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Effect of White Sorghum Supplemented with Graded Levels of Synthetic Methionine on Haematological Indices and Serum Biochemicals of Broiler Chickens

By

[1]Olusiyi, J. A., [2]Omotoso O B, [3]Akhigbe, O. and [4]Ojinnaka P.E.

[1,2,3,4]Department of Animal Production and Health. Federal University, Wukari.

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Abstract

Investigation was carried out to elucidate the effect of white sorghum supplemented with synthetic methionine diets on haematological indices and serum biochemistry of broiler chickens. Three hundred (300) day old Anak chick were used in a Completely Randomized Design (CRD) for 56 days. The birds were randomly assigned to 5 dietary treatments consisting of 60 birds/treatment and replicated thrice with 20 birds/replicate. Treatments 1-5 were supplemented with synthetic methionine at the levels of 0.1, 0.2, 0.3, 0.4 and 0.5% for T_1, T_2, T_3, T_4 and T_5 respectively. Results obtained revealed that incorporating synthetic methionine into white sorghum soya-bean based diets did not significantly ($P>0.05$) affect the haematological indices, however, serum biochemical was significantly ($P<0.05$) affected in almost all parameters measured except in Urea. From the result also, the diet did not distort the haematological indices and serum biochemical since they fall within standard values. It was concluded that synthetic methionine supplementation up to 0.5% has no deleterious effect but beneficial effect on haematology and serum biochemical.

Keywords: *White sorghum, methionine haematology, serum indices, Broiler chickens.*

Introduction

One of the major constraint of insufficient intake of animal protein in Sub-Africa is inadequate production of conventional protein and energy sources. The production is still grossly inadequate in most of the least developed countries of the world and often times the demand exceeds supply. Nigeria, like other developing countries with all potential to become self-sufficient in food production still finds it difficult to feed her citizens adequately. All efforts to increase arable crop production to a level that can satisfy both animal and human needs have not yielded appreciable results. The main problem confronting livestock producers in Nigeria today is the unavailability and high cost of the conventional feed ingredients. The increasing demands for feed ingredients as industrial raw materials is not only aggravating the poor situation but pushing the market prices of the conventional feed ingredients to alarming heights (1). Nevertheless, the need to bridge the gap of animal protein shortage and provide quality and sufficient animal protein for the growing human population is of paramount importance to animal scientists. Poultry has been identified as the fastest means of bridging the protein deficiency gap prevailing in most tropical countries like Nigeria (2). Presently, maize appears to be the major ingredient being used in feed formulation as a source of energy and it's being used by man and animals as food, as this results in a strong competition between human and animals for maize. The competition has led to a soaring cost of maize, which is now a major source of instability in poultry industry today. The inability to produce maize to a level that can satisfy its demand by both man and animal has led to a search for other energy feed sources which can be more cost effective than maize at the same time meet the nutritional requirement. Such alternative if found would reduce the present pressure on maize and subsequently lead to a reduction in the cost of feeding poultry. Attempts to tackle poultry feed problems have led to the exploration of some affordable alternative energy feed sources to replace maize in poultry diets. One of the alternative crop that have potential to replace maize as a feed (energy ingredient) is white sorghum. It is not highly competitive between humans, animals and industrial purposes. Also, the anti-nutritional content of white sorghum is not as pronounced like that off red sorghum. Sorghum is the cultivation and commercial exploitation of species of grasses within genus sorghum (*bicolor*), as the plant is used for grain, fibre and fodder. The plants are cultivated in warm climates worldwide as it is native to tropical and sub-tropical regions of Africa and Asia (3). Sorghum grows in harsh environments where other crops do not grow well, just like other staple foods, such as cassava

