Brewer's Grain from Cameroon Brewery in Breeder Chicken Rations: Effect on Productive and Reproductive Performance

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Summary

In order to evaluate the effect of brewer's dried grain (BDG) on the productive and reproductive traits in breeder chickens, 120 laying hens and 12 cocks of ISA commercial breed were subjected to dietary treatments containing 0, 10, 20, and 30% levels of BDG. Feed and water were provided ad libitum *over the 5-months experimental period. Reproductive and productive traits such as egg production, egg weight, albumen height, shell weight, semen quantity, fertility and hatchability of fertile eggs were measured.*

Results indicated that when BDG was fed at the 30% level in the ration, the hen-day egg production (50.6%) was significantly (P< 0.05) depressed compared with the 0% level (56.2%), 10% level (56.9%) and 20% level (56.7%) of inclusion. There was a significant (P< 0.05) increase in egg weight, hatchability of fertile eggs and feed intake per bird per day with increasing levels of BDG. No significant difference (P> 0.05) was noticed between treatments for ratio of shell weight to egg weight, albumen height, semen quantity and fertility. The results suggest that although the 30% level of BDG can be tolerated, the 20% level of BDG inclusion is more appropriate for breeder birds.

Résumé

Drèche desséchée des brasseries du Cameroun dans l'alimentation des poules de reproduction: Effet sur les performances de production et de reproduction.

Les effets de la drèche desséchée des brasseries (DDB) sont examinés sur la production et la reproduction des souches ISA rousses. Cent vingt poules et douze coqs sont soumis à des rations expérimentales contenant 0 ; 10 ; 20 et 30% de DDB. Les oiseaux sont nourris et abreuvés à volonté pendant les 5 mois que dure l'essai. Les paramètres enregistrés sont: Ingéré alimentaire, production et poids des œufs, hauteur de l'albumine, poids de la coquille vide, production du sperme, fertilité et éclosabilité des œufs. Les résultats ont montré qu'au taux alimentaire de 30% de DDB, la ponte est significativement (P< 0,05) affectée par rapport à celles obtenues avec 0% (56,2%), 10% (56,9%), et 20% (56,7%) de DDB dans la ration. Le poids des œufs, l'éclosabilité des œufs fécondés et l'ingéré alimentaire augmentent (P< 0,05) avec des taux alimentaires croissants de DDB. Il n'y a pas eu d'effets significatifs (P> 0,05) sur le ratio poids-coquille des œufs, hauteur de l'albumine, quantité du sperme produit et fertilité. Ces résultats permettent de recommander l'utilisation de DDB au taux optimal de 20% dans la ration de poule de reproduction, bien que le taux alimentaire de 30% de DDB soit bien toléré.

Introduction

In most developing countries, Cameroon inclusive, one of the limitations to the expansion of the chicken industry is the high cost of protein and energy ingredients such as fish meal, decorticated cottonseed cake, maize and guinea corn. In order to reduce this high cost, efforts are being directed toward the use of non-conventional feed ingredients. Brewer's grain, a by-product of the beer industry might offer a suitable substitute. Although many breweries exist in Cameroon, knowledge about the nutritive value of brewers' grain is almost non-existent. The problem facing most of the breweries is that of disposing the wet grains. Current disposal practices include free donations of wet grains to interested persons or payment of contractors by the breweries to collect and dump the bulky daily output of the wet grains. Currently the wet grains are used as manure, and some farmers feed it to pigs. Brewers' grains contain a wide variety of essential nutrients, which are required in feed formulation for poultry. Couch (3) and Ewing (4) analysed BDG and found that it contained over 20% crude protein, 6% ether extract, 15% crude fibre and about 4% ash. Almquist (1) reported values of 25% crude protein and rich quantities of essential amino acids i.e. lysine 0.9%, methionine 0.4%, tryptophane 0.4%, phenylalanine 1.2%, threonine 1.1% and valine 1.6%. BDG is therefore higher in protein and amino acids than corn. It's use, as animal feed does not call for competition between man and livestock, as is the case with corn and other feedstuffs. The present study has as primary objective to evaluate the effect of

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including sun-dried Brewers grain obtained from Cameroon brewery on reproductive performance and egg production in breeder chicken rations.

Materials and methods

Source and processing of brewer grain.

