PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 6 (6): 530-533, 2007
ISSN 1680-5194

Replacement Value of Dusa (Locally Processed Maize Offal) for Maize in the Diets of Egg Type Chicks (0-8 Weeks)

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Abstract: A study was conducted to evaluate the replacement value of dusa (Locally processed maize offal) for maize in the diets of egg type chicks. The proximate analysis and the metabolizable energy of dusa were determined. Three hundred and seventy eight (378) day-old egg type chicks were randomly allocated to seven dietary treatments containing graded levels of dusa from control to treatment seven with three replicates of 18 birds each. Feed consumption, weight gain and mortality were recorded. The proximate analysis revealed that dusa is higher in crude protein than the maize grain (10.82% and 8.57% respectively). The metabolizable energy value was however lower than for maize grain (2784 kcal kg^{-1} versus 3432 Kcal kg^{-1} respectively). There was no significant difference (p>0.05) between treatment means for the average weight gain of birds. Feed consumption and feed to gain ratio increased as the level of dusa increased in the diets. There was no mortality throughout the study. The cost (N/kg weight gain) and feed cost (N/bird) were significantly higher (p<0.05) for the control and they decreased as the level of dusa increased in the diets. There were significant savings in cost of production in using dusa as a source of energy in chicks' diets. It was concluded that dusa could replace all the maize in the diets of egg type chicks without any adverse effect on the performance.

Key words: Dusa, egg type chicks, cost (N/Kg gain), cost (N/bird)

Introduction

The continuous increase in human population for many years has greatly influenced the demand for food of animal origin (Akunisu, 1999). This increase in population growth in the third world country like Nigeria has not been commensurate with agricultural growth especially for animal production. The world's livestock producers are having difficulties in meeting the demand for animal production and this disparity has led to serious malnutrition (Onimisi *et al*., 2006). The report of FAO (1993) revealed that an average Nigerian consumes 15g of animal protein per capita per day against and average of 54g per capita per day in Europe. It was reported years after that the number of under nourished people is still increasing world-wide by about five million each year with over whelming majority in the developing world (FAO, 2003). Unfortunately the egg which is a compact source of essential nutrients (Olomu, 1983) and which should have been an easier means of supplying the required nutrients is very expensive and it has gone beyond the reach of the average man.

This high cost of animal products can be traced to the high cost of feed which sometimes account for about 70% of the total cost of production (Ogundipe, 1987; Kehinde *et al*., 2006). This is a major obstacle to the expansion of poultry industry in Nigeria and by extension in most developing countries of Africa (Fasuyi, 2005).

In Nigeria the popular cereal grain for feed formulation is the maize grain. It supplies more than half of the M.E. requirements (Ravindra and Ravindra, 1988; Durunna *et al*., 2000). The high cost of maize is due to its high demand by human for direct consumption (Vantsawa, 2001; Agbede *et al*., 2002). If poultry industry must continue to survive in a developing country like Nigeria, alternative and cheaper energy sources must be sort for. Many researchers have tried energy-based by-products in poultry diets. For example Cresswell and Zainuddin (1980) reported that industrial maize bran could replace maize on weight for weight basis in broiler diets. Fadugba (1989) also showed that the industrial maize offal is as good as maize in chick rations. Atteh *et al*. (1993) reported that maize mill waste could replace all the maize in the diets of pullets without adverse effect on performance. Dafwang and Shwarmen (1996), showed that rice offal can be incorporated up to 10% in broiler rations without any adverse effect.

Dusa is one of the agro-industrial by-products that is available in large quantities all year round in the maize growing areas of Nigeria. It is obtained as the by-products from the dehulling of maize grain using a locally fabricated machines which produces the polished grain used for human consumption. The dusa contains the testa, aleurone layer, reasonable quantities

