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Replacement Value of Dusa (Locally Processed Maize Offal) for Maize in the Diets of Pullets and Subsequent Early Laying Characteristics

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Abstract: An experiment was conducted to study the replacement value of dusa (locally processed maize offal) for maize in the diets of pullets (9-20 weeks) and their subsequent early laying performance. Three hundred and seventy eight (378) eight weeks old egg type pullets of approximately equal weights were randomly allocated to seven dietary treatments with three replicates of 18 birds each. The seven dietary treatments composed of rations in which graded levels of dusa replaced maize up to 100% in diet seven. At the end of the experiment average feed consumption was significantly ($p<0.05$) lower for the control and it increased as the level of dusa increased in the diets. The final body weight of pullets was better for treatment four which contained equal proportion of maize and dusa in the diets. The cost (N*kg gain) was significantly ($p<0.05$) higher for the control diet and it decreased as the level of dusa increased in the diets. The subsequent performance of birds revealed that the weight of birds at first egg, 10% and at 50% egg production were better for treatment four. The weight of first egg and ages at first egg were better for the diets with higher level of maize. There were no significant differences ($p>0.05$) in ages at 10%, 50%, peak egg production, weight of eggs at peak production and cost (N*dozen egg) for all the treatments. There was a 39.03% savings in cost of production by using dusa in pullets diets.

Key words: Dusa, pullets, cost (N*kg gain), cost (N*dozen egg)

Introduction

While the consumption of animal products such as meat, egg and fish are a regular part of the meal of an American and European, a Nigerian is much more worried about satisfying hunger and so it is a common knowledge that the meals without any piece of meat are a regular diet for a large proportion of Nigerians (Dafwang, 2006). The food and Agriculture Organization (FAO, 1985) of the United Nations recommended a minimum of 56g of protein intake per person per day. Many Nigerians cannot meet this requirement due to cost of animal products (Fasuyi, 2005).

This high cost of animal products is traced to high cost of feed which accounts for about 70-80% of the total cost of production (Ogundipe, 1987; Kehinde *et al*., 2006). In Nigeria the most popularly incorporated cereal grain in feed formulation is maize where it supplies more than half of the Metabolizable Energy (ME) requirement of poultry (Ravindra and Ravindra, 1988; Durunna *et al*., 2000). However, the high cost of maize due to demand by humans for direct consumption contributes to the high cost of the conventional feed (Vantsawa, 2001; Agbede *et al*., 2002). As a result of this high cost, many poultry farms all over the country are folding up despite encouragement by the government.

For the poultry industry to be sustained, alternative and cheaper energy sources must be sort for. Scientists in the past have tried energy by-products to feed poultry and results obtained by such researchers were quite encouraging. For example, Cresswell and Zainuddin (1980) reported that maize bran can replace maize on a weight for weight basis in broiler diet without any compensation being made for the lower energy content of the bran. Fadugba (1989) showed that industrial maize offal is as good as maize in growers rations. Abound *et al*. (1990) fed maize cob-mix to broilers and found that there was no significant difference ($p>0.05$) in final body weight when compared with the control. Atteh *et al*. (1993) reported that Maize Mill Waste (MMW) could replace all the maize in the diets of pullets without adverse effect on the performance and early lay characteristics. However, Velasco *et al*. (1985) found that maize bran replacement for maize in the diets of 20 weeks old pullet gave a decreasing live weight as the inclusion level increased. They concluded that egg production and feed to gain ratio were best when 10% of the bran was included in the diet. Vantsawa *et al*. (2007) reported that dusa can replace all the maize in the diets of chicks without any adverse effect on performance.

