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Biological Availability of Betafin for Methionine Sparing in Broiler Chickens

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ABSTRACT

To ascertain the bioavailability of Betafin® (Betaine anhydrous 97%) as methionine sparing in broiler diets, 250 day old chicks were randomly divided into five groups having five replicates of 10 chicks each in a completely randomized design, i.e. (A) adequate methionine, (B) Low methionine (LM), (C) LM with choline (0.17%/0.15%), (D) LM with Betafin (0.14%/0.12%) and (E) LM with Betafin (0.07%/0.06%) in starter/finisher diets. Choline was supplemented @ 700 mg/kg to A and B. Significant ($P<0.05$) differences were found in weight gain, feed intake and FCR among different groups. The supplementation of choline and Betafin to methionine deficient diet did not improve either weight gain or FCR. However, Betafin supplementation showed better results than choline ($P<0.05$). Carcass yield among treatment groups was not different ($P>0.05$).

Key Words: Betafin; Methionine; Growth rate; Broilers

INTRODUCTION

Methionine (Met) is the second limiting amino acid after lysine in poultry feeds. It is required in number of metabolic functions such as protein synthesis and as a methyl donor. As a methyl donor, Met is activated to S. adenosyl methionine (S-AM), utilized in number of body reactions, such as maintenance of DNA, formation of epinephrine and choline. The amount of Met needed by the body to provide S-AM is far in excess than dietary intake of Met. Thus the remethylation of homocysteine allows the conversion to methionine. Choline and folic acid are also methyl donors. Folic acid has to take methyl group before liberating methyl group, choline first has to be activated and then converted to betaine before methyl group are liberated to fulfill methylation function (McKeever *et al.*, 1991). Betaine can be used as a methyl group donor to convert homocysteine to Met in the transmethylation path way in the liver. Betaine needs no activation. Once in the cytosol, betaine regardless of its origin is used to methylate Homocysteine to Met. through the action of the enzyme betaine homocysteine methyl transferase (BHMT) (McKeever *et al.,* 1991). A commercial preparation Betafin (Betaine anhydrous 97%) can spare 25% of the methionine and choline as suggested. Thus present work was undertaken to evaluate effect of Betafin for Met sparing in broiler chicken.

MATERIALS AND METHODS

Two hundred and fifty Hubbard male chicks were reared in the battery brooder. Chicks were randomly divided into five groups having fifty chicks per group. Each group was further divided into five replicates of 10 chicks each. The five experimental treatments (A) adequate methionine, (B) Low methionine (LM), (C) LM with choline (0.17%/0.15%), (D) LM with Betafin (0.14%/0.12%) and (E) LM with Betafin (0.07%/0.06%) were allotted to each group of chicks. Five isocaloric and isonitrogenous broiler rations (Table I & II) deficient in Met (0.36% in starter and 0.30% in finisher) were prepared and supplemented with 0.14/0.12% Met, 0/0% Met, 0.17/0.15% choline, 0.14/0.12% Betafin and 0.07/0.06% Betafin in starter/finisher, respectively.

RESULTS AND DISCUSSION

The starter and finisher diets were formulated to about 70% of level as recommended by Hubbard Feeding Standards (these are the values used by commercial feeds in the country). Mean body weight gain, feed intake, feed conversion ratio and carcass yield of different experimental treatments are presented in Table III. The diet fed to birds in treatment B was

Table I. Experimental rations (starter/finisher)

Ingredients	Starter	Finisher
Corn	42.92	40.00
Rice Tips	10.00	20.00
Rice Polish	4.95	0.00
Corn Gluten 60%	5.00	1.34
Soybean meal	20.00	20.00
Guar meal	5.00	5.00
Rape seed meal	2.91	3.60
Molasses	2.00	2.00
Soya oil	3.00	4.00
$CaCO_3$	1.29	1.15
DCP	1.54	1.60
Lysine	0.39	0.31
Methionine	NIL	NIL
VitaMin. Premix	1.00	1.00
Total	100	100

Table II. Calculated chemical composition of experimental rations

	Starter	Finisher
CP (%)	21.00	19.00
ME (M.Cal/kg)	3.05	3.10
Crude Fiber (%)	4.12	3.57
Calcium (%)	0.95	0.92
Phosphorus (%)	0.42	0.42
Lysine (%)	1.17	1.08
Methionine (%)	0.36	0.30
Cystine (%)	0.308	0.26
Linoleic Acid (%)	1.2	0.94

The differences in body weight of subsample of 50 birds per dietary treatment showed non significant differences in carcass yield (Lowry & Baker, 1987). The experiment was designed to test Betafin as a Met replacer. To exclude the effect of other interacting factor choline was supplemented at level of 700 mg/kg to treatments A and B. Experiment was conducted in an ideal environment to exclude coccidiosis challenge and ruling out all other influencing factors. All the evidence suggests that Betafin cannot replace Met. in its function as an amino acid and a replacement of Met with Betafin carries risk of producing diets marginal in Met.

Table III. Mean weight gain (g), feed intake (g), FCR and dressing percentage 0-42 days

Parameter	Treatment Group				
	A	B	C	D	E
Wt. Gain (g)	$2127.59^{a} \pm 23.59$	$1732.78^{c} \pm 41.52$	$1720.00^{c} \pm 34.96$	$1911.02^{b} \pm 47.16$	$1890.76^{b} \pm 39.75$
Feed Intake (g)	$3942.16^{a} \pm 63.08$	$3609.00^{c} \pm 44.75$	$3439.21^{d} \pm 28.28$	$3763.36^{b} \pm 58.04$	$3775.46^{b} \pm 48.35$
FCR	$1.84^{c} \pm 0.003$	$2.08^{a} \pm 0.032$	$1.99^{b} \pm 0.026$	$1.96^{b} \pm 0.024$	$1.99^{b} \pm 0.025$
Carcass Yield (%)	$66.36^{a} \pm 0.76$	$65.40^{a} \pm 0.87$	$66.42^{a} \pm 0.89$	$65.80^{a} \pm 0.58$	$65.00^{a} \pm 0.89$

Means with different superscripts indicate significant differences ($P < 0.05$).

deficient in Met as can be seen from large responses to addition of Met in treatment A during the 42 d experimental period. The weight gain was improved 28% in treatment A over the deficient ration "B" (Takahashi *et al.*, 1994; Rostagno & Pack, 1996). This improvement was consistent over the rest of the three treatments, C, D and E. The differences among the treatments were significant ($P<0.05$). The addition of Met. similarly showed improved feed conversion (Morgan, 1994). Birds in treatment "A" consumed 13% less feed/kg gain than treatment "B". This experiment clearly shows positive responses to Met. supplementation (Schuttle *et al.*, 1995; Anonymous, 1996).

The effect of added choline to diet "C" showed negative response (Vogt, 1994). If choline could furnish Met from Homocysteine, its addition to deficient diet would yield positive results. Supplementation of Betafin to diets D&E had no ($P>0.50$) effect. The ability of Betaine to deliver Met, its addition should have yielded a positive response. The 0.12% addition of Betafin should have showed similar effects as supplemented with Met. The present experiment, however, indicates that Betafin cannot replace Met (Anonymous, 1996) in its original function as a dietary essential amino acid and this finding agrees with earlier findings (Schuttle & Pack, 1995; Rostango & Pack, 1996).

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