PERFORMANCE EVALUATION AND COST BENEFITS OF BROILER CHICKENS FED WHITE SORGHUM SUPPLEMENTED WITH GRADED LEVELS OF SYNTHETIC METHIONINE.

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Abstrac: 56 days' experiment was carried out to study performance evaluation and cost benefits of broiler chickens fed white sorghum supplemented with graded levels of synthetic methionine. White sorghum was supplemented with synthetic methionione at 0.10, 0.20, 0.30, 0.40 and 0.50% for T_1, T_2, T_3, T_4 and T_5 respectively in a Completely Randomized Design. Three hundred (300) day-old unsexed broiler chickens were randomly assigned to 5 treatments of 60 birds and 3 replicates of 20 birds. The study was carried out in two phases; starter (1-4 weeks) and finisher (5-8 weeks). Results showed similar trends in both phases as Daily Feed Intake, All parameters measured were not significantly different. Daily feed intake and weight gain increased slightly with increased levels of synthetic methionine inclusion. There was also decreased in mortality rate with increased levels of methionine inclusion. Total feed cost (TFC/(₦)), total weight gain TWG/kg) and Feed cost (₦/kg gain) were better in T_1 (₦1,089.73, 1.9kg and ₦422.34) respectively. In conclusion, white sorghum can be supplemented with synthetic methionone upto 0.50% without any deleterious effect on performance with the best economic benefits in T_1.

Keywords: White sorghum, broiler chicken, synthetic methionine

Introduction:

The inadequate supply or availability of conventional feedstuffs have been a major impediment to poultry industry in Nigeria consequently affecting the protein intake of the citizenry that is grossly inadequate. The search for non-conventional feedstuffs which are more affordable and available in place of costly conventional feedstuffs has become the priority of animal nutritionists (Orayaga and Anugwa, 2014). The production of conventional protein and energy sources is still grossly inadequate in most developed countries of the world and often times the demand exceeds supply (*Odetola et al.,* 2014), leading to inadequate supplies, increase in price and most often importation of such products that subsequently impact on our foreign exchange and make it out of the reach of an average farmers. With increase human population all over the world, there is a stiff competition between man and livestock for the available feed resources, particularly those of energy and protein sources. As a result of that, feed producers and animal scientist are always searching for an alternative for a partially or whole replacement for conventional feedstuffs. Therefore, in order to reduce feed cost, which account for about 60 to 70% of production cost (*Nworgu et al.,* 1999), efforts are being geared towards evaluating an alternative feed ingredient. In this study, attention is on white sorghum as an alternative to conventional maize. Atteh and Ologbenla (1993) observed that such an alternative and emerging crops should not only have comparative nutritive value but should be cheaper than the conventional sources, and should be available in large quantities. One of such emerging crops is white sorghum (milo, guine corn). Conventionally, maize is the major energy source in poultry diets contributing upto 60% of complete poultry ratio in Nigeria (*Udedibie et al.,* 2004).

White Sorghum

Sorghum is the cultivation and commercial exploitation of species of grasses within the germs sorghum (bicolar). These plants are used for grain, fibre and fodder. The plants are cultivated in warm climates worldwide. It is native to tropical and sub tropical regions of Africa and Asia (WCSPF, 2016). Sorghum is fifth important staple cereal and was considered to be drought resistant crop (FAO, 2006; *Dlamini et al.,* 2007;). Sorghum grows in harsh environments where other crops do not grow well, just like other staple foods, such as cassava that are common in impoverished regions of the world. It is usually grown without other inputs by a multitude of small-holder farmers in many countries (WCSPF, 2016). Sorghum contains slightly lower energy but more protein than maize (ME3200kcal/kg. Protein 10%, sorghum protein is deficient in lysine and methionine and arginine (*Sally et al.,* 2016) hence the supplementation of methionine. It was also reported that light coloured (white) sorghum varieties can be used as principal energy source. It has been utilized as porridge, beer, unleavened bread, couscous, composite blend and ethric beverages (*Taylor et al.,* 2006). Sorghum is a principle source of energy, protein, minerals including trace component like zinc and iron in diet for African and Indian population (FAO, 2006; Mohammed *t al.,* 2011). Besides these nutrients, sorghum also contains high amount of phenolic acid, flavonoid, antioxidant and tannin (Awika and Rooney, 2004; Serna – Saldirer and Rooney, 1995). Although, sorghum is considered as food with low nutritional value (Raihanatu *et al.,* 2011). Poor digestibility of sorghum and limited product diversification compared to other cereals limits the use of sorghum (Mella, 2011). It has been established also that sorghum contains antinutritional factors like tannin, cyanogenic glucosside, phytic acid, teypsin inhibitor and oxalate (*Mohammed et al.,* 2011; *Etuk et al.,* 2012;). Due to these and other reasons, sorghum is categorized as low nutritional value food and, poor low protein digestibility and mineral absorption are also associated with the presence of antinutritional factors (*Scalbert et al.,* 1999; *Mohammed et al.,* 2011). Various researchers have revealed that the processing condition decreased antinutirtional factors and increased the bio-availability of other nutrients in cereal legumes (Adegunwa, 2012; *Adebowale et al.,* 2012). Hence, the need for synthetic methionine supplementation in this study.

