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Weight Gain and Haematolgical Profile of Broiler Chicks Fed a Maize-Soyabean Diet Supplemented with Different Levels of Methionine, Sodium Sulphate and Sodium Sulphite

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Abstract: An experiment was carried out to investigate the effect of substituting synthetic methionine with sodium sulphate and sodium sulphite in maize-soyabean diets fed to broiler chicks on weight and haematological profile. Two hundred and forty (240) unsexed Hubbard day old broiler chicks were fed iso-caloric and iso-nitrogenous maize-soyabean diets (3,000 cal/kg and 22% crude protein) for four weeks. There were eight treatment groups, T1-T8, each replicated three times. T1 had no methionine, T2 had 3% methionine, T3 had 3% sodium sulphate, T4 had 3% sodium sulphite, T5 had 1.5% methionine and 1.5% sodium sulphate, T6 had 1.5% methionine and 1.5% sodium sulphate T7 had 1.5% methionine and 1.5% sodium sulphite while T8 had 1.5% methionine and 1% sodium sulphite. Chicks in T6 had the highest average weekly weight gain of 106.58 g while birds in T8 had the lowest average weekly weight gain (79.94 g). The average weekly weight gain of birds in T1, T2 and T5 did not differ significantly ($p>0.05$) from one another. Likewise the average weekly weight gain of birds in T1, T2, T3 T4 and T5 did not differ significantly ($p>0.05$) from one another. The average weekly weight gain of chicks in T7 and T8 which had the lowest weight gains, also did not differ significantly ($p>0.05$). All haematological parameters evaluated fell within safe precincts as stipulated in literature. Treatment 6 is therefore recommended for broiler starter rations alongside T2 and T5 because they did not differ significantly ($p>0.05$) from one another.

Key words: Methionine, sodium sulphate, sodium sulphite, amino acids, weight gain, haematology

INTRODUCTION

The protein of legumes is located in the cotyledons and embryonic axis where protein content is highest; only small amounts are present in the seed coat (Uadia, 1984). The amino acid content of legume grains depends on species, variety, locality and management practices. Bressani and Elias (1962), discovered that the uptake of zinc by the pea bean caused increase in the methionine content of the pea bean. They also discovered while working with *Pisum sativum*, that the methionine content was increased from 1.29-2.18 g per log of protein when the soil was fertilized with sulphur.

Among legumes, soyabean is the best-balanced plant protein with an amino acid profile comparable to that of milk protein (Uadia, 1984). Its protein content varies from variety to variety, but generally ranges between 32.4%-50.2%. It is known to be particularly rich in all known nutritionally essential amino acids, particularly lysine and tryptophan but is limiting in sulphur amino acids like methionine, cystine and cysteine (Njike, 1973). Besides, Jenssen *et al*. (1979) stated that about 20% of total amino acids (TSAA) contained in feedstuffs is not available on digestion, making supplementation necessary. The 20% TSAA content of feedstuff, especially those that have maize as their major energy source arises essentially from the fact that maize, though low in lysine and tryptophan, has a reasonably high content of sulphur amino acids like methionine and cystine (Oyenuga, 1968).

Synthetic, pure amino acids are often added to poultry feeds to balance for the requirement of the limiting amino acids in most protein concentrates especially the oil seed cakes. Methionine supplementation of soyabean- based diets has been a common practice over the years and the supplementation has been shown to lead to better performance of birds (Njike, 1973 and Osti, 2008). Methionine can be supplied in form of DL-methionine (containing 99% pf active substance) or as liquid DL-methionine hydroxyanalogue - free acid (containing 88% of active substance) with the latter being less expensive and almost equivalent to DL-methionine in efficacy (Calet and Melot, 1961; Bateman *et al*., 2005; Liu *et al*., 2004 and Reid *et al*., 1982).

Most of the sulphates in the body is found in proteins- in the amino acids like cystine, cysteine and methionine. Another sizable portion of body sulphur is in the form of sulphated proteoglycans in connective tissues. Other important organic forms are the vitamins-(thiamine, biotin and lipoic acid), enzyme co-factors and clotting and anticoagulant factors in blood.