The brewer's wet grains were collected from Bafoussam, a town 90 km from Mankon Research Station. The product collected had moisture content of 80%, which increases its bulkiness. Sun drying was the most common method used and this required large space for drying. During drying, the wet grains were spread in a thin layer and frequently turned to avoid fermentation that could lower the nutritive value of the product.

Chemical composition

Before the BDG and corn were used in the formulation of the rations, a sample of each was analysed for proximate composition and amino acid profile (Tables 1a and 1b). In addition, complete rations were analysed for their proximate composition using methods outlined by AOAC (2).

Table 1a
Proximate composition of brewers dried grains and corn (% dry-matter basis)

Ingredient	Brewers dried grains	Yellow corn
Crude protein	27.7	9.1
Crude fibre	15.7	2.9
Ether extract	7.2	4.3
Ash	3.8	1.2

Allocation of dietary treatment to birds

A total of 120 laying hens and 12 cocks of ISA commercial breed were used in the trial. The layers which had been in lay for 120 days were randomly divided into four equal treatment groups of 30 birds each and these were further divided into five replicate groups of 6 birds each. The cocks were divided into four dietary groups of 3 cocks each. The hens and cocks were placed in cages in pairs and singly, respectively. A complete randomized design was used in which the four dietary treatments (Table 2) containing 0, 10, 20 and 30% levels of BDG were adjusted to maintain Iso- protein, energy, calcium and phosphorus levels as BDG content was increased. Palm oil was used to balance the energy levels. A period of one week was allowed for the birds to adjust to the cage environment. During this period they were fed a normal layer diet without BDG. Thereafter, birds were fed the experimental diet for a week before data collection started. Feed and water were provided *ad libitum.*

Table 2
Composition of experimental rations

Ingredient (kg)	% Level of BDG			
	0	10	20	30
Corn (yellow)	63.5	57.5	49.5	42.3
Brewers dried grain	0	10	20	30
Cottonseed cake	17.5	13.0	9.0	4.7
Fish meal	5.6	5.6	5.6	5.6
Palm oil	2.1	3.1	5.1	6.7
Bone meal	3.0	3.0	3.0	3.0
Calcium carbonate	7.1	6.6	6.6	6.5
L-Lysine	0.2	0.2	0.2	0.2
Layer concentrate1	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total (kg)	100	100	100	100
Analysis (dry-matter) basis				
Crude protein (%)	17.8	17.7	17.7	17.8
Crude fibre (%)	3.5	4.4	5.3	6.2
ME (kcal \ kg), calculated	2949.9	2931.3	2931.3	2929.5
Calcium (%)	4.4	4.5	4.5	4.4
Phosphorus, total (%)	0.78	0.77	0.77	0.75

[1] SADE (Cameroon) layer concentrate supplied per kg the following: Vitamin A 9000 IU; vitamin D3 1800 IU; vitamin E 14.4 mg; vitamin K 1.4 mg; vitamin B1 1.0 mg; vitamin B2 4.1 mg; vitamin PP 18 mg; calcium patothenate 9 mg; vitamin B6 1.8 mg; vitamin B12 0.02 mg; folic acid 0.7 mg; biotin 0.06 mg; choline chloide 300 mg; BHT antioxidant 120 mg.

Semen collection and artificial insemination

Semen was collected from the cocks by the massage technique (9). Semen from the same dietary group was pooled and inseminated to the corresponding hens offered the same diet. Approximately 0.1 ml of whole semen (estimated to contain 8 x 10^8 spermatozoa) (10), was inseminated into each hen using the insemination gun designed for poultry. The artificial insemination was done usually in the evening, at about 4.00 p.m. when it was assumed that the hens had laid and it was repeated at intervals of 3 days.

Incubation of eggs

The eggs from each dietary group were marked after collection for identification and stored in a cool room

Table 1b
Amino-acid composition of brewers dried grain and corn used in the rations

Ingredient	Amino-acid composition (%)											
	Arginine	Cystine	Histidine	Isoleucine	Leucine	Lysine	Methionine	Phenylanine	Threonine	Tryptophan	Trrosine	Valine
Corn (Yellow)	0.45	0.09	0.18	0.45	0.99	0.18	0.09	0.45	0.36	0.09	-	0.36
Brewers dried grain	1.30	-	0.50	1.50	2.3	0.90	0.40	1.30	0.90	0.40	1.2	1.60

(18ºC) for ten days before incubation. On the seventh day of incubation the fertile eggs were detected by candling the eggs using a locally made Candler. The hatchability was calculated from the number of fertile eggs.

