeing [7].

Herbal methionine premixes have recently found their way into animal feed industry. Methiorep® and Meth-o-Tas® are herbal methionine premixes that are available in animal feed market. They are phytoadditive containing herbal ingredients that mimic the activity of methionine. Under Indian conditions, herbal methionine (Methiorep®) has been found to replace DL-methionine very effectively when used in broiler rations [7 and 8]. However, [9] reported that Methiorep® is not substitute for synthetic methionine in broiler diets under Nigerian environment.

Thus the current study was conducted to determine the effects of herbal methionine versus DL-methionine on broilers performance.

II. Materials and Methods

The present experiment was conducted in an open- sided poultry house at the premises of Faculty of Agricultural Technology and Fish Sciences, University of Alneelain. The

Mohamed E. Ahmed[1] is with the Department of Poultry Production and Technology, Faculty of Agricultural Technology and Fish Science, Alneelain University, P.O. Box 12702, Postal Code 11121, Khartoum, Sudan (corresponding author's phone: 00249912903328; e-mail: moha_555@hotmail.com)

Talha E. Abbas[2] is with the Department of Poultry Production and Technology, Faculty of Agricultural Technology and Fish Science, Alneelain University, P.O. Box 12702, Postal Code 11121, Khartoum, Sudan (e-mail: talhabbs@yahoo.com).

average ambient temperature during the experimental period was 31 °C. One hundred and fifty one day-old unsexed Ross 308 broiler chicks were procured from a commercial company. The chicks were randomly assigned to 5 dietary treatments, each was replicated 3 times. Diet A was the control without supplementing methionine, Diet B was supplemented with 0.15% DL-methionine, Diet C was supplemented with 0.15% herbal methionine, Diet D was supplemented with 0.20% DL-methionine and Diet E was supplemented with 0.20% herbal methionine. Experimental starter and finisher diets were isocaloric, isonitrogenous and formulated according to National Research Council [10], to be fed during starter period (0- 3 weeks) (Table I) and finisher period (4- 6 weeks) (Table II). The chicks were reared in wood shavings litter and had full access to water and feed and continuous light.

Live body weight, body weight gain, feed intake, feed conversion ratio (FCR) and protein efficiency ratio (PER) were determined weekly while incidence of mortality recorded daily as it occurred. At 42 day of age, 2 birds per pen were randomly selected, sacrificed, defeathered, eviscerated and evaluated for dressing%, breast muscle, thigh muscle, drumsticks muscle and abdominal fat. Moreover, length of intestine and relative weights of liver, gizzard and heart were also evaluated.

Vaccination against Newcastle and infectious bronchitis disease was done at 5 days of age with mix (IB Ma5 + Newcastle clone30). Gumboro D78 vaccine was administered at two weeks of age, and replicated the doze at three weeks of age. Finally the vaccination against Newcastle (live clone 30) was done at 4 weeks of age. All these vaccines are offered via drinking water with blue stain.

The experiment was arranged in a completely randomized design. Statistical analysis of the data was carried out using the General Linear Models procedure of SAS version 9.0 for Windows [11-12]. Duncan's Multiple Range Test was used to detect significant differences between treatment means.

III. Results and Discussion

The effects of source and level of methionine on the performance of broiler chicks are presented in Table III. Feed intake, live body weight, body weight gain, FCR and PER during starter period were not significantly ($P \geq 0.05$) influenced by dietary treatments. However, during the finisher period, the dietary treatments had significantly ($P \leq 0.05$) affected feed intake, body weight gain, FCR and PER. Similar results were reported by [13] who found that the chicks in herbal methionine group showed a significant increase gain in body weight as compared to the chicks in control group and numerically higher weight gain as compared to the chicks in synthetic methionine group. Different results with regards to FCR were observed by [14] who found that supplementation of herbal methionine at the rate of 15g/kg showed better FCR compared to DL-methionine supplemented birds. Furthermore, overall feed intake was significantly ($P \leq 0.05$) influenced by the different diets. In disagreement, [7 and 15] reported significant higher feed intake on the control treatment over methionine supplemented diets. Nevertheless feed intake by birds fed different sources and levels of methionine was not significantly ($P \geq 0.05$) different compared to the control. Birds fed 0.15% herbal methionine diet consumed significantly ($P \leq 0.05$) higher amount of feed versus 0.15% DL-methionine. Overall body weight gain of broilers fed 0.15% herbal methionine diet increased by 9.5% compared to those on 0.15% DL-methionine. This increase in body weight gain of chicks with herbal methionine supplementation is similar to the findings of [9, 7 and 8]. The increase in body weight and weight gain is attributed to the potential role of methionine in promoting growth [9].