*Corresponding Author: **Olusiyi, J. A.**

that are common in impoverished regions of the world. It is usually grown without application of any fertilizers or other inputs. One of the major limitations for its use in poultry feed is its relatively high tannin content but the concentration of tannin in white sorghum is not as severe as red sorghum. The detrimental effects of high tannin sorghums on the growth and feed efficiency of the growing chickens are well documented by (4), they reported that as little as 0.5% tannin acid will depress growth. According to (5), Sorghum is lower in energy than maize, but higher and more variable in protein (8-12%). It contains less oil than maize, it's a main food grain for human and livestock and it's more drought-resistant than maize. He observed that varieties in Nigeria contain tannin in a range of 0.012-0.215%. Tannin have a deleterious effect on the nutritive value of Sorghum as there is reduction in amino acid availability with increasing tannin content. Research have confirmed that detrimental effect of high-tannin Sorghum on growing chicks may be alleviated by supplementing practical diets with lysine or methionine (6), hence the supplementation with methionine in the study. The question has always been raised as to whether naturally occurring Sorghum tannin are as toxic as tannic acid. It was observed by (7) that growth depression regardless of the source of the tannin, but a higher Sorghum tannins content was necessary to cause growth depression equivalent to commercial tannic acid. He observed that supplementation of high tannin Sorghum diets with methionine or chlorine alleviated the growth depression. (8) found the addition of 0.15% methionine to high-tannin Sorghum-Soyabean meal brought the growth of broilers up to that obtained with similar diet containing a low-tannin-Sorghum grain. Other methods for improving the nutritional values of high-tannin Sorghum are the addition of fats and the adequate grinding (9). (10) concluded that the main effects of grinding is to improve feed utilization, which is accompanied by increasing the surface area of the grain relative to its reduced particle size. If found suitable, adopting its usage will go a long way to reduce over-dependence on maize, reduce cost of production and attempt to bridge the gap of animal protein shortage. The present study was therefore, designed to investigate the effect of white sorghum supplemented with graded levels of synthetic methionine on haematological indices and serum biochemical of broiler chickens.

Material and Methods

Study Area

The study was carried out at the poultry unit of Teaching and Practical Farm Taraba State College of Agriculture, Jalingo. Taraba State is in the North-East geo-political zone of Nigeria. It lies between latitude $8^0$53" North and longitude $11^0$23" East of the equator in the guinea Savannah zone of Northern Nigeria (11). There are two main seasons existing in the area of study, it has an annual rainfall between 1000-1500mm with temperature range from 30-42^0C depending on the season (11). The State is characterized by tropical climate marked by dry and rainy/wet season. The rainy season usually commences in the month of March and ends in October, while the dry season starts late October and ends in March (11).

Experimental Diets

Five experimental diets were formulated as treatment T_1, T_2, T_3, T_4 and T_5 supplemented with synthetic methionine at graded levels of 0.1, 0.2, 0.3, 0.4 and 0.5% respectively (Tables 1 and 2). The feed ingredients used for this experiment were purchased from the Jalingo main market and from other commercial feed ingredients depot within Jalingo, Taraba State.

The Experimental Animals and their Management

The experimental design used in the study was a Completely Randomized Design (CRD) model. Three hundred (300) day-old broiler chicks were used for this study. They were purchased from Obasanjo farm Otta, Ogun State. About two weeks before the arrival of the birds, the deep litter Pens were thoroughly washed and disinfected. Few hours to their arrival, all equipment were put in place (feeders, drinkers, bulbs, heat source etc) and heated to a suitable temperature. On arrival, the birds were weighed and allocated randomly into five dietary treatments groups of sixty (60) birds per treatment and three replicates per diet consisting of 20 birds per replicate. The birds were fed *ad libitum* with the experimental diets for 8 weeks. Routine management operations such as daily removal of left-over (uneaten) feed, washing of drinkers, provision of clean drinking water and cleaning of the environment were carried out. A standard vaccination programme suitable to the environment was followed strictly, and medications such as antibiotics, coccidiostats and ant-stress were administered appropriately.

