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Performance of Laying Hens Fed Graded Levels of Indomie® Waste as Replacement for Maize in a Humid Tropical Environment

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Abstract: An 8 week feeding trial was carried out to evaluate the use of Indomie® waste as a substitute for maize at levels of 0, 25, 50, 75 and 100%. Seventy-five Nera black layers of commercial strain, aged 32 weeks were used for the experiment. Mean feed intake, mean body weight change, feed conversion ratio, percentage egg production, egg weight yolk colour shell thickness and the economy of production were investigated. Significant differences were observed in the mean daily feed intake ($p<0.05$). Mean daily feed intake was highest (125.06 g) for birds fed diet A, while the least value (115.11 g) was obtained from birds fed diets E. The mean body weight gain numerically improves as the percent Indomie® waste substitution increased from 0-100%. Birds fed diets E had the highest value (0.71 g), while birds fed diet A had the least value (0.21 g). The percentage egg production was highest (78.88%) for birds fed diet C, while birds fed diet E had the lowest value (71.13%). The mean egg weight was highest in birds fed diet A (64.25 g), while the least values (61.61 and 64.25 g) were obtained from birds fed diets D and E, respectively. There were significant differences ($p<0.05$) in eggshell thickness. Birds fed diet E had the highest value (0.3150 mm) while birds fed diet A had the least value (0.3350 mm). Birds fed diet E had the highest (6.0) egg yolk color score while birds fed diet A had the least value (4.0). With regards to feed conversion ratio, there were significant differences among the 5 treatments ($p<0.05$). Birds fed diets A and B had the highest value (1.95) and differed significantly from birds fed diets C, D and E with the least values of 1.90, 1.90 and 1.8. Optimum result could be obtained by replacing maize with 50% dietary maize with Indomie® waste in a layers diet and is therefore recommended.

Key words: Laying hens, maize, tropical environment, performance

INTRODUCTION

The extent of by-products utilization as a feed ingredient depends on the cost of conventional feedstuff, safety to animal health and the alternative use (Bickel and Deober, 1988). Therefore, the economics of crop residue and by-products utilization require intensive analytical investigation to formulate a least cost ration for animal production. Some of the non-conventional feedstuffs used as substitute for the conventional feedstuff include cassava meal, flour dust, biscuit waste, sorghum sprout, cocoa pod, poultry offal, hatchery waste, shrimps waste, plantain peels, etc.

Indomie® waste is of special importance among the non-conventional feedstuffs. Indomie® noodule is basically a fast foods for human beings that is highly relished by both children and adults. Indomie noodle is produced from wheat flour, refined palm oil, salt, sodium polyphosphate, guargum, tartiazine, C1 19140 and spices (which gives the noodules a good flavor). During the process of packaging the noodules, the waste obtained is sold to livestock industry as Indomie® waste. Indomie® waste has several advantages over other non-conventional feed ingredients. Since, Indomie® noodule is meant for human consumption, they are hygienically packaged and this removes the fear of contamination. Indomie® waste has no anti-nutritional factor and the high-energy content of Indomie® waste makes it a good substitute for maize (and other cereal grains).

The objective of this study is to evaluate the effects of feeding Indomie® waste on the performance of laying hens.

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MATERIALS AND METHODS

Experimental birds and management: Seventy-five Nera black layers of commercial strain, birds aged 32 weeks were used for this experiment. The birds were selected from a larger flock after balancing for weight. The birds were randomly assigned to 5 dietary treatments with fifteen birds on each treatment. Each treatment was replicated 5 times with 3 birds each. The birds were raised in a 2-tier battery cage placed inside an open-sided poultry house. Experimental diets and drinking water were provided ad-libitum and the study lasted 8 weeks. The water troughs were washed daily before fresh water was served. The birds were dewormed, treated with broad-spectrum antibiotics and vaccinated before the commencement of the experiment. Antistress was administered occasionally during the experiment.

Five experimental diets, A, B, C, D and E were formulated such that the diets were isonitrogenous, 17.04% and isocaloric, 2528 kcal kg^{-1}. Diet A served as the control diet and contained 100% maize and 0% of Indomie® waste. Diets B, C, D and E contained 25, 50, 75 and 100% of Indomie® waste at the expense of maize in the experimental diets. Other ingredients used for ration formulation were obtained from a reputable feed mill. The composition of the experimental diets is shown in Table 1.

Experimental design: The design of the experiment was Completely Randomized Design (CRD) with 5 treatments that were replicated 5 times and each replicate contained 3 birds. Data collected included body weight, (initial and final), weight gain, feed intake, percentage egg production, egg weight, shell thickness and yolk colour.

Chemical and statistical analysis: Proximate analysis and metabolizable energy of the test material and experimental diets were determined by the method of the Association of Official Analytical Chemist (AOAC, 2000). Data obtained in the study were subjected to analysis of variance (ANOVA) using Completely Randomised Design (Steel and Torrie, 1980). Significant means were further separated by the use of Duncan Multiple Range Test (Duncans, 1955).