The effect of herbal and synthetic amino acids on carcass characteristics and visceral organs weight expressed as percent of dressed weight is given in Table IV. Data revealed significant ($P \leq 0.05$) effect of the dietary treatments on relative weight of liver, relative weight of gizzard, relative weight of heart and length of intestine. Relative weight of liver of broilers fed 0.15% DL-methionine or 0.15% herbal methionine was significantly ($P \leq 0.05$) lower compared to control. It's probably connected with decreased fat in liver [16]. 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, [17] reported that percentage of breast yield was more when DL-methionine and herbal methionine was added in the diet. Relative weight of abdominal fat of broilers fed 0.15% and 0.20% herbal methionine was decreased by 32.4% and 29.1%, respectively, compared to control. This is agreement with the results of [18] who showed that herbal methionine significantly decreased abdominal fat.

TABLE I
COMPOSITION AND CALCULATED NUTRIENT CONTENT OF EXPERIMENTAL BROILER STARTER DIETS

Ingredients%	Dietary Treatments				
	Control	0.15% DL-methionine	0.15% Herbal methionine	0.20% DL-methionine	0.20% Herbal methionine
Sorghum	60.70	60.70	60.70	60.70	60.65
Ground nut cakes	21.00	21.00	21.00	21.00	21.00
Sesame cakes	8.00	7.85	7.85	7.80	7.85
Wheat bran	0.70	0.50	0.50	0.50	0.50
Super concentrates*	5.00	5.00	5.00	5.00	5.00
L-Lysine	0.10	0.10	0.10	0.10	0.10
DL-methionine	0.00	0.15	0.00	0.20	0.00
Herbal methionine	0.00	0.00	0.15	0.00	0.20
Lime stone	0.80	0.80	0.80	0.80	0.80
Dicalcium phosphate	0.50	0.50	0.50	0.50	0.50
Vegetable oil	2.80	3.00	3.00	3.00	3.00
Choline	0.10	0.10	0.10	0.10	0.10
Enzymes	0.10	0.10	0.10	0.10	0.10
Mycotoxin binder	0.20	0.20	0.20	0.20	0.20
Calculated analysis					
ME (kcal/kg)	3140.0	3157.0	3157.0	3159.0	3158.0
CP%	22.50	22.40	22.40	22.40	22.40
Ca%	0.97	0.97	0.97	0.97	0.97
Available P%	0.45	0.45	0.45	0.45	0.45
Lysine%	1.07	1.06	1.06	1.06	1.06
Methionine%	0.50	0.62	0.60	0.67	0.64
Methionine+Cystine%	0.72	0.87	0.85	0.92	0.89

*Cp 38%, ME 2010 kcal/kg, C.fiber 2.01%, EE 1.5%, Ash 35%, Ca 6.52%, Av. P 4.8%, Lysine 10%, Methionine 3.7%, Methionine+Cystine 4.05%. Vitamin A 250000 IU/Kg, Vitamin D3 50000 IU/Kg, Vitamin E 500Mg/Kg, Vitamin K3 60 Mg/Kg, Vitamin B1/ Thiamin 20 Mg/Kg, Vitamin B2/ Riboflavin
100 Mg/Kg, Niacin Vitamin PP 600 Mg/Kg, Pantothenic acid/ Vitamin B3 160 Mg/Kg, Vitamin B6/ Pyridoxine 40 Mg/Kg, Vitamin B12 300 Mcg/Kg, Biotin/
Vitamin H 2000 Mcg/Kg, Choline 10000 Mg/Kg, Vitamin C 4000 Mg/Kg, Folic Acid

