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NUTRITIVE VALUE OF MALTED SORGHUM SPROUT IN BROILER CHICKEN DIETS

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ABSTRACT

A study was carried out to determine the nutritive value of Malted Sorghum Sprouts (MSS) in broiler chickens at Starter and Finisher phases. The first trial was conducted to determine the effect of graded levels of MSS inisocaloric-isonitrogenous diets on performance. A total of Two hundred and seventy (270) birds were used for both the starter and finisher phases. There were five (5) dietary treatments, replicated three times with eighteen birds per pen and a total of fifty four birds per treatment in a Completely Randomized Design. Five (5) isocaloric-isonitrogenous experimental diets were formulated to contain MSS at 0, 5, 10, 15 and 20% to compliment other energy components in the diets. The experiment lasted for eight (8) weeks. Data analysis of Starter phase revealed that dietary treatments had significant ($P<0.05$) effect on feed intake, body weight gain, feed conversion ratio, feed cost/kg gain. Feed intake was significantly ($P<0.05$) the lowest for birds fed diet 5(49.62g), while those on diet 2 had the highest significant values(62.81g). Body weight gain significantly ($P<0.05$) decreased as the percent MSS increased in the diets (616- 1130g). Feed conversion and cost/kg gain significantly ($P<0.05$) favoured birds on diet 2 with (1.71 and ₦135.79) compared to those on diets 1, 3, 4 and 5 respectively. Feed intake of finisher phase was significantly the highest in Treatment 1(140.81g) and least in Trt5 (105.75g). Treatment l was numerically the highest in final weight (2331g). Treatment 5 recorded the lowest final weight as daily weight gains was least for this treatment (1888g). Treatment 1 had the highest Feed Conversion Ratio (3.74) and cost/kg gain (₦286.79). This study showed that birds in Treatment 2 gave the best result at the Starter phase and Treatment 2 for the finisher phase. It is therefore recommended, that MSS can be included in the diet of broilers at 5% level for good performance, reduced feed cost and better feed conversion ratio.

Key words: Malted Sorghum Sprouts, Isocaloric-isonitrogenous.

INTRODUCTION

The poultry industry has suffered more than any other livestock industry as a result of inadequate supply and high cost of feed (Lepleaideur, 2004). Cereal grains constitute the major sources of energy in poultry diets in the tropics (Subramanian and Metta, 2000). However, maize has remained the chief energy source in compounded diets and constitutes about 50% of poultry ration (Ajaja *et al*., 2002). Pressure on maize, wheat and recently cassava has been on the increase worldwide with emphasis being placed on export and other diversified uses mostly in flour based foods and ethanol production as an alternative source of fuel (Doki, 2007). According to Etuk (2008), these trends require serious diversification of energy and protein feedstuffs for poultry. The fact that feed alone accounts for 70 – 80% of the recurrent production input in intensive monogastric animal production makes the utilization of multiple feed ingredients

expedient (Maunder, 2002). Field observations in Nigeria revealed the inclusion of sorghum and possibly wheat in poultry and rabbit diets (Etuk, 2008) as alternatives.

Sorghum bicolor (L) Moench is widely grown in the semi-arid and arid savannah regions of Nigeria. Maunder (2002) reported that sorghum is a traditional crop in Africa and Asia and an introduced or hybridized crop in the western hemisphere. Sorghum is the world's fifth most important cereal and is grown in semi-arid regions of Africa being well adapted to the harsh climate and naturally resistant to many pests (Belton *et al*., 2003).

Sorghum has the ability to tolerate drought, soil toxicities and temperature extremes effectively than other cereals. In terms of the nutritive value, cost and availability, sorghum grain is the next alternative to maize in poultry feed (Tacon, 1995). Several varieties of sorghum have been developed and introduced in Nigeria (IARMS, 1999). However, the diversity of chemical composition and anti-nutritional factors, mainly tannin resulting in variability in digestibility from 35 – 60% or more have been reported (Becker, 1992). Varieties of sorghum, climatic and soil conditions, fertilizer types are listed among the factors responsible for the variations in chemical composition of sorghum (Etuk, 2008). The usefulness of sorghum by-products has been reported world-wide (Odunsi *et al*., 2007). Some varieties of sorghum have phenols concentrated in the outer layers of the kernel which serves as natural source of antioxidants for foods (Awika *et al*, 2001). Taylor and da Silva (2004) reported sorghum bran could be a source of protein for industrial application. Apart from serving as a staple food in Nigeria, sorghum grain is used for the production of beverages.