Table 1: Composition of 19% CP chick mash fed 0-8 weeks

Ingredient/treatment	1	2	3	4	5	6	7
Maize	49.26	40.34	31.43	22.51	13.59	4.67	0.00
Maize offal (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	2893.00	2821.00	2750.00	2678.00	2607.00	2536.00	2500.00
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
Methionine (%)	0.25	0.25	0.25	0.26	0.26	0.26	0.26
Lysine (%)	0.87	0.81	0.81	0.81	0.81	0.80	0.80
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 chick premix supplied the following per kg diet: -Vita, 10,000 i.u.; VitD_3, 2000i.u; VitE, 23mg; Niacin 27.5mg, VitB_1, 1.8mg; VitB_2, 5mg; VitB_6, 3mg; VitB_{12}, 0.015mg, VitK, 2mg; Pantothenic acid, 7.5mg, Folic acid, 0.75mg; Choline choloride, 300mg; cobalt, 0.2mg, copper, 3mg; Iodine, 1mg, Iron, 20mg; Manganese, 40mg: Selencim, 0.2mg

Table 2: Proximate analysis of lcoal maize offal

	%DM	%CP	%CF	%EE	%ASH	%NFE
Animal Sc. Lab.	87.76	11.00	4.45	4.80	4.12	78.66
NAPRI Lab	91.25	10.63	5.55	4.40	4.14	75.28
Average	89.51	10.82	5.00	4.60	4.13	76.98
Value of Maize*	92.05	8.57	2.19	3.65	1.67	83.92

*Nelson, 1984

Table 3: The energy contents of the basal and the substituted rations

Ration	GE Kcal kg^{-1}	AME Kcal kg^{-1}	AMEn Kcal kg^{-1}
Basal ration	4200	2780	2756.49
80% basal+20% dusa	4558	2780.86	2759.41
Dusa		2784.00	

GE = Gross Energy, AME = Apparent Metabolizable Energy, AME_n = Apparent Metabolizable Energy corrected for Nitrogen

of broken endosperm and most of the germ of the maize grain. Vantsawa (2001) showed that dusa could replace all the maize in broiler starter and finisher diets without any adverse effect on performance. Reports on experiments to determine the replacement value of dusa for maize in the diets of chicks are very rare. Hence the need for this study.

Materials and Methods

Samples of dusa were taken for proximate analysis at the Biochemistry Laboratory of the Animal Science Department and at the NAPRI Central Laboratory all in zaria, Nigeria. The samples were determined for their Dry Matter (DM), Crude Protein (CP) Crude Fibre (CF) Ether Extract (EE), Ash and NFE Compositions according to AOAC (1990) methods. The metabolizable energy of the dusa was also determined.

For the feeding trial, 378day-old egg type chicks were obtained from NAPRI farm and randomly allocated to seven dietary treatments with 3 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 as shown in Table 1. The rearing of the birds was done in an open sided wire screened deep litter house. The floor space for the birds was approximately 225×120cm^2. Kerosine stoves were used to provide additional heat during the brooding; while the open sides of the house were covered to conserve heat. Feed and water were provided ad-libitum. Vaccinations and other management practices were done according to the local schedule.

Records of feed consumption and weight gain were taken each week. Feed to gain ratio, feed cost (N/kg gain) and cost (N/bird) were calculated for each of the replicate group. All data were subjected to analysis of variance using the general linear model procedure of statistical analysis (SAS, 1990). Trend analysis was also done and differences between means were separated using Duncan Multiple Range Test (Steel and Torrie, 1980).

Results

The results of the proximate analysis as obtained from the two Laboratories are presented in Table 2. The

Table 4: Effect of graded level of dusa (locally processed maize offal) as replacement for maize on the performance of chicks (0-8 weeks)

Levels of Dusa	0.00	10.00	20.000	30.000	40.000	50.00	55.23		
% Maize Replaced	0.00	18.11	36.20	54.30	72.41	90.52	100.00		
Parameters/Treatment	1	2	3	4	5	6	7	SEM	L
Average feed consumption (g)	2112.33^{a}	2099.00^{a}	2139.00^{a}	2155.67^{ab}	2245.67^{ab}	2225.67^{b}	2239.00^{b}	56.48	*
Average final wt of birds (g)	611.11	611.11	609.26	612.96	611.57	610.33	609.26	3.93	NL
Average wt gain (g)	578.11	578.57	576.25	579.96	578.57	577.33	576.25	3.92	NL
Feed to gain ratio	3.65^{a}	3.62^{a}	3.71^{a}	3.72^{ab}	3.88^{a}	3.86^{b}	3.88^{b}	0.10	*
Feed Cost (N/kg gain)	84.00^{a}	78.46^{de}	78.59^{d}	76.59^{bc}	73.76^{bc}	67.92^{b}	66.45^{a}	1.62	*
Feed Cost (N/bird)	51.33^{a}	47.95^{de}	46.66^{d}	45.21^{c}	43.07^{bc}	41.45^{b}	40.49^{a}	1.81	*
% Mortality	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NL