Parameters Determined

i. Haematological indices
ii. Serum biochemical

Blood Collection and Analysis

At the end of the feeding trial, 5ml of blood samples were collected from each of 3 birds of a replicate via the wing vein and put into ethylene Di-amine Tetra Acetic Acid (EDTA) treated Bijou bottles (1mg/ml) for both haematological and serum biochemical assay. Blood were analysed within three hours of their collection at the Federal Medical Centre, Jalingo.

Proximate Analysis

Proximate analysis of feed samples were determined using the method of Biochemistry and Applied Molecular Biology Department, National Veterinary Research Institute (NVRI), Vom (Tables 3 & 4).

Statistical Analysis

Data generated in the study were subjected to Analysis of Variance (ANOVA) and differences between treatment mean were compared using the Duncan's multiple Range Test according to (13).

Results and Discussion

The results of haematological indices of broiler chickens fed white sorghum supplemented with graded levels of synthetic methionine is shown in Table 5. All parameters evaluated were not significantly ($P>0.05$) different across treatment groups. The PCV values ranged from 28.31 in T_1 to 29.21% in T_5. It fell within the normal range of 24.90-45.20% reported

*Corresponding Author: **Olusiyi, J. A.**

by (14, 15 and 16) for healthy birds. It is however higher than 21.00-24.67% reported by (17). Numerical increases in the PCV values can be attributed to age from starter and finisher stages (18). The PCV follows a particular trend as it increases slightly with increased levels methionine supplementation. The normal values of PCV revealed a normal haemotopothesis in the birds and also an indication that birds were not aneamic. The observed white blood cell count values of 7.60-10.33x10^9/L agrees with 5.0-15.00 x 10^9/L reported by (15). Since the diet does not affect WBC significantly is an indication that no pathological effect was induced by the inclusion of methionine in the diets, hence, the health status of bird was not threatened. Red Blood Cell (RBC) range values of 4.77-5.07 is in the range of 4.00-6.57 x 10^{12}/L reported by (17) and slightly higher than 2.50-4.50 x 10^{12}/L reported by (20) for normal birds. The Haemoglobin (Hb) values of 9.57-10.10g/dl agrees with the values of 7.40-13.10g/dl reported by (15) and slightly lower than 11.60-13.68g/dl reported by (21). The increase value of Hb concentration suggests that the inclusion of methionine supports iron formation. High PCV and Hb have been reported by (15) as an indication of high feed conversion efficiency. The mean corpuscular haemoglobin concentration (MCHC) values of 30.33-34.09% falls within the range of 26.00-35.00% reported by (22) and 29.25-36.00% reported by (23) for normal healthy birds. The mean corpuscular volume (MCV) range of 59.87-60.40fl falls within the range of 48.66-62.18fl reported by (24). MCV is an important trait which determines the cell size of erythrocytes and is therefore an important factor which determines the ability of birds to withstand prolonged oxygen starvation according to (15). Table 6 shows the effect of graded levels of synthetic methionine on serum biochemical of broiler chickens fed white sorghum – soya bean based diets. Almost all parameters measured were significantly ($P<0.05$) different except Urea that is not significantly ($P>0.05$) difference. The Serum protein ranged from 32.00-35.54g/dl which is within the range of 30.41-36.02g/dl reported by (25). Serum protein levels have been reported to depend on the quality and quantity of protein available in the diet (26, 27). The high values of Serum protein implies that sorghum based diets supplemented with methionine was not inferior or deficient nutritionally when compared with maize. The high level of serum protein is a good sign that the birds were not nutritionally deficient in serum protein as low serum protein could be attributed to stress, chronic disease, parasitism, starvation or malnutrition and high values may imply dehydration, chronic infection or leukemia (28). The Albumin values observed in this study (17.02-20.74g/dl falls within 16.50-21.00g/dl reported by (24). It was reported by (28) that Albumin acts as a stranger predictor of health, that low Albumin indicates poor health, while high level is usually attributed to dehydration or poor protein utilization. Serum Globulin Values of 13.67-16.73g/dl agrees with (29) who recorded 12.06-16.89g/dl. However, higher than 1.33-3.55g/dl reported by (30). Although, increased globulin levels may be attributed to infections caused by virus or bacteria and kidney dysfunction, likewise, globulin levels may decrease as a result of emphrosis and acute haemolytic anaemia (28).