Sulphates are normal constituents of food. It is consumed in the diet in both organic and inorganic

forms. The organic forms constitute the largest portion, which include the sulphur amino acids. The smaller forms of sulphur, like the sulphates and sulphites are readily absorbed.-in a process regulated by a transport mechanism dependent on vitamin-D (Fuller and Benevenga, 2008). Inorganic sulphates from exogenous dietary sources and from endogenous release from sulphur-containing amino acids are used in synthesizing the chondroitin matrix, in the biosynthesis of taurine, heparin, cystine and other organic constituents in the animal body (Baker, 1977; Fuller and Benevenga, 2008). In birds, sulphates are incorporated into the feathers, the gizzard lining and muscle (Pond *et al*., 1995). Sulphate is incorporated into glycoprotein via an ATP-like intermediate (adenosine-3-phosphate-5-phospphosulphate) or 'active sulphate. Sulphate is attached to the galactose or N-acetyl glucose amine in connective tissues and other cell surfaces as chondroitin sulphate, keratin sulphate, heparin, heparin sulphate and dematin sulphate. Another reason why sulphate is very important is that it conjugates drugs and facilates their urinary excretion.

In metabolism, cysteine is the primary source of sulphate. Cystine contains 26.7% inorganic sulphate and is a precursor of body sulphates (Ross *et al*., 1972; Fuller and Benevenga, 2008). The sulphur contents of methionine and sodium sulphite are 21 and 22% respectively. This very similar sulphur contents prompted the hunch that inorganic sulphates could possibly replace methionine in poultry rations.

The need to know if supplementation of chicks' diets with methionine and inorganic sulphates has any health/clinical implications prompted the inclusion of haematology as part of the study. This paper therefore reports the weight gain and haematological profile of broiler chicks fed maize-soyabean diets supplemented with different levels of methionine, sodium sulphate and sodium sulphite.

MATERIALS AND METHODS

The experiment, which lasted for four weeks, was carried out at the Teaching and Research farm, University of Ibadan, first, in the Pullet house and later in the metabolic cage unit. Most of the very sensitive weightings that required the chemical balance were done in the Research Laboratory of the Department of Animal Science, University of Ibadan.

Eight different iso-caloric and iso-nitrogenous diets with different levels of inclusion of methionine, sodium sulphate and sodium sulphite (except Treatment 1 which had neither methionine, sodium sulphate nor sodium sulphite) were prepared.

The percentage composition of the different experimental diets is shown in Table 1.

Two hundred and forty Hubbard day old chicks were purchased from Folawiyo Farms, Oyo. Their weights at day old were taken after which they were randomly distributed to the eight treatment groups. Each Treatment group was replicated three times; the experimental units were laid out in a Completely Randomized design.

On arrival, the birds were given an antistress, which was administered through their water. The feeding and watering troughs were removed, cleaned and refilled on a daily basis. Water was supplied ad labium and weekly weights of birds were taken. The birds were put in groups of ten for each replicate and weighted inside a light perforated carton whose weight had earlier been determined. The average weekly weight, which was determined at the end of every week, was determined thus:

$$\frac{\text{Wt of 110 chicks-weight of perforated carton}}{\text{10 chicks}}$$

Haematological studies: Blood was collected from the brachial veins using sterile syringes and needles. Blood samples were transferred immediately after collection into sterile tubes containing an anti coagulant-the disodium salt of Ethylene Diamine Tetra Acetic Acid (EDTA). Packed Cell Volume (PCV/haematocrit) was determined by the microhaematocrit method. Haemoglobin (Hb) concentration was photometrically determined at the wavelength of 540 nm. Erythrocyte (RBC) and Leukocyte (WBC) counts were done by using the improved Neubauer haemocytomyceters. Blood constants were calculated by the formulae stipulated below:

$$\text{MCHC} = \frac{\text{Hb (g/dl) x 100}}{\text{PCV (\%)}}$$

$$\text{MCH} = \frac{\text{Hb (g/dl) x 10}}{\text{RBC (x 10}^{6}\text{µl)}}$$

$$\text{MCV} = \frac{\text{PCV (\%) x 10}}{\text{RBC (million/µl)}}$$

Source: Jain, 1993

Data were analyzed statically by analysis of Variance (ANOVA) to determine significant mean differences and mean separation was carried out using the Duncan's New Multiple Range Test as outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The average weight gain of chicks in T1, T2, T3, T4 and T5 did not differ significantly ($p>0.05$) form one another.