Collection and analyses of data

Eggs were collected daily and records of daily egg production and egg weight for all replicate groups were kept for five months. Average hen-day production was calculated. Two eggs from each replicate group were taken daily at random, weighed, broken and albumen height measured as an indicator for egg quality (using a Haugh Unit gauge). The eggshells from broken eggs were washed and dried in an oven at 60°C overnight and weighed. The eggshell weight was expressed as a percentage of the egg weight. The semen quantity from each cock was measured using calibrated vaccine tubes. Data collected were subjected to analysis of variance using the General Linear Model (GLM) of the SAS programme package (version 6.08).

Results and discussion

Results for the laying performance (Table 3) show that feeding up to 20% of BDG did not significantly affect the hen-day production. However, the laying performance was significantly (P< 0.05) depressed when the ration containing 30% BDG was fed. The average hen-day production percentages for the 0, 10, 20, and 30% levels of BDG inclusion were 56.2, 56.8, 56.6 and 50.5, respectively. These results do not agree with the findings of Onwudike (8) who reported that the laying performance was not significantly affected when BDG was fed up to 40%. Although the amino acid levels of diets were increasing as the BDG levels in the rations increased, the fall in the egg production at 30% levels of BDG in the ration may be caused by high crude fibre level of the ration at this level.

Egg weight progressively increased with increasing levels of the BDG in the rations. Birds fed the ration containing 10% level of BDG laid significantly (P< 0.05) larger eggs (62.3 g) than those on the control ration (60.7 g). The 30% level of BDG also significantly (P< 0.05) increased the egg weight (63.9 g) as compared with (62.3 g) in the ration containing 10% level of BDG. There was, however, no significant difference in egg weight for birds fed the 20 and 30% levels of BDG. The improved egg size may be due to the increase of amino acid pattern (Table 4) caused by increased BDG levels in the rations that may increase the egg protein synthesis and hence larger egg sizes.

Table 3
Calculated amino acid composition of experimental diets

Amino acid	Level of BDG (%) in the rations			
	0	10	20	30
Arginine	1.25	1.12	1.09	1.04
Cystine	0.26	0.48	0.49	0.48
Histidine	0.45	0.40	0.38	0.37
Isoleucine	0.79	0.85	0.90	0.94
Leucine	1.75	1.90	2.03	2.14
Lysine	0.96	0.95	0.96	0.96
Methionine	0.27	0.28	0.33	0.38
Phenylalanine	0.87	0.85	0.82	0.80
Threonine	0.65	0.65	0.65	0.66
Tryptophan	0.21	0.21	0.22	0.23
Tryrosine	0.09	0.21	0.33	0.45
Valine	0.79	0.84	0.88	0.93

This could be in part as result of higher linoleic acid level, which corresponds to higher BDG levels. Bragg cited North (7) stated that increasing the linoleic acid in chicken diets could raise the deposition of polyunsaturated fatty acids in the egg yolk from basic level of about 5% to approximately 28%. The average feed intake per bird per day significantly (P< 0.05) increased with increasing levels of BDG. The average feed intake for the 0, 10, 20 and 30% levels of BDG were 100, 111, 122, and 130 g, respectively. This same trend was noticed by Lopez *et al.* (6) and Onwudike (8). The cause of this trend in feed intake is unknown and could not be related to the energy levels of the rations since the rations were about ISO—caloric. There were no significant (P> 0.05) differences noticed for the ratio of weight to egg weight, albumen height and semen quan-

Table 4
Effect of feeding brewers dried grain on breeder chicken performance

Traits	Level of BDG (%)				
	0	10	20	30	Level of significance
Average hen-day production (%)	56.2a	56.9a	56.7a	50.6b	*
Average egg weight (g)	60.8c	62.3b	62.5ab	63.9a	*
Average feed intake/ bird/ day (g)	100.7d	111.7c	122.9b	130.5a	*
Ratio of shell weight: egg weight (%)	9.6	9.9	9.9	9.4	ns
Albumen height (haught unit)	101.7	101.2	102.4	104.9	ns
Semen quantity / cock (ml)	1.4	1.0	1.1	1.1	ns
Fertility (%)	58.5	59.3	58.8	58.9	ns
Hatch of fertile eggs (%)	67.2c	75.8b	80.9a	81.3a	

