African Journal of Biotechnology Vol. 11(29), pp. 7579-7581, 10 April, 2012
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB11.1500
ISSN 1684–5315 © 2012 Academic Journals

Short Communication

Effects of additional DL-methionine in broiler starter diet on blood lipids and abdominal fat

Mohammad Amiri Andi

Department of Animal Sciences, Faculty of Agriculture, Sanandaj Branch, Islamic Azad University, Sanandaj, Iran. E-mail: m-amiriandi@iausdj.ac.ir.

Accepted 24 October, 2011

In a completely randomized design, the study was undertaken to investigate the effects of additional DL-methionine (Met) in starter diet of broilers on blood lipids (21 days of age) and abdominal fat (42 days of age). 288 days-old Ross 308 hybrid chicks were divided into 16 groups for the starting period. Dietary treatments were divided into four levels of sulfur amino acids (SAA), [0.7(control), 0.8 (NRC), 0.9 and 1.0% diet] with graded levels of Met (0, 0.1, 0.2 and 0.3% diet). At 21 days of age, chicks receiving 0.2% Met had lower (*$p \leq 0.05$*) serum total cholesterol (TC) than the control (98.93 vs. 113.75 mg/dl, respectively). Serum high density lipoprotein (HDL) in chicks that received 0.3% Met was significantly (*$p \leq 0.05$*) higher than that of the control (80.60 versus 63.45 mg/dl, respectively). In chicks fed 0.2 and 0.3% Met, serum low density lipoprotein (LDL) were lower (*$p \leq 0.05$*) than for chicks that received 0 and 0.1% Met containing diet (17.25 and 13.33 versus. 24.15 and 25.00 mg/dl, respectively). Serum triglyceride (TG) and very low density lipoprotein (VLDL) in the control group was significantly (*$p \leq 0.05$*) greater than that of the other groups (136.60 versus 72.45, 66.53 and 54.27 mg/dl for TG; 26.15 vs. 14.57, 13.33 and 10.60 mg/dl for VLDL, respectively). Consequently, In 42 days of age, 0.2% Met in the starter diet had significantly (*$p \leq 0.05$*) reduced abdominal fat than the control (1.58 versus 2.5%, respectively). Based on the results, it seems that additional Met in broiler starter diet can increase good cholesterol (HDL) in blood level and reduce abdominal fat.

Key words: Methionine, broilers, blood lipids, abdominal fat and starter period.

INTRODUCTION

Severe selection for higher live weight gain in broiler parent/breeder production industries resulted in heavy broilers with greater body and abdominal fat. This subject not only reduces carcass quality of broilers, but also influences human health. On the other hand, producers desire to sell leaner carcasses with attention to the market demands for meat instead of live weight presently. Then, methods for reducing body or abdominal fat of new broilers had many advantages. DL-Methionine (Met) is an essential amino acid for poultry (NRC, 1994) and it plays an important function in lipid metabolism as a methyl group donor and act as a lipotropic agent (Pesti et al., 1979). Met supplementation in growing chick is a common practice (Neto et al., 2000; Swick et al., 1990). In many investigations, supplemental Met increased blood HDL or good cholesterol and decreased TG and abdominal fat (Kalbande et al., 2009; Mersmann, 1998; Zhan et al., 2006). Therefore, the purpose of this study was to investigate the effects of additional Met in broiler starter diet on blood lipoproteins, TG and abdominal fat.

Abbreviations: Met, DL-Methionine; **SAA,** sulfur amino acids; **TC,** total cholesterol; **HDL,** high density lipoprotein; **LDL,** low density lipoprotein; **TG,** triglyceride; **VLDL,** very low density lipoprotein; **A. fat,** abdominal fat; **ME,** metabolizable energy; **LW,** live weight; **LWG,** live weight gain; **FI,** feed intake; **FCR,** feed conversion ratio; **HSL,** hormone-sensitive lipase; **CP,** crud protein.

MATERIALS AND METHODS

288 Ross unsexed day old 308 strain chicks were purchased from a commercial hatchery and were randomly divided into four groups with four replicates (1.5 × 1.0 m, floor pen) in each treatment on equal body weight basis having 18 chicks. Chicks were fed corn

Table 1. Composition of the basal diet (0 to 21 days of age).