Malting of sorghum, like barley, involves steeping or soaking, germination, drying and curing in

Kiln and polishing. The resultant malt extract is a useful input in breweries and food processing companies where it is utilized for the manufacture of malt drinks, syrups, beverages, baby foods,

microbiological media and other useful products. Malted sorghum sprout (MSP) is a by-product of sorghum malting. The separated roots and shoots which are left after malt extraction from the young germinating sorghum seedlings are collectively called sorghum sprout (Aletor *et al*., 1998). Malted sorghum sprout has a lot of prospect as a feed stuff of the livestock industry. It is rich in organic nitrogen (Ikediobi, 1989). Sorghum sprout is reported to contain a considerable number of amino acids with low level of methionine, lysine and threonine (Aning *et al*., 1998).

MATERIALS AND METHODS

Experimental site

This study was carried out at the Poultry Unit, Department of Animal Science Teaching and Research Farm, Faculty of Agriculture, Ahmadu Bello University, Zaria. Zaria is located on latitude 11˚11' N and longitude 07˚38' E having an altitude of 686m above sea level. The maximum temperature ranges between 26˚C to 35˚C depending on season, while the mean relative humidity during the wet and dry (harmattan) seasons are 72% and 21% respectively (Ovimaps, 2015). The area has an annual rainfall of 1080mm as reported by IARMS (2016).

Experimental birds

A total of 5-week old 240 birds of Hubbard flex® breed from Zarm farm, Ilemona, Kwara State a Commercial hatchery were used for this experiment. They were grouped into five on the basis of equal weight and were randomly assigned to 5 dietary treatments. There were 48 birds per dietary treatment with three replicates consisting of 16 birds per replicate, raised on deep litter. Feed and water were provided *ad libitum*. The experiment was conducted during the cool season between October and January,

2013. The maximum temperatures varied between 14°C - 24°C.

Experimental diets

Fiveisocaloric and isonitrogenous Broiler Starter and Finisher diets were formulated, to contain 0, 5, 10, 15 and 20% Malted sorghum sprouts, respectively as shown in Tables 1 and 2. The formulated diets met the requirements for energy, Protein, Calcium, Phosphorus and lysine. Diet 1 was formulated to serve as a control without Malted sorghum sprouts and fed to the birds at the Starter and Finisher phases.

Parameters measured

At the beginning of the experiment, the birds were randomly allotted to five dietary treatments on the basis of equal weights and subsequently weighed weekly. Weights obtained were subtracted from the initial weighs to get the weekly weight gain. The cumulative weight gain and feed consumption were computed and used to calculate the feed efficiency and feed cost per kilogram weight gain. Mortality rates were also recorded.

Carcass analysis

At the end of the finisher phase, three birds per replicate with weights closest to the mean were selected and used for the carcass analysis study. The birds were slaughtered after being kept off-feed for about sixteen (16) hours. The birds were weighed, slaughtered, bled, de-feathered and eviscerated. Weight of the conventional cut up parts, as well the giblets and the abdominal fats were taken and each expressed as a percentage of the live weight.

Statistical analysis

Data obtained in the course of experimentation were subjected to the Analysis of Variance (ANOVA) using the General Linear Model (GLM) Procedure (SAS, 2002). Significant differences among treatment means were separated using Duncan's Multiple Range Test. Model of experiment is as shown below;

$Y_{ij} = \mu + K_i + e_{ij}$

Y_{ij} = Observation of the i^{th} level of malted sorghum sprouts as shown by broilers performance