This by-product has not been tried as replacement for maize in the diets of pullets. It is available all year round especially in the Northern part of the country where majority of households consume maize flour in form of "tuwo". Dusa production is directly proportional to maize

Table 1: Composition of Experimental Grower Mash

Ingredient/treatment	1	2	3	4	5	6	7
Maize	49.26	40.34	31.43	22.51	13.59	4.67	0.00
Dusa	0.00	10.00	20.00	30.00	40.00	50.00	55.23
GNC	24.49	23.41	22.32	21.24	20.16	19.08	18.52
PKC	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Rice Offal	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Blood meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Premix/TM*	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis							
ME Kcal/kg	2893	2821	2750	2678	2607	2536	2500
Crude Protein (CP)	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Crude Fibre (CF)	4.59	4.66	4.73	4.80	4.81	4.94	4.97
Phosphorus (%)	0.87	0.89	0.92	0.95	0.97	0.99	1.00
Calcium (%)	1.46	1.46	1.46	1.46	1.46	1.46	1.46
Lysine (%)	0.87	0.81	0.81	0.81	0.81	0.80	0.80
Methionine (%)	0.25	0.25	0.25	0.26	0.26	0.26	0.26
Methionine+cystine	0.65	0.61	0.62	0.63	0.64	0.64	0.65
Cost/kg feed (N)	24.22	22.94	21.73	20.50	19.26	18.02	17.37

*Biomix grower premix supplied the following per kg diet: - Vit. A, 10,000 i.u.; Vit D3, 2000i.u; Vit E, 23mg; Niacin 27.5mg, Vit B_1, 1.8mg; VitB_2, 5mg; Vit B_6, 3mg; Vit B_{12}, 0.015mg, Vit K, 2mg; Pantothenic acid, 7.5mg, Folic acid, 0.75mg; Choline choloride, 300mg; cobalt, 0.2 mg, copper, 3 mg; Iodine, 1mg, Iron, 20mg; Manganese, 40mg: Selenium, 0.2mg

Table 2: Composition of Common Layers Mash

Ingredient	%
Maize	20.00
Dusa	35.73
GNC	23.72
PKC	10.00
Limestone	7.00
Bone Meal	3.00
Salt	0.30
Premix/TM*	0.25
Total	100.00
Calculated analysis	
M.E. Kcal/kg	2492
Protein (%)	18.00
P%	0.68
Ca %	3.84
Methionine (5)	0.23
Lysine (%)	0.71
Cystine (%)	0.46
Methionine+Cystine	0.69
Cost/Kg Feed	21.85

•Biomix layer premix supplied the following per kg diet:- Vit. A, 10,000 i.u.; Vit. D3, 2000i.u; Vit. E, 23mg; Niacin 27.5mg, Vit. B1, 1.8mg; Vit. B2, 5mg; Vit. B6, 3mg; Vit. B12, 0.015mg, Vit. K, 2mg; Pantothentic acid, 7.5mg; Folic acid, 0.75mg; Choline chloride, 300mg; Cobalt, 0.2mg; Copper, 3mg; Iodine, 1mg, Iron, 20mg; Manganese, 40mg; Selenium, 0.2mg

consumption. To get the dusa maize grain is passed through a dehulling machine with a small amount of water added so as to soak the testa. The machine when on, revolves at a very high speed. The pistol rubs off the testa of the grain and thereafter the endosperm which is used for human consumption comes out in one direction while the testa, bran, germ and reasonable quantity of broken endosperm is ejected in the opposite direction. It is the testa, bran, germ and the reasonable quantity of endosperm that constitute dusa. It is about 25% of the total maize dehulled (Vantsawa, 2001). This study was therefore conducted to evaluate the replacement value of dusa for maize in the diets of growing pullets. (9-20 weeks) and its effect on subsequent early lay performance of birds.

Materials and Methods

Three hundred and seventy eight (378) eight weeks old birds of approximately equal weight were randomly allocated to seven dietary treatments with three replicates of 18 birds each. The seven dietary treatments composed of rations in which graded levels of dusa replaced maize up to 100% in diet seven. The birds were reared in an open-sided deep litter house screened with wire mesh. The growers mash was formulated as shown in Table 1.

Feed and water were given *ad-libitum* and Mortality was recorded as it occurs. Feed consumption and weight gain were recorded every two weeks. Vaccination and other management practices like debeaking were done on schedule. Cost (N*kg) Feed cost (N*kg gain) and cost (N*kg bird) were computed for the grower phase.

After the final weights of birds were taken at week 20, the birds were switched over to a common layers mash as shown in Table 2. Feed and water were provided *ad-libitum*. Record of mortality was taken as it occurs. Other records taken include body weight at first egg, body weight at 10%, 50%, peak egg production and cost per dozen eggs. All the data collected were subject to the analysis of variance using the general linear statistical model (SAS, 1990).