Ingredient	% Diet
Corn	59.18
Soybean meal	35.97
Sunflower oil	1.25
DCP	1.42
Oyster	1.26
Salt	0.42
Vitamin/mineral premix ≠	0.5
Calculated composition ≠≠	
ME (kcal/kg diet)	2900
CP	20.84
CF	2.7
Ca	0.9
P (available)	0.41
Na	0.18
Lys	1.12
Met+Cys	0.7
Analyzed composition	
CP	20.52
Ca	0.92
P (total)	0.52
Met (HPLC method)	0.38

≠ Provided per kg of diet: vitamin A, 8000 IU; cholecalciferol, 2000 ICU; vitamin E, 30 mg; manadione, 2 mg; riboflavin, 5.5 mg; pantothenic acid, 13 mg; niacin, 36 mg; choline, 500 mg; vitamin B12, 0.02 mg; folic acid, 0.5 mg; thiamin, 1 mg; pyridoxine, 2.2 mg; biotin, 0.05 mg; ethoxiquin, 125 mg; Mn, 65 mg; Fe, 55 mg; Cu, 6 mg; Zn; 55 mg; ≠≠ Based on NRC, 1994.

soybean meal based diet (with 1.25% sunflower oil) as per standards of nutritional requirement recommended by NRC (1994). Ingredients and chemical composition of the basal diet are presented in Table 1. Finisher diet was similar for all groups, with 3000 kcal/kg metabolizable energy (ME) and 17.5% crude protein (CP). All the groups were subjected to similar management and nutritional regimens except the levels of SAA given to them. Graded levels of Met were 0, 0.1, 0.2 and 0.3% of diet that create SAA levels of 0.7, 0.8, 0.9 and 1.0% of starter diet. At day 21, two birds from each replicate were randomly selected for blood samples collection to estimate the serum TG and lipoproteins. After blood collection, samples were placed in a room temperature and then serum was separated and centrifuged at 3000 rpm for 15 min in a centrifuge machine. Serum samples were frozen and stored at -20℃, and analyzed subsequently. Serum TC, TG and HDL were analyzed by using appropriate laboratory kits (Friedewald et al., 1972; Gordon et al., 1977; Gowenlock et al., 1988). VLDL was calculated from TG by dividing the factor by 5. The LDL was calculated by using the equation: (LDL= TC-HDL-VLDL). At 42 days of age, eight birds per treatment were sacrificed and animal fat was separated and weighed.

Statistical analysis

All data were analyzed using the one way ANOVA procedure of SAS (SAS Institute Inc, 1996) for analysis of variance. Significant differences among the treatments were identified at 5% level by Duncan's multiple range tests.

RESULTS AND DISCUSSION

The effects of experimental treatments on blood serum lipids and broiler performance are shown in Table 2. At 21 days of age, chicks that received 0.2% Met had lower (*p≤0.05*) serum total cholesterol than the control (98.93 versus 113.75 mg/dl, respectively). Serum HDL in chicks that received 0.3% Met was significantly (*p≤0.05*) higher than that of the control (80.60 versus 63.45 mg/dl, respectively). In chicks fed 0.2 and 0.3% Met, serum LDL were lower (*p≤0.05*) than 0 and 0.1% Met in their diet (17.25 and 13.33 versus 24.15 and 25.00 mg/dl, respectively). Serum TG and VLDL in the control chicks was significantly (*p≤0.05*) greater than those of the other groups (136.60 versus 72.45, 66.53 and 54.27 mg/dl for TG and 26.15 versus 14.57, 13.33 and 10.60 mg/dl for VLDL, respectively). In 42 days of age, 0.2% Met in the starter diet had significantly (*p≤0.05*) lower abdominal fat than the control (1.58 versus 2.5%, respectively). Experimental treatments had no effects on live weight gain (LWG), feed intake (FI) and feed conversion ratio (FCR).

In this investigation, additional Met in broiler starter diet lowered serum TG level which is in agreement with the results of other reports (Kalbande et al., 2009; Fowler, 1996; Roth and Milstein, 1957; Zhan et al., 2006). Researchers demonstrated that Met results in higher levels of hormone-sensitive lipase (HSL) in adipose tissue which decrease TG (Mersmann, 1998; Zhan et al., 2006). This is a reason for the reduction of abdominal fat in Met supplemented broilers. Based on the findings of this study, it seems that, higher concentration of SAA in diet of chickens resulted in the lowering of serum TC. The findings of this investigation can be well correlated to those reported by Kalbande et al. (2009) and Roth and Milstein (1957) that dietary Met insufficiency may induce fatty liver thereby increasing total serum cholesterol. There are not sufficient researches about the effects of SAA in broiler diet on blood lipoproteins but in numerous studies, the relationships between low HDL levels and the risk of atherosclerotic disease have been shown. In this study, additional Met in broiler starter diet resulted in high level of HDL and low levels of VLDL and LDL. These findings are in agreement with Oda et al. (1991) in rat. They postulated that dietary Met increase the secretion rate of HDL cholesterol from the liver

Conclusion

Based on the results of this investigation, it seems that additional Met in broiler starter diet can increase good HDL in broiler blood and reduce abdominal fat. There is need for further investigations for the measurement of liver enzymes in this subject.