μ = Overall mean

$k_i = i^{th}$ effect of Malted Sorghum sprouts

e_{ij} = Random error

RESULTS

The performance of broiler chicks fed varying levels of malted sorghum sprouts (MSS) at the Starter phase in Table 3 showed that there was a corresponding decrease in feed intake and weight gain as levels of MSS increased in the diets. Five percent (5%) level of MSS had significantly ($P<0.05$) higher final weight (1130g) above those fed higher levels of MSS, but there was no significant difference from the control. This trend was also observed in the values for feed conversion ratio as there was no significant difference ($P>0.05$) between the control (1.71) and 5% (1.71) level of MSS inclusion but significantly different from others. These values contradicted earlier reports by Akinola *et al*. (2002) who reported no significant decrease in weight gain, feed intake and feed conversion ratio as levels of MSS increased in broiler diets. Similarly, Fafiolu *et al*. (2006) reported an increase in weight gain as levels of MSS were increased in layer hen diets, results showed that number of egg produced varied significantly ($P<0.05$) across the dietary treatments. The mean values of 0.82, 0.61 and 0.41 were recorded for birds fed 0,150 and 300 g/kg MSS respectively. The sharp reduction recorded for consumption of MSS diets may be due to the presence of certain anti-nutritional factors in the feed material. MSS is known to contain dhurrin a glucoside which on hydrolysis yielded equal quantity of HCN (Ikediobi, 1989). Tannin an ANF was also known to be present in MSS (Aning *et al*., 1998; Oduguwa *et al*., 2001). As MSS increased there was a corresponding decrease in the cost per Kilogram of feed but a significant ($P<0.05$) increase in

cost per Kilogram gain in weight of birds, which was also reported by Akinola *et al*. (2002). This could be due to the poor taste and a greater proportion of the feed is required by the birds.

The performance of broilers fed varying levels of Malted Sorghum sprouts at the finisher phase in Table 4 showed that birds fed 5% level of MSS had significantly ($P<0.05$) higher final weight (2179g) than those fed 10, 15 and 20% levels of MSS but did not differ from the control at the finisher phase. This trend was also observed in the values for feed conversion ratio as there was no significant difference ($p<0.05$) between the control (1.71) and 5% (1.71) level of MSS inclusion but significantly differed from others. These values contradicts the earlier reports by Akinola *et al*. (2002), who reported no significant decrease in weight gain, feed intake and feed conversion ratio as levels of MSS increased in broiler diets. Fafiolu *et al*. (2006) on the other hand reported an increase in weight gain from 1644.9 – 1702g as levels of MSS were increased from 0- 300g/Kgin layer hen diets. Number of eggs produced per hen day varied significantly ($P<0.05$) across the dietary treatments decreasing from 0.83- 0.42.

Table 1: Composition of Starter Diet Containing Malted Sorghum Sprouts

	Dietary Levels of MSS %				
Feed Ingredients (kg)	**0%**	**5%**	**10%**	**15%**	**20%**
Maize	54.40	50.90	47.40	43.40	40.40
Malted sorghum sprout	0.00	5.00	10.00	15.00	20.00
Groundnut cake	21.00	19.50	18.00	17.00	15.00
Soyabean cake	20.00	20.00	20.00	20.00	20.00
Limestone	0.50	0.50	0.50	0.50	0.50
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Premix*	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
Metabolisable Energy (kcal/kg)	2859	2858	2857	2851	2856
Crude protein (%)	23.23	23.21	23.20	23.35	23.17
Crude fibre (%)	4.12	4.55	4.98	5.43	5.84
Ether extract (%)	4.67	4.50	4.33	4.17	3.99
Calcium (%)	1.05	1.05	1.06	1.07	1.07
Avail Phos (%)	0.52	0.53	0.54	0.55	0.57
Meth + Cys (%)	0.87	0.89	0.91	0.94	0.95
Lysine (%)	1.32	1.33	1.34	1.36	1.37
Cost/kg of diet (₦/kg)	82.28	79.41	76.53	73.78	70.78

*Biomix premix supplied per kg of diet: Vit. A,10000IU; Vit D_3 2000iu; Vit E 23mg; Vit K 2mg; calcium pantothenate 2.5mg; Vit B_{12},0.051mg; Folic acid 0.75mg; Chloride 300mg; Vit B_1 1.8mg; VitB_2 5mg; manganese 40mg; iron 20mg; zinc 30mg; copper 3mg; iodine 1mg; cobalt 0.2mg.