Trend analyses were done for average daily feed consumption, average weight gain, feed to gain ration, cost (N*kg gain) and cost (N*kg bird). Differences

Table 3: Effect of Graded levels of Dusa as a Replacement for Maize on the Performance of Grower (9-20 Weeks)

Levels of Dusa	0.00	10.00	20.00	30.00	40.00	50.00	60.22		
% Maize Replaced	0.00	16.60	33.22	49.86	66.47	83.07	100.00		
Parameters/Treatment	1	2	3	4	5	6	7	SEM	LQ
Avg total feed cons. (g)	5406.84^{e}	5481.20^{dc}	5558.82^{d}	5786.38^{c}	5831.47^{bc}	5960.74^{ab}	5997.22^{a}	46.13	*
Avg final wt of birds (g)	1389.67^{c}	1383.33^{c}	1382.00^{c}	1445.00^{a}	1424.00^{ab}	1411.00^{bc}	1415.00^{bc}	11.65	*
Average wt gain (g)	778.56^{b}	771.76^{b}	772.74^{b}	832.04^{a}	812.43^{ab}	801.00^{ab}	805.74^{ab}	12.62	*
Feed to gain ration	6.95^{a}	7.11^{a}	7.20^{ab}	6.94^{a}	7.18^{ab}	7.44^{b}	7.45^{b}	0.10	*
Cost (N/kg gain)	154.20^{a}	150.02^{a}	141.16^{b}	126.35^{c}	120.11^{d}	113.53^{e}	02.51^{f}	2.04	*
Cost (N/ bird)	214.29^{a}	207.53^{a}	195.08^{b}	182.58^{c}	171.04^{d}	160.23^{e}	145.05^{f}	2.00	*

Means along the same row bearing the same superscript are not significantly difference (p>0.05); SEM = Standard error of the means; L,Q = Polynomial showing linear and quadratic relationship across the treatments

Table 4: Effect of Graded Levels of Dusa on Subsequent early laying Performance of Pullets 20-32 Weeks

Levels of Dusa	0.00	10.00	20.00	30.00	40.00	50.00	60.22		
% Maize Replaced	0.00	16.60	33.22	49.86	66.47	83.07	100.00		
Parameters	1	2	3	4	5	6	7	SEM	Q
Body wt at first egg (g)	1428.00^{bc}	1447.00^{abc}	1421.33^{c}	1487.67^{a}	1462.00^{abc}	1466.67^{ab}	1439.67^{bc}	12.66	*
Body wt at 10% Prod (g)	1565.00^{b}	1628.00^{ab}	1573.33^{b}	1685.00^{a}	1620.00^{a}	1641.00^{ab}	1596.33^{b}	24.65	*
Body wt at 50% prod (g)	1666.67^{c}	1693.33^{bc}	1660.00^{c}	1770.00^{a}	1740.00^{ab}	1750.00^{ab}	1676.67^{c}	19.88	*
Age at first egg (days)	147.33^{a}	162.00^{b}	160.00^{ab}	156.00^{ab}	154.33^{ab}	152.67^{ab}	158.00^{ab}	4.14	
Age at 10% prod (days)	159.00	162.00	164.67	164.33	161.00	155.67	158.00	3.28	
Age 50% prod (days)	1 77.33	175.67	176.00	174.33	174.00	171.00	1 75.0	1.91	
Age at peak prod (days)	211.00	215.33	222.33	209.67	196.33	203.00	221.33	9.22	
Weight of first egg (g)	40.83^{b}	50.00^{a}	48.87^{a}	46.70^{ab}	44.37^{ab}	47.53^{ab}	46.67^{ab}	2.89	
Weight of egg at peak (g)	60.78	61.02	59.90	61.87	61.49	61.74	61.46	0.78	
Feed Cost/dozen egg (N)	50.61	51.06	51.26	50.32	51.38	50.75	57.41	0.98	
%hen-day prod.20-32wks	77.06^{ab}	72.68^{b}	73.29^{b}	78.27^{ab}	78.68^{ab}	82.28^{a}	76.04^{ab}	2.28	
%hen-housed20-32wks	76.62^{ab}	72.68^{b}	71.82^{b}	76.04^{ab}	78.68^{ab}	82.26^{a}	76.04^{ab}	2.11	
% Mortality	5.56	0.00	5.56	5.56	0.00	0.00	0.00	0.79	

Means along the same raw bearing the same superscripts are not significantly different; SEM = Standard error of the means;
Q = polynomial showing quadratic relationship across the treatments

between treatment means were separated using Duncan's Multiple Range Test (Steel and Torrie, 1980).