Materials and Methods

The study was conducted at the Poultry Unit of Teaching and Practical Farm of Taraba State College of Agriculture, Jalingo. Taraba State is in the North-East geo-political zone of Nigeria. It lies between latitude 8" 53" North and between longitudes 11" 23" East of the equator in the savannah zone of Northern Nigeria (TRSD, 2008). There are two main seasons existing in the area of study. It has an annual rainfall of between 1000 – 1500mm with temperature range from 30^0 – 42^0 (depending on the season) (TRSD, 2008). The state is characterized by tropical climate marked by dry and rainy/wet seasons. The rainy season usually commences in the month of March and ends in October, while the dry season starts in late October and ends in March (TRSD, 2008).

Sourcing and Processing Experimental Feed Ingredients

White sorghum, bone meal, fish meal, premix, salt, lysine, wheat offal and limestone were all sourced locally from Jalingo main market, while soyabean cake was purchased at Afcot Industry, Ngurore, Adamawa state. The sorghum was coarsely / grounded to the normal feed size.

Experimental Birds and Management

Three hundred (300) unsexed, day old Anak white broiler chicks were used for the experiment. Brooding was done for the first one week (7 days), thereafter, birds were randomly allotted to five experimental diets of 60 birds with 3 replicates of 20 birds each. A completely randomized design (CRD) was used. Experimental diets and clean water were served *ad-libitum* with necessary vaccination and management practices also carried out throughout the experiment.

Experimental Diets and Design

Five isonitrogenous, isocalric experimental diets for both starter and finisher phases were formulated. White sorghum was supplemented with graded levels of synthetic methionine at 0.10, 0.20, 0.30, 0.40, and 0.50% for T_1, T_2, T_3, T_4 and T_5 respectively. Each phase lasted for 4 weeks. The ingredients composition of broiler starter and finisher diets are presented presenin Tables 1 and 2. So also, the proximate composition of starter and ted finisher diets were as presented in Tables 3 and 4.

Data Collection

Data on feed intake, weight gain**,** mortalities and feed to gain ratio were collected, evaluated and calculated according to the procedures of Scott *et al*. (1969) and Ojewola and Longe (2000). Economics of production of the broiler chickens produced were also evaluated. All the data obtained were subjected to Analysis of Variance (ANOVA) in a Completely Randamized Design (CRD). Differences observed among the means were separated using Duncan's Multiple Range Test (Duncan, 1995 and Steel and Torrie, 1980).