Means along the same raw bearing the same superscript are not significantly different ($p>0.05$), SEM = Standard error of the means.
L = Polynomial showing linear relationship across the treatments, *Significant at 5%

average composition were as follows: DM 89.51%, CP 10.82%, CF 5%, EE 4.60%, ASH 4.13% and NFE 76.98%. The results show that the crude protein, Crude fibre, ether extract and ash were higher in the dusa than in the maize grain Table 4.1. It is however, lower in Nitrogen free extract.The Gross Energy (GE) the Apparent Metabolizable Energy (AME), the apparent metabolizable energy corrected for nitrogen (AME_n) for dusa are presented in Table 3. Dusa had AME of 2784 Kcal kg^{-1}.

The effects of graded level of dusa as replacement for maize on the performance of chicks are as presented in Table 4. There was linear increase in consumption of feed as the level of dusa increased in the diet. The least consumption was observed for treatment two with 10% dusa. There was no significant difference ($p>0.05$) in the average final weight and weight gain of birds. Feed to gain ration however, showed a significant difference ($p<0.05$). Treatment two with 10% dusa had better feed to gain ration than all other treatments. The gains were similar for treatments five and seven. There were significant differences ($p<0.05$) in feed cost (N/kg gain) and feed cost (N/bird) the costs were significantly higher for the control diet and decreased as the level of dusa increased in the diets. There was no mortality in all the treatments.

Discussion

The mean Crude protein value of 10.82% obtained in this experiment was higher than that of maize (8.57%). The reason for the higher crude protein for dusa when compared with that of maize may be due to the greater proportion of the germ and aleurone layer in the dusa. During de-hulling of maize in the local mills greater proportions of the germ are removed and are concentrated in the dusa. Since germ contains more protein than other parts of maize, this explains why there was higher protein in dusa than in the same quantity of maize grain (Vantsawa, 2001).

The metabolizable energy of 2784 Kcal kg^{-1} in the dusa is higher than the value of 2675 Kcal kg^{-1} ME obtained by Fadugba (1989) for the industrial maize offal. This result shows that local dusa is fairly good as an energy source for chicks. In the experiment conducted by Vantsawa (2001), it was discovered that dusa can replace all the maize in broiler starter and finisher diets without any adverse effect on weight gain with significant savings in the cost of production.

The significant difference ($p>0.05$) in weight gain observed in this experiment is contrary to the observations made by Fadugba (1989). In her study, the diets with 34.3%, 68.8% and 100% replacement of maize by industrial maize offal gave significantly ($p<0.05$) heavier birds than those that were fed on the control diet. Her explanation was that by increasing the percentage of the industrial maize offal in the rations, the fibre contents of the rations were increased and consequently their energy densities lowered which was compensated for by increased feed intake and hence higher weights. Morris (1968), reported that for a wide range of energy levels, birds adjust feed intake so as to maintain almost constant caloric intake. Due to increased feed intake, the birds would consume more of the vital nutrients, resulting in better growth. Sunde (1984) also observed that feed consumption decreased when the energy contents of the diets increased. That was why the birds on the control diet that had 100% maize could not perform better than birds on treatment seven having 100% dusa in the diets.

The highest feed cost (N/kg gain) and feed cost (N/bird) observed in the control diet which decreased as the level of dusa increased in the diets shows that it was more economical to use dusa as a source of energy in the chicks diets. The difference in cost between maize and dusa was substantial. Maize was costing N35/kg while dusa was only N14/kg. As shown in table 4.4., the average weight gain for birds on control diet was 578.11g while the value for the treatment seven having 100% dusa was 576.25g. The difference in weight was 1.86g. This difference was not significant ($p>0.05$). The inclusion of high percentage of maize in poultry diets translate to high costs of feed because of the high cost of maize. Unstable price and high competition for its use by man also contributed to this high cost (Agbede *et al.*, 2002). It was concluded that dusa could replace all the maize in chicks' diets without any adverse effect on performance of birds.

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