Conclusion

The results suggested that Synthetic methionine up to the highest level 0.5% tested did not have any deleterious effect on blood parameters and had no health implications as all parameters obtained falls within established blood parameters of healthy birds.

Table 1: Ingredient composition of broiler starter diets (1-4 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Ingredients	Diets				
	T_1 (0.1 %)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)
White Sorghum	47.10	46.96	46.82	46.69	46.57
Soya bean	33.60	33.64	33.68	33.71	33.73
Wheat offal	9	9	9	9	9
Methionine	0.1	0.2	0.3	0.4	0.5
Fish meal	5	5	5	5	5
Bone meal	2	2	2	2	2
Lime stone	1	1	1	1	1
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Calculate Analysis					
Crude protein	23.47	23.47	23.47	23.47	23.47
ME/kcal/kg	2934.88	2931.26	2982.12	2924.75	2921.41
Crude fibre (%)	3.49	3.49	3.49	3.49	3.49
Calcium (%)	1.62	1.62	1.62	1.62	1.62
Phosphorus (%)	0.80	0.72	0.72	0.71	0.72
Lysine (%)	1.33	1.33	1.33	1.33	1.33
Methionine (%)	0.52	0.52	0.52	0.52	0.52

* Vitamin-mineral premix provide per kg: Vit. A 1500 IU; Vit. D_3 3000 IU; Vit. E; 30 IU, Vit. K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4mg; Niacin 40mg; Vit. B_{12} 0.02mg; Panthonic acid 10mg; Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.014g; Se 0.24g; Co 0.240g.

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Table 2: Ingredient composition of broiler finisher diets (5-8 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Ingredients	Diets				
	T_1 (0.1 %)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)
White Sorghum	53.09	52.97	52.82	52.70	52.56
Soya bean	22.61	22.63	22.68	22.70	22.74
Wheat offal	12	12	12	12	12
Methionine	0.1	0.2	0.3	0.4	0.5
Fish meal	5	5	5	5	5
Palm oil	3	3	3	3	3
Bone meal	2	2	2	2	2
Lime stone	1.5	1.5	1.5	1.5	1.5
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Calculate Analysis					
Crude protein	20.53	20.53	20.53	20.53	20.53
ME/kcal/kg	2989.12	2985.78	2982.38	2979.04	2975.66
Crude fibre (%)	3.05	3.05	3.05	3.05	3.05
Calcium (%)	1.62	1.62	1.62	1.62	1.62
Phosphorus (%)	0.78	0.76	0.76	0.76	0.76
Lysine (%)	1.09	1.09	1.09	1.09	1.09
Methionine (%)	0.51	0.51	0.51	0.51	0.51

* Vitamin-mineral premix provide per kg: Vit. A 1500 IU; Vit. D_3 3000 IU; Vit. E; 30 IU, Vit. K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4mg; Niacin 40mg; Vit. B_{12} 0.02mg; Panthonic acid 10mg; Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.014g; Se 0.24g; Co 0.240g.

Table 3: Proximate composition of broiler starter diets (1-4 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Nutrients	Diets				
	T_1 (0.1%)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)
Dry matter	94.20	95.50	95.20	95.40	94.80
Moisture content	5.80	4.50	4.80	4.60	5.20
Crude protein	21.66	20.99	21.95	20.20	23.95
Crude fibre	4.90	4.50	4.10	4.40	3.90
Ash	9.20	14.20	9.90	16.20	12.50
Ether extract	9.40	9.31	9.48	9.13	9.26
Nitrogen	49.04	46.50	49.77	45.45	45.19
ME (kcal/kg)	3303.74	3181.49	3346.87	3101.12	3240.46