Table 2. Effects of additional methionine in broiler starter diet on serum lipids (21 days of old), performance and abdominal fat (42 days of age) [1].

Trait	Additional methionine (%diet)			
	0.0	0.1	0.2	0.3
TG (mg/d)l	136.60^{a}±20.96	72.45^{b}±11.26	66.53^{b}±11.81	54.27^{b}±4.77
TC (mg/dl)	113.75^{a}±3.95	108.14^{ab}±4.28	98.93^{b}±2.50	104.53^{ab}±3.3
LDL (mg/dl)	24.15^{a}±2.00	25.00^{a}±1.52	17.25^{b}±0.85	13.33^{b}±1.20
VLDL (mg/dl)	26.15^{a}±4.85	14.57^{b}±2.36	13.33^{b}±2.37	10.60^{b}±0.86
HDL (mg/dl)	63.45^{b}±2.55	68.57^{ab}±2.84	67.35^{ab}±3.55	80.60^{a}±7.48
A.fat (%carcass)	2.50^{a}±0.21	2.10^{ab}±0.23	1.58^{b}±0.31	1.90^{ab}±0.31
LW (g)	2132.0±84.6	2151.2±57.5	2228.5±16.7	2185.0±41.1
LWG (g/d	48.29±1.73	48.76±1.07	51.01±0.62	49.77±0.72
FI (g/d)	95.73±2.39	96.50±2.49	96.44±1.18	95.73±2.02
FCR (g/g)	1.99±0.05	1.98±0.04	1.92±0.04	1.89±0.06

[1]Data expressed as means ± SE.
[a-b]Means in each row with different superscript are significantly different ($p \leq 0.05$).

ACKNOWLEDGEMENT

The author wishes to thank the Islamic Azad University, Sanandaj branch.

REFERENCES

Fowler NG (1996). Nutritional disorders. In: Poultry diseases, 4th Ed. FTW Jorden and M Pattison, Eds. WB Saunders, London, England, pp. 306-331.

Friedewald WT, Levy RI, Fredrickson DS (1972). Estimation of the concentration of LDL cholesterol in plasma, without use of the preparative ultracentrifuge. Clin. Chem. 18: 499-502.

Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR (1977). High density lipoprotein against coronary heart disease: The Framingham study. Am. J. Med. 62: 707-714.

Gowenlock AH, McMurray JR, McLauchlan DM (1988). Varley's Practical Clinical Biochemistry. 6th Edn., CAS Publishers and Distributers, New Delhi, pp. 477-749.

Kalbande VH, Ravikanth K, Maini S, Rekhe DS (2009). Methionine supplementation options in poultry. Int. J. Poult. Sci. 8: 588-591.

Mersmann HJ (1998). Lipoprotein and hormone-sensitive lipase in porcine adipose tissue. J. Anim. Sci. 76: 1396-1404.

National Research Council (1994). Nutrient Requirement of Poultry. 9th Edn., National Academy Press, Washington DC. USA.

Neto MG, Pesti GM, Bakalli RI (2000).Influence of dietary protein level on the broiler chicken's response to methionine and betaine supplements. Poult. Sci. 79: 1478-1484.

Oda H, Fukui H, Hitomi Y, Yoshida A (1991). Alteration of serum lipoprotein metabolism by polychlorinated biphenyls and methionine in rats fed a soybean protein diet. J. Nut. 121: 925-933.

Pesti GM, Harper AE, Sunde ML (1979). Sulfur amino acid and methyl donor status of corn-soybean diets fed to starting broiler chicks and turkey poults. Poult. Sci. 58: 1541-1547.

Roth JS, Milstein SW (1957). Some effects of excess methionine on lipid metabolism in the rat. Arch. Biochem. Biophys. 70: 392-398.

SAS Institute Inc, (1996). SAS/STAT User's Guide. SAS Institute Inc, Cary, North Carolina.

Swick RA, Creswell DC, Dibner JJ, Ivey FJ (1990). Impact of methionine source on performance of broilers growing under warm and humid conditions [abstracts]. Poult. Sci. 69:194.

Zhan XA, Li JX, Xu ZR, Zhao RQ (2006). Effects of methionine and betaine supplementation on growth performance, carcase composition and metabolism of lipids in male broilers. Br. Poult. Sci. 47(5): 576-580.