Results

The results of the effect of graded levels of dusa as replacement for maize on the performance of pullets (9-20 weeks) and the subsequent early lay characteristics are presented in Table 3 and 4 respectively. Feed consumption increased linearly from control diet to diet seven (treatment in which all the maize was replaced with dusa). While highest final weight was recorded for birds in treatment four in which there was equal proportion of maize and dusa, the least gain was observed in birds on treatment two in which 10% dusa replaced about 16.6% maize in the diet. The best feed to gain ration was obtained for birds on treatment four. The poorest feed to gain ration was observed for the birds on treatment seven. There was no mortality during this phase of study. The cost (N*kg gain) and cost (N*kg bird) decreased significant ($p<0.05$) as the level of dusa increased in the diet.

The subsequent performance showed that weight of birds at first egg was better for treatment four. This was followed by treatment 6 in which dusa replaced maize at 83.07%. There was no significant ($p>0.05$) difference between treatment five and two and between seven and the control. The least weight was observed in birds on treatment three replacing 33.22% maize. Treatment four had a significantly ($p<0.05$) higher body weight at 10% and 50% egg production.

Treatment 5 and 6 had similar values and both had higher gain when compared to the control treatment. The birds on the control diet came to lay earlier than those on other treatment diets. There was no difference in age at first egg between treatments 3, 4, 6 and 7. Birds on treatment 2 however, had a delayed on set of lay. The weight of egg at peak production did not show any significant difference ($p>0.05$). Similarly no difference was observed in cost (N*dozen) egg. Percent hen day and percent hen-housed were better for treatment 6 and the least were in treatments 2 and 3. There was no significant difference ($p>0.05$) in the percent mortality.

Discussion

The increase in consumption as the level of dusa increased in the diet is in agreement with the work of Fadugba (1989) who observed that feed intake increased for all the industrial maize offal diets than the control. This is also in agreement with the work of Farrel and Johnson (1973) and Olomu (1984) where all reported that feed intake of chickens is inversely related to the dietary energy concentration. Since dusa is lower in energy than the maize (2784Kcal*kg versus 3432 Kcal*kg respectively), that explains why there was a higher feed consumption by birds in treatment seven than all other treatments. Sunde (1984) also observed that feed consumption decreased when the energy contents of the diets increased. The better feed to gain ratio observed for the control diet when compared with other treatments may be as explained by Duarak and

Bray (1978) who observed that when high fibre diets are fed to monogastric animals, there were reductions in digestibility and utilization resulting in poor feed conversion.

The fact that dusa is higher in fibre than maize explains why feed conversion became poorer as the level of dusa increased in the diets. However, despite the poor feed to gain ration observed in treatment 7, the overall advantage in terms of cost saving in using dusa was better than using maize in pullets diets. Dusa can therefore be used in the diets of pullets without any adverse effect on performance with a 39.03% saving in cost of production.

In the subsequent early lay characteristics, the significant difference ($p<0.05$) observed for body weight of pullets at first egg, at 10% and 50% egg production may indicate that dietary levels of dusa did not affect the performance of birds during the growing phase. Atteh *et al*. (1993) observed that Maize Mill Waste (MMW) could replace all the maize in the diet of pullet without any adverse effect on the performance and on early lay characteristics. This is however, contrary to the observation made by Velasco *et al*. (1985) where they reported that performance of laying birds were best at 10% maize bran inclusion in the diets of birds. The differences observed in the weight of first egg may be as a result of age of birds before first lay. The earlier the birds come to lay the smaller the size of the first egg laid. That was why the size of egg in the control was smaller than others. The non-significant difference in egg weight at peak egg production and the higher percent hen day and hen housed egg production for the treatments signifies that high level of dusa can sustain egg production without any significant effect on the performance of birds.

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