Results and Discussion

The proximate analysis of the diets containing white sorghum supplemented with graded levels of synthetic methionine are as shown in Tables 3 – 4. The crude protein (CP) and energy content of the various diets met the standards for straight line diets for broiler production as recommended by Akinmutimi (2011). The growth performance of broiler chickens fed white sorghum supplemented with graded levels of synthetic methionine after 8 weeks is shown in Table 5. There was no significant difference in all parameters considered in the starter phase except for initial body weight and daily weight gain (DWG), same as in the finisher phase. There was progressive increase in daily weight gain (DWG) with increased inclusion of methionine. Most of the parameters evaluated were influenced by the dietary treatments except daily weight gain (DWG) in both starter and finisher phases. The positive influence of diets with respect to daily feed intake (DFI), DWG and Feed Conversion Ratio (FCR) is consistent with the report of (Kawu, 2019; *Rostago et al.*, 1995 and *Rama Rao et al.,* 2022) that millet gives equal or better performance than maize when fed to broiler chickens. The DFI values in the finisher was highest in T_2 (121.98g), followed by T_5 (107.02g) and the least in T_1 (103.24g). The DFI values of 103.24 – 121.98g in the finisher phase are in the range of 111.90 – 335.34g/bird and 85 – 115g as reported by Wiki-Vet 2012). The high value of DFI in all treatments may be attributed to the presence of methionine which enhances feed intake in birds as reported by Summer et al. (1991) in their experiment in which broiler chickens were fed varying dietary energy and protein levels. This result agrees with the postulation of Summer *et al*. (1992) that the level and balance of essential amino acid (EAAS) also significantly affect feed intake consequently weight gain and carcass composition. Baker and Han,1994 have also confirmed that careful and moderate supplemental levels of methionine in corn-soyabean diets have so much beneficial effects which include feed consumption that is mainly controlled by dietary energy. The FCR ranged values of 2.35 – 2.89 in the finisher, the best FCR (2.61) is in T_3 which agrees with 1.98 – 2.59 recorded by Younis (2014) and it also fall within the values of 1.95 – 2.50 reported by Parkhaust and Montney (1997). The mortality of 6.75% is higher than 5% recommended by Oluyemi and Roberts (2000). The highest mortality was recorded in T_1 (7 birds), followed by T_2 and T_3 (5 birds) and the least in T_5 (1 bird). As can be observed, there were decreased in mortality with increased inclusion of methionine. This confirms the report of Bunchasak (2008) that adding methionine to a low protein diets reduced the mortality rate of hen under heat stress. The high mortality rate can be attributed to heat stress as the experiment was carried out at the peak of heat period (March – April). The economics of feeding white sorghum supplemented with graded levels of methionine to broiler chickens is presented in Table 6. Feed cost (FC) and Total Feed Cost (TFC) for fininisher phase was lower in T_1 (N221.12/kg and N1,089.73/kg respectively, resulting in 1.91kg of total weight gain. The feed cost (N/kg gain) for finisher was also best in T_1 (422.34 N1kg gain). The feed cost (FC) as can be observed increased slightly from T_1 (221.12) – T_5 (238.43 N1kg). TFC also increased from T_1 (N1089.75 T_5 1231.28). This can be attributed to the fact that, increased in methionine inclusion will automatically increased the cost of those items since the same ingredient were used throughout.

Conclusion and Recommendation

Based on the results obtained, white sorghum holds a great promise as a replacement of maize in broiler productions when supplemented with synthetic methionine. It can be supplemented upto 0.50% without any deleterious effect but the best result is in T_5 (0.5%). Therefore, white sorghum is highly trcommended for broiler production where it is highly available and cheaper than conventional maize.

Table 1: Ingredients Composition of Broiler Starter Diets (1-4 Weeks)

Ingredient	T1 (0.1%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)	T5 (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	9.00	9.00	9.00	9.00	9.00
Methionine	0.10	0.20	0.30	0.40	0.50
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.50	1.50	1.50	1.50	1.50
Palm oil	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
Crude Protein	23.7	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
Phosphorous (%)	0.80	0.72	0.72	0.71	0.72
Lysine (%)	1.33	1.33	1.33	1.33	1.33
Metionine (%)	0.52	0.56	0.59	0.60	0.65

*Vitamin-mineral premix provided 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 40 mg; Vit. B_{12} 0.02mg; Pantothenic acid 10mg;Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.0014g; Se 0.24g; Co 0.240g

Table 2: Ingredients Composition of Broiler Finisher Diets (5-8 Weeks) Diets

Ingredient	T1 (0.1%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)	T5 (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	12.00	12.00	12.00	12.00	12.00
Methionine	0.10	0.20	0.30	0.40	0.50
Fish meal	5.0	5.00	5.00	5.00	5.00
Palm oil	3.00	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.500	1.50	1.50	1.50	1.50
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**
Calculated 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
Phosphorous (%)	0.78	0.76	0.76	0.76	0.76
Lysine (%)	1.09	1.09	1.09	1.09	1.09
Metionine (%)	0.51	0.53	0.56	0.58	0.61

*Vitamin-mineral premix provided 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 40 mg; Vit. B_{12} 0.02mg; Pantothenic acid 10mg;Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.0014g; Se 0.24g; Co 0.240g.