TABLE II
COMPOSITION AND CALCULATED NUTRIENT CONTENT OF EXPERIMENTAL BROILER FINISHER DIETS

Ingredients%	Dietary Treatments				
	Control	0.15% DL-methionine	0.15% Herbal methionine	0.20% DL-methionine	0.20% Herbal methionine
Sorghum	72.10	72.10	70.35	71.40	72.60
Ground nut cakes	9.00	11.00	12.10	10.10	9.40
Sesame cakes	3.60	1.45	3.00	3.20	3.40
Wheat bran	6.40	6.40	5.50	6.00	5.50
Super concentrates*	5.00	5.00	5.00	5.00	5.00
L-Lysine	0.00	0.00	0.00	0.00	0.00
DL-methionine	0.00	0.15	0.00	0.20	0.00
Herbal methionine	0.00	0.00	0.15	0.00	0.20
Lime stone	0.90	1.00	0.90	1.00	0.90
Dicalcium phosphate	0.10	0.00	0.00	0.00	0.10
Vegetable oil	2.50	2.50	2.60	2.70	2.50
Choline	0.10	0.10	0.10	0.10	0.10
Enzymes	0.10	0.10	0.10	0.10	0.10
Mycotoxin binder	0.20	0.20	0.20	0.20	0.20
Calculated analysis					
ME (kcal/kg)	3139.0	3143.0	3150.0	3155.0	3155.0
CP%	18.00	18.00	18.70	18.10	17.90
Ca%	0.82	0.82	0.81	0.83	0.82
Available P%	0.36	0.34	0.35	0.35	0.36
Lysine%	0.84	0.85	0.96	0.94	0.93
Methionine%	0.39	0.52	0.53	0.59	0.57
Methionine+Cystine%	0.58	0.71	0.72	0.78	0.75

*as shown in Table I.

TABLE III
THE EFFECT OF SOURCES AND LEVELS OF METHIONINE ON OVERALL PERFORMANCE OF BROILERS

Ingredients%	Dietary Treatments					
	Control	0.15% DL-methionine	0.15% Herbal methionine	0.20% DL-methionine	0.20% Herbal methionine	± SEM
0-3 wk						
Feed Intake	1253.5 ±55.3	1232.0 ±38.7	1216.1 ±40.2	1231.2 ±26.6	1244.8 ±591.4	24.4
Live Body W.	822.8 ±61.6	836.5 ±47.6	810.7 ±62.8	863.3 ±25.7	781.1 ±189.8	55.8
Body W. Gain	776.5 ±61.0	790.2 ±47.2	764.3 ±63.3	815.7 ±26.8	734.4 ±189.2	55.7
FCR	1.62 ±0.07	1.56 ±0.08	1.60 ±0.09	1.51 ±0.03	1.78 ±0.47	0.13
PER	2.75 ±0.14	2.86 ±0.16	2.80 ±0.15	2.96 ±0.07	2.62 ±0.60	0.17
4-6 wk						
Feed Intake	2404.1 ^{ab}±105.5	2281.7 ^{b}±80.3	2681.7 ^{a}±231.6	2555.3 ^{ab}±201.7	2692.2 ^{a}±176.7	97.7
Body W. Gain	1085.5 ^{ab}±96.7	1085.7 ^{ab}±134.7	1289.6 ^{a}±173.1	1000.8 ^{b}±108.8	1208.7 ^{ab}±96.8	72.4
FCR	2.22 ^{ab}±0.19	2.12 ^{b}±0.18	2.09 ^{b}±0.09	2.57 ^{a}±0.36	2.23 ^{ab}±0.06	0.12
PER	2.51 ^{ab}±0.22	2.64 ^{a}±0.23	2.56 ^{ab}±0.12	2.19 ^{b}±0.31	2.51 ^{ab}±0.07	0.12
0-6 wk						
Feed Intake	3657.5 ^{ab}±149.0	3513.7 ^{b}±118.7	3897.8 ^{a}±197.7	3786.5 ^{ab}±195.8	3937.0 ^{a}±176.7	98.30
Live Body W.	1908.3 ±157.7	1922.2 ±156.7	2100.3 ±111.1	1938.1 ±127.6	1989.1 ±140.6	81.65
Body W. Gain	1862.0 ±157.1	1875.9 ±156.8	2054.0 ±110.5	1890.4 ±128.3	1943.1 ±301.4	81.66
FCR	1.97 ±0.14	1.88 ±0.10	1.90 ±0.01	2.02 ±0.20	2.03 ±0.15	0.09
PER	2.60 ±0.19	2.73 ±0.14	2.65 ±0.02	2.47 ±0.22	2.56 ±0.17	0.09