NFE - Nitrogen Free Extract
ME - Metabolizable Energy
ME (kcal/kg) - 37 x % CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)

Table 4: Proximate composition of broiler finisher diets (5-8 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Nutrients	Diets				
	T_1 (0.1%)	T_2 (0.2%)	T_3 (0.3 %)	T_4 (0.4%)	T_5 (0.5 %)
Dry matter	93.80	95.00	94.60	93.80	91.70
Moisture content	6.20	5.00	5.40	6.20	8.30
Crude protein	19.95	18.85	19.20	18.40	19.60
Crude fibre	5.70	5.40	4.80	5.80	6.40
Ash	11.10	9.90	10.50	10.30	8.80
Ether extract	9.20	9.90	9.30	9.00	9.35
Nitrogen free extract	47.85	51.95	50.80	50.30	47.55
ME (kcal/kg)	3182.03	3262.58	3267.10	3203.45	3197.58

NFE - Nitrogen Free Extract
ME - Metabolizable Energy

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Parameters	Diets					SEM
	T_1 (0.1 %)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)	
PCV (%)	28.13	28.41	28.88	29.00	29.21	2.10^{ns}
TWBC (x10^9/L)	9.13	7.60	8.13	10.33	8.93	1.32^{ns}
RBC (x10^{12}/L)	5.00	5.07	4.80	4.77	4.77	0.2^{ns}
Hb (g/dl)	10.00	10.10	9.70	9.57	9.57	0.47^{ns}
MCH (Pg)	20.00	19.93	20.20	20.07	20.07	0.09^{ns}
MCHC (%)	30.33	31.29	33.40	33.15	34.09	0.06^{ns}
MCV (fL)	60.03	59.87	60.40	60.13	60.13	0.19^{ns}
WBC Types						
Heterophil (%)	30.30	30.33	29.00	28.67	28.67	1.44^{ns}
Monocytes (%)	2.73	2.85	2.89	2.91	3.01	1.72^{ns}
Lymphocytes (%)	81.00	79.67	81.00	88.67	81.33	4.44^{ns}
Eosinophil (%)	1.95	2.30	2.31	2.33	2.35	4.40^{ns}
Neutrophil (%)	19.00	20.00	19.00	11.33	18.67	4.40^{ns}

ME (kcal/kg) - 37 x % CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)

Table 5: Haematological indices of broilers chickens fed white sorghum supplemented with graded levels of synthetic methionine (%) supplemented with graded levels of synthetic methionine (%)

Nb - Haemoglobin
NS - Not significant
PCV - Packed Cell Volume
RBC - Red Blood Cell
WBC - White Blood Cell
MCV - Mean Corpuscular Volume
MCHC - Mean Corpuscular Haemoglobin Concentration
MCH - Mean Corpuscular Haemoglobin

Table 6: Serum biochemical of broilers chicken fed white sorghum supplemented with graded levels of synthetic methionine

Parameter	Diets					SEM	P-VALUE
	T_1 (0.1 %)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)		
Protein (g/dl)	32.00^{c}	35.29^{a}	33.66^{b}	35.54^{a}	33.43^{b}	0.56*	0.553
Albumin (g/dl)	18.30^{b}	18.58^{b}	20.16^{a}	20.74^{a}	17.02^{c}	0.45*	0.323
Globulin (g/dl)	13.67^{c}	16.73^{a}	13.50^{c}	14.80^{b}	16.40^{a}	0.38*	0.186
Cholesterol (mg/dl)	3.52^{c}	4.16^{a}	3.98^{b}	3.43^{c}	3.69^{c}	0.09*	0.295
Glucose (mg/dl)	10.53^{a}	9.26^{a}	8.68^{bc}	7.14^{d}	8.06^{c}	0.35*	0.294
Urea (mg/dl)	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Creatine (mg/dl)	30.09^{b}	30.10^{a}	30.06^{c}	30.11^{a}	30.09^{b}	0.01*	0.285

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