Table 3: Proximate composition (%) of Broiler Starter Diets (1-4 weeks) Diets

Nutrients	T1 (0.1%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)	T5 (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
NFE	49.04	46.50	49.77	45.47	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 Diet (5-8 Weeks)

Nutrients	T1 (0.1%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)	T5 (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	8.90	9.30	9.00	9.35
NFE	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
ME(kcal/kg) = 37 x % CP + 81 x % EE + 35.5 x % NFE (Pauzenga, 1985).

Table 5. Performance of Broiler Chickens fed White Sorghum Supplemented with Graded Levels of Synthetic Methionine in Experiment 3

Parametres (%)	DIETS T1 (0.1%)	T2 (0.2%)	T3 (0.3%)	T4 (0.4%)	T5 (0.5%)	SEM
Starter Phase (1 – 4 Weeks)						
Initial weight (kg)	92.33	92.17	92.17	90.67	92.83	1.10^{ns}
Weight gain (g/bird)	477.67	511.25	523.89	536.55	543.17	1.73^{ns}
Feed intake (g)	1327.55	1349.99	1369.17	1403.88	1464.79	2.10^{ns}
Daily feed intake (g)	47.40	48.21	48.90	50.14	52.31	0.07^{ns}
Daily weight gain (g)	17.06	18.26	18.71	19.16	19.39	0.99^{ns}
Feed conv. Ratio	2.78	2.64	2.61	2.62	2.79	0.01^{ns}
Mortality (No)	4	2	3	1	0	
Finisher Phase (5 – 8 Weeks)						
Initial weight (kg)	92.33	92.17	92.17	90.67	92.83	1.10^{ns}
Final weight gain (g/bird)	1760.00	1785.00	1810.00	1850.00	1911.67	2.42^{ns}
Daily weight gain (g)	62.86	63.75	64.64	66.07	68.29	2.58^{ns}
Feed intake (g/bird)	2890.60	3415.40	2945.60	2970.00	2996.70	2.71^{ns}
Daily feed intake (g)	103.24	121.98	105.20	106.07	107.02	0.06^{ns}
Feed conv. Ratio	2.43	2.89	2.47	2.43	2.35	
Mortality	3	3	2			
Pooled (1 – 8 Weeks)						
Initial weight (kg)	92.33	92.17	92.17	90.67	92.83	1.10^{ns}
Final Weight	1760.00	1785.00	1810.00	1859.00	1911.67	2.42^{ns}
Total weight gain (g/bird)	1667.67	1692.83	1717.83	1759.33	1818.84	2.68^{ns}
Daily feed intake (g)	75.32	85.09	77.05	78.11	79.67	1.28^{ns}
Daily weight gain (g)	29.78	30.23	30.68	31.2	32.48	1.69^{ns}
Feed conv. Ratio	2.53	2.81	2.51	2.49	2.45	0.05^{ns}
Mortality	7	5	5	2	1	

a,b,c = Means with different superscripts on the same row are significantly different
* = Significant (P<0.05)
NS = Not significant (P>0.05)
SEM = Standard Error of Means

Table 6: Financial Benefits of Using White Sorghum Supplemented with Methionine for Broiler Chickens Production

	DIETS				
Parametres	**T1 (0.1%)**	**T2 (0.2%)**	**T3 (0.3%)**	**T4 (0.4%)**	**T5 (0.5%)**
TFI (kg)	5.17	5.08	5.22	5.22	5.25
FC (N/kg)	221.12	223.10	228.26	230.89	238.89
TFC (N)	1, 089.73	1100.88	1162.34	1193.29	1231.28
TWG (kg)	1.91	1.82	1.72	1.86	1.70
FC (N/kg gain)	422.34	426.12	435.98	440.99	464.94

TFI= Total feed intake
FC=Feed cost
TFC= Total feed cost
TWG= Total weight gain

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