Values are means of 3 replicates per treatment (10 birds/ replicate).

^{ab} Means with different superscripts in the same row were significantly different ($P \leq 0.05$).

SEM: Standard error of the means from ANOVA d.f 10.

TABLE IV
THE EFFECT OF SOURCES AND LEVELS OF METHIONINE ON CARCASS CHARACTERISTICS AND VISCERAL ORGANS

Ingredients%	Dietary Treatments					
	Control	0.15% DL-methionine	0.15% Herbal methionine	0.20% DL-methionine	0.20% Herbal methionine	± SEM
Dressing%	81.1 ±1.1	75.3 ±2.1	76.4 ±40.2	82.3 ±3.2	79.5 ±2.7	3.4
Relative weight of liver	2.36 ^{a} ±55.3	1.75 ^{b} ±38.7	1.73 ^{b} ±40.2	1.93 ^{ab} ±26.6	1.85 ^{ab} ±591.4	0.17
Relative weight of gizzard	2.98 ^{a} ±61.6	2.19 ^{ab} ±47.6	2.03 ^{b} ±62.8	2.28 ^{ab} ±25.7	2.13 ^{b} ±189.8	0.25
Relative weight of heart	0.64 ^{a} ±0.2	0.56 ^{ab} ±0.2	0.41 ^{c} ±0.4	0.46 ^{bc} ±0.3	0.52 ^{abc} ±0.2	0.04
Intestine length	171.3 ^{a} ±0.07	179.3 ^{a} ±0.08	138.0 ^{b} ±0.09	190.4 ^{a} ±0.03	172.7 ^{a} ±0.47	7.4
Relative weight of abdominal f.	2.75 ±0.14	2.28 ±0.16	1.86 ±0.15	2.52 ±0.07	1.95 ±0.60	0.42
Relative weight of breast	15.1 ±0.14	17.1 ±0.16	15.9 ±0.15	17.5 ±0.07	17.3 ±0.60	1.4
Meat/Bone of breast	16.8 ±1.6	22.8 ±2.2	26.7 ±0.8	16.1 ±1.7	13.9 ±1.7	6.5
Relative weight of thigh	7.3 ±1.7	8.0 ±1.7	7.9 ±1.1	8.2 ±1.8	8.6 ±1.9	0.55
Meat/Bone of thigh	6.0 ±0.7	7.3 ±1.4	7.6 ±1.3	7.1 ±1.1	7.9 ±0.8	0.81
R Relative weight of drum	6.7 ±1.1	7.0 ±1.2	6.7 ±0.5	6.3 ±0.9	6.5 ±0.7	0.12
Meat/Bone of drumsticks	3.3 ±0.5	3.6 ±0.1	3.2 ±0.1	4.7 ±0.4	3.2 ±0.4	0.4

Values are means of 6 replicates per treatment (2 birds/ replicate).

^{ab} Means with different superscripts in the same row were significantly different ($P \leq 0.05$).

SEM: Standard error of the means from ANOVA d.f 25.

IV. Conclusion

This study concludes that herbal methionine can efficiently replace DL-methionine in broiler feed with improvement in feed intake, body weight gain and breast meat yield.

Acknowledgment

I would like to express my deep gratitude to the staff of Department of Poultry Production and Technology, Faculty of Agricultural Technology and Fish Science, Alneelain University.