Table 2: Composition of Broiler finisher diet containing Malted Sorghum Sprouts

	Dietary levels of MSS,%				
Feed Ingredients (kg)	**0%**	**5%**	**10%**	**15%**	**20%**
Maize	60.40	56.90	53.40	49.40	46.40
Malted sorghum sprout	0.00	5.00	10.00	15.00	20.00
Groundnut cake	15.00	13.50	12.00	11.00	9.00
Soyabean cake	20.00	20.00	20.00	20.00	20.00
Limestone	0.50	0.50	0.50	0.50	0.50
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Premix*	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated analysis					
ME (kcal/kg)	2922	2921	2920	2914	2918
Crude protein (%)	21.19	21.17	21.16	21.31	21.13
Crude fibre (%)	3.89	4.32	4.75	5.20	5.62
Ether extract (%)	4.54	4.37	4.20	4.04	3.86
Calcium (%)	1.04	1.04	1.05	1.06	1.06
Phosphorus (%)	0.51	0.52	0.54	0.55	0.56
Meth + Cys (%)	0.82	0.84	0.86	0.89	0.90
Lysine (%)	1.23	1.25	1.26	1.28	1.29
Cost/kg of diet (₦/kg)	80.78	77.91	75.03	72.28	69.28

*Biomix premix supplied per kg of diet: Vit. A,10000iu; Vit D_3 2000iu; Vit E 23mg; Vit K 2mg; calcium pantothenate 2.5mg; Vit B_{12},0.051mg; Folic acid 0.75mg; Chloride 300mg; Vit B_1 1.8mg; VitB_2 5mg; manganese 40mg; iron 20mg; zinc 30mg; copper 3mg; iodine 1mg; cobalt 0.2m

Table 3: Effect of graded levels of Malted Sorghum sprouts on the performance of Broiler starter chickens

	Graded Levels of Malted Sorghum sprouts (%)					
Parameter	**0**	**5**	**10**	**15**	**20**	**SEM**
Initial weight (g)	100	100	100	100	100	0.00
Final weight (g)	1102[a]	1130[a]	1016[b]	819[c]	616[d]	36.21
Feed intake (g/bird/day)	61.08[a]	62.81[a]	59.59[a]	52.94[b]	49.62[b]	1.93
Daily weight gain(g/bird/day)	35.78[a]	36.77[a]	32.71[b]	25.69[c]	18.44[d]	1.29
Feed conversion ratio	1.71[a]	1.71[a]	1.82[b]	2.06[b]	2.76[c]	0.142
Feed cost/kg	82.28[e]	79.41[d]	76.53[c]	3.78[b]	70.78[a]	0.00
Feed cost/kg gain (~~N~~)	140.69[c]	135.79[a]	139.28[b]	151.99[d]	95.35[e]	0.00
Mortality (%)	0.33[a]	0.00[b]	0.00[b]	0.00[b]	0.00[b]	0.00

a, b, c = Means in the same row having different superscript are significantly different (P<0.05).
SEM = Standard error of means

Table 4: Effect of graded levels of Malted Sorghum sprouts on the performance of finisher Broiler chickens

	Graded Levels of Malted Sorghum sprouts (%)					
Parameter	**0**	**5**	**10**	**15**	**20**	**SEM**
Initial weight (g)	1265	1267	1265	1266	1264	0.00
Final weight (g)	2331[a]	2179[b]	1990[c]	1986[d]	1888[e]	1.48
Feed intake (g/bird/day)	140.81[a]	140.69[a]	124.39[b]	109.13[c]	105.75[d]	1.54
Daily weight gain(g/bird/day)	38.09[a]	32.58[b]	25.89[c]	25.72[c]	22.30[c]	2.50
Feed conversion ratio	3.74[a]	4.38[b]	4.86[b]	4.28[b]	4.95[b]	0.45
Feed cost/kg gain (~~N~~)	286.79	323.36	344.98	291.30	322.70	30.58
Mortality (%)	0.00	0.00	0.00	0.00	0.00	0.00

MSS = Malted sorghum sprouts
a, b, c = Means in the same row having different superscript are significantly different (P<0.05).
SEM = Standard error of means

CONCLUSIONS

It was concluded from this study that MSS can be included in broiler diets at Starter and Finisher phases but not beyond 5% level of inclusion in order not to affect performance of birds. There are cost benefits as to justify the inclusion of MSS in broiler diet as regards cost of feed. The proximate analysis of Malted Sorghum Sprouts showed that it has a very high potential as a feed resource having very high energy content although it contains some anti-nutritional factors such as *Tannin, Phytic acid* and *Hydrogen cyanide* which may be metabolized by Broiler birds.

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