Means with different superscript along row are significantly different at (P< 0.05)
*: Statistical significant at (P< 0.05)
ns: Not significant at (P> 0.05)

Table 5 – Economic analysis

Traits	Level of BDG (%)				
	0	10	20	30	Level ofsignificance
Cost/100 kg of ration (CFA)[1]	20,698	20,013	19,529	18,982	*
Cost of feed/Kg egg (CFA)	599	559	546	544	
Kg feed/ dozen eggs[2]	2.01b	2.19b	3.04a	3.43a	

Means with different superscript along row are significantly different at (P<0.05)
*: Statistical significant at (P< 0.05)
[1] 600 CFA is equivalent to 1 US dollar
[2] Only the kg feed/dozen egg was analysed statistically

tity for birds fed rations having different level of BDG. Although the fertility percentage increased with increasing levels of BDG in the rations (Table 4), this increase was not significantly (P> 0.05) different between dietary treatments. The hatchability for fertile eggs from birds fed BDG was significantly (P< 0.05) greater than those of the control group (Table 4). However, the hatchability for the 20 and 30 % levels of BDG in the rations was significantly (P< 0.05) greater than those of 10% level of BDG (80.9, 81.3 versus 75.8%), respectively. The cause of this increase is unknown but Kienholtz and Jone (5) attributed improved fertility and hatchability to an unidentified factor in BDG. The economic analysis for the cost of producing the different rations and their egg production cost is shown in Table 5.

There was a significant (P< 0.05) effect of feed required for dozen eggs produced. The inclusion of BDG above 20% in the ration significantly (P< 0.05) increased the amount of feed required to produce a dozen eggs. It was also noticed that the cost of feed required to produced a kilogram of eggs (egg output) was progressively reduced for 0, 10, 20, 30% levels of BDG in the rations, since egg weight increased with BDG level of inclusion. This reduction in cost with increase in the level of BDG was a result of the fact that BDG cost was less than corn, 50 vs. 180 CFA a kg, respectively. This was the dry season cost which includes the cost of processing and transportation. During this season in Cameroon, mature maize cobs are left in the fields to be sun-dried before harvest.

Conclusions

The results show that 30% level of BDG inclusion can be tolerated in breeder diets but the 20% level of BDG in the rations seem to be the most appropriate level for breeder birds. For now drying of the wet grains is done in the dry season since this ingredient has high fermentation properties. It is hoped that in the near future drying ovens would de designed or adapted the existing corn dryers to handle brewers' grain. The existing corn dryers use wood as fuel source and the construction is approximately 200,000 CFA for a 20 tonnes (un-thresh maize) capacity oven. It's therefore necessary to conduct another study to compare the cost of oven-dried brewers' grain to compare it with that of maize, which cost about 210 CFA in the rainy season due to the drying process.

Literature

1. Almquist H.J., 1972. Protein and amino acids in animal nutrition. S.B. Penick and Co., New York.
2. AOAC (Association of Official Analytical Chemists), 1975. Official methods of analysis. 12th ed. AOAC. Washington, D.C.
3. Couch J.R., 1978. Brewers dried grains in poultry feed. Poultry International, July 42.
4. Ewing W.R., 1965. Poultry nutrition. 5th ed. Pasadena, ray ewing co., Pasadena. California. Pp.396-418
5. Kienholtz E.W. & Jone M.L., 1967. The effect of brewers dried grains in some poultry rations. Poultry Sci. 46: 1280.
6. Lopez D.S., Carmmona F.S. & Pascual M.J.L., 1981. Evaluation of Brewers dried grains in diets of laying hens. Feed Science Technol. **6** (2) 169-178.
7. North M.O., 1972. Commercial chicken production manual. The Avi publishing Co.Inc., West Port, Connecticut. pp .454
8. Onwudike O.C., 1981. The use of brewers dried grains by layer hens. Nutr. Rep. Int. 24 (5): 1009.
9. Quin J.P. & Barrows W.H., 1937. Collection of spermatozoa from domestic fowl and turkey. Poultry Sci. 16: 19-24
10. Yousif Y.F., Ansaband G.A. & Buckland R.B., 1984. Effect of selection for fertility of fresh and stored semen. Poultry Sci. 63: 1475-1480

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