References

[1] C.P. Ojano-Dirain, and P.W. Waldroup, "Evaluation of lysine, methionine and threonine needs of broilers three to six week of age under moderate temperature stress," Int. J. Poult. Sci., 1: 16-21. 2002. http://dx.doi.org/10.3923/ijps.2002.16.21

[2] M. Binder, "Life cycle analysis of DL-methionine in broiler meat production. In: Information for the feed industry," Degussa feed additives, Hanau-Wolfgang, Germany. pp. 1-8. 2003.

[3] DA. Bender, *Amino Acid Metabolism*. 1st ed. John Wiley and Sons Ltd. New York, USA, 1975, pp. 112-142.

[4] J.B. Schutte, J. De Jong, W. Smink and M. Pack, "Replacement value of betaine for DLmethionine in male broiler chicks," Poult. Sci., 76: 321-325. 1997. http://dx.doi.org/10.1093/ps/76.2.321

[5] A. Fanatico, "Organic Poultry Production: Providing Adequate Methionine," A publication of ATTRA – National Sustainable Agriculture Information Service 1-800-346-9140. www.attra.ncat.org. 2010.

[6] Anonymous, Statistica v5.5. Statsoft, Inc., Tulsa, OK, USA. 1999.

[7] K. Chattopadhyay, MK. Mondal and B. Roy, "Comparative efficacy of DL- methionine and herbal methionine on performance of broiler chicken," Int. J. Poult. Sci. 5: 1034-1039. 2006. http://dx.doi.org/10.3923/ijps.2006.1034.1039

[8] V.H. Kalbande, K. Ravikanth, S. Maini and D.S. Rekhe, "Methionine supplementation options in poultry," Int. J. Poult. Sci. 8(6): 588- 591. 2009. http://dx.doi.org/10.3923/ijps.2009.588.591

[9] S. Itoe, I.I. Dafwang, and G.S. Bawa, "Evaluation of Methiorep as a substitute for methionine in broiler diets," Int. J. Poult. Sci. 9 (8): 809-812. 2010. http://dx.doi.org/10.3923/ijps.2010.809.812

[10] NRC, *Nutrient requirement of poultry*. Ninth revised edition, National Academy Press, Washington, D. C 1994. pp. 19-26.

[11] SAS Institute, Inc. SAS/STAT(R) User's Guide, Version 9, Cary, NC: SAS Institute, Inc. 2003.

[12] RGD. Steel and JH Torrie, *Principles and Procedures of Statistics. A Biometrical Approach.* 1980. 2nd ed. McGraw-Hill Book Co, Inc, New York, NY.

[13] H.D. Narayanswamy and V.G. Bhagwat, "Evaluating the efficacy of methionine supplementation options in commercial broiler chickens," Poultry Line 3: 5-7. 2010.

[14] R.R. Chattopadhyay, "Possible mechanism of hepatoprotective activity of Azadirachta indica leaf extract," part II, J. Ethnopharmacol., 89: 217-9. 2003. http://dx.doi.org/10.1016/j.jep.2003.08.006

[15] G. Halder and B. Roy, "Effect of herbal or synthetic methionine on performance, cost benefit ratio, meat and feather quality of broiler chicken," Int. J. Agric. Res. 2: 987-996. 2007. http://dx.doi.org/10.3923/ijar.2007.987.996

[16] K. Takahashi and y. Akiba, "Effect of methionine supplementation on lipogenesis and lipolysis in broile chickens," Jpn. Poultry. Sci. 32:99-106. 1995. http://dx.doi.org/10.2141/jpsa.32.99

[17] K. Kiran, S. P. Tiwari1, N. Subhankar, M.J. Saxena, K. Ravikanth and M. Shivi, "Studies on comparative efficacy of herbal amino acid (Methiorep) supplement with synthetic Dl methionine on broiler growth performance and carcass quality traits," International Journal of Scientific and Research Publications, Volume 2, Issue 8, 2012.

[18] F.A. Igbasan, A.M. Ibrahim and B. I. Osho, "Comparative efficacy of herbal and synthetic methionine on performance of some haematological and biochemical parameters in domestic laying hens," African Journal of Biotechnology Vol. 11(46), pp. 10617-10625, 7. 2012.