Table 1: Proximate Composition of Different Diets

Ingredients	T1	T2	T3	T4	T5	T6	T7	T8
Maize	55.7	55.40	55.40	55.40	55.40	55.45	55.40	55.45
BDG	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
SBM	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Blood Meal	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Oyster Shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Bone Meal	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Vit/Min Premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine		0.30	-	-	0.15	0.15	0.15	0.15
Sodium Sulphate	-	-	0.30	-	0.15	0.15	-	-
Sodium Sulphite	-	-	-	0.30	-	-	0.15	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

BDG = Brewers Dried Grains SBM = Soyabean bean meal

Table 2: Average weekly weight of Broiler Chicks

Ingredients	T1	T2	T3	T4	T5	T6	T7	T8
1	46.99	53.20	49.00	50.40	49.00	49.00	42.00	43.96
2	26.60	25.20	26.60	14.70	21.98	31.50	9.59	11.20
3	144.91	152.95	151.97	156.10	156.59	170.80	141.40	140.70
4	157.99	164.99	154.00	154.00	164.50	175.00	140.40	140.70
Total	375.55	394.34	381.57	315.20	392.08	426.30	332.99	319.76
Mean	93.98^{b}	99.09^{ab}	95.39^{b}	93.80^{b}	98.021^{ab}	106.58^{a}	85.13^{c}	79.94^{c}
S.E	±10.30	±8.82	±10.27	±14.05	±11.63	±11.77	±10.23	±9.52

Means with the same superscript did not differ significantly from one another

Table 3: Haematolgical profile of broiler chicks fed a maize- soyabean Diet supplemented with different levels of methonine, sodium sulphate and sodium sulphite

	T1	T2	T3	T4	T5	T6
RBC (x10^{6}µl)	2.90±0.03	2.90±0.00	2.92±0.03	2.91±0.04	2.91±0.03	2.93±0.03
Hb (g/dl)	9.72±0.01	9.80±0.02	9.82±0.01	9.82±0.02	9.83±0.00	9.89±0.00
PCV (%)	27.25±0.06	28.45±0.04	28.26±0.04	27.27±0.06	28.77±0.05	28.83±0.04
MCHC (gm/dl)	35.66±0.04	34.46±0.02	34.75±0.06	36.01±0.02	34.17±0.01	34.30±0.02
MCH (pg)	33.51±0.01	33.79±0.01	33.63±0.00	33.75±0.00	34.78±0.00	33.75±0.01
MCV (fl)	9.40±0.01	9.81±0.00	9.57±0.00	9.37±0.01	9.89±0.01	9.84±0.01
WBC (x10^{3}µl)	9.31±0.00	9.45±0.00	9.40±0.01	9.41±0.02	9.42±0.01	9.44±0.01

The weight gain ranged between 93.02 g for T5 to 99.09 g for T2. The average weekly gain of chicks in T6 was the highest (106.58 g). It differed significantly ($p<0.05$) from the other treatments except T2 and T5. T7 and T8 had the chicks with the lowest average weekly weight gains of 83.25 and 79.94 g respectively and did not differ significantly ($p>0.05$) from each another.

Chicks in T6 had average weekly weight gains that were significantly ($p<0.05$) higher than T1, T3, T4, T7 and T8. It is on the strength of this that T6 alongside T2 and T5 is recommended for broiler starter diets because they did not differ significantly ($p>0.05$). Treatment 6 (T6) which had a 1.5% inclusion of methionine and 1% sodium sulphate is recommended for broiler starter rations. Table 2 shows the average weight gains of birds in the different treatment groups.

All haematological parameters evaluated fell within the ranges stipulated in Literature for the physiologically normal chicken (Mitruka *et al*., 1997; Schalm *et al*., 1975; Oyewale, 1987; Simarak's *et al*., 2004; Islam *et al*., 2004). The results of haematology revealed that the birds did not face any immediate health threat because of the inclusion of synthetic methionine and inorganic sulphates in their diets.

Conclusion and recommendations: Inorganic sulphates like sodium sulphate and sodium sulphite can replace methionine in broiler starter rations. A closer look however has to be given to the feed: gain ratio which points to the efficiency of feed utilization. Feed cost per kilogram gain should also be determined to enable us know the Treatment that gives us a kilogram weight gain at least cost.

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