Table 1: Gross composition of experimental diets (%)

		Experimental diets				
Ingredient		A	B	C	D	E
Maize		45.0	33.75	22.5	11.25	-
Indomie® waste		-	11.25	22.5	33.75	45.0
Groundnut cake		10.0	9.95	10.05	10.0	14.0
Soya bean cake		6.3	7.0	7.6	8.35	4.4
Fish meal (65%)		1.5	1.5	1.5	1.5	1.5
Wheat offal		16.0	18.05	20.2	21.8	23.0
Palm kernel cake		9.5	6.9	3.95	1.55	0.4
Oyster shell		8.5	8.5	8.5	8.5	8.5
Bone meal		2.5	2.5	2.5	2.5	2.5
Salt		0.25	0.25	0.25	0.25	0.25
Layers premix		0.25	0.25	0.25	0.25	0.25
Lysine		0.10	0.10	0.10	0.10	0.10
Methionine		0.10	0.10	0.10	0.10	0.10
Total		100	100	100	100	100
Parameters	IW	A	B	C	D	E
Dry matter	94.70	90.73	90.80	91.08	91.13	91.4
Crude protein	8.75	17.30	17.30	17.29	17.30	17.28
Crude fibre	1.50	4.88	4.59	4.52	4.42	4.33
Crude fat	16.35	3.29	3.38	3.41	3.48	3.59
Ash	13.60	5.07	5.13	5.37	5.72	6.01
Nitrogen free extract	61.27	60.24	60.40	60.49	60.21	60.24
M.E (kcal kg^{-1})	3464	2560	2560	2568	2572	2580

RESULTS AND DISCUSSION

Proximate analysis of experimental diets: The results of the metabolizable energy and the proximate analysis of the experimental diets are shown in Table 1.

The calculated and determined values of the crude protein are in close agreement. The determined values of other nutrients of the diets also appeared similar with the values ranging from 4.33-4.83% for crude fiber; 3.29-3.59% for crude fat and 5.07-6.01% for Ash. The calculated and determined crude protein level of about 17% and metabolizable energy of about 2500 kcal kg^{-1} diets were within the range recommended by Oluyemi and Robert, (2000) and Scott *et al.* (1982). The energy and proximate analysis of Indomie® waste is shown in Table 2. The crude protein content of Indomie® waste was 8.75%, compared to maize 9% and whole wheat 11.5% the metabolizable energy of Indomie® waste was 3464 kcal kg^{-1} compared to maize 3434 kcal kg^{-1} and wheat 3120 kcal kg^{-1}. The crude fibre of Indomie® waste was negligible, which indicated a better digestibility. The crude fat of Indomie® waste was 16.38%, while the ash was 13.6%. The higher value of crude fat and ash of Indomie® waste could be accounted for by the refined palm oil and mineral content (e.g., Sodium chloride, Sodium polyphosphate, Tartrazine CI 19140) of Indomie® waste.

Performance of birds on diets containing Indomie® waste: In replacing maize with Indomie® waste, the performance of layers in terms of feed intake of the birds (kg), average weight gain of the birds (g), feed conversion ratio, total egg production, egg weight (g), egg yolk colourations, egg shell thickness (mm) and the economy of production were investigated. The results are shown in Table 2.

There were significant differences in daily feed intake ($p<0.05$) among the 5 treatments. Treatment A had the highest daily feed intake/bird 125.06 g, while the least feed consumption was recorded in treatment E with an average

Table 2: Performance of Layers fed diets containing graded levels of Indomie® Waste

Parameter	A	B	C	D	E	SEM
Average daily feed intake/bird (g)	125.06^{a}	122.97^{b}	119.54^{c}	117.68^{d}	115.11^{e}	12.51*
Average initial body weight (kg)	1.97	1.97	1.97	1.97	1.97	0.66
Average final body weight (kg)	1.983	1.985	1.993	1.999	2.011	0.41
Average weight gained/bird/day (gm)	0.21^{d}	0.25^{cd}	0.38^{bc}	0.5^{b}	0.71^{a}	0.08*
Average percentage egg production	76.38^{c}	77.38^{b}	79.88^{a}	74.25^{d}	71.13^{e}	5.28*
Average egg weight (g)	64.25^{a}	63.19^{b}	62.95^{b}	61.61^{c}	60.95^{c}	4.49*
Average egg yolk coloration	4.0^{d}	4.5^{c}	5.15^{b}	5.63^{ab}	6.0^{a}	0.21*
Average egg shell thickness (mm)	0.3350^{c}	0.3438^{bc}	0.3538^{abc}	0.3625^{ab}	0.3750^{a}	0.02*
Feed conversion ratio (feed/dozen eggs	1.95^{a}	1.95^{a}	1.90^{b}	1.90^{b}	1.8^{b}	0.01*

Means along the same row with different superscripts differ significantly ($p<0.05$)

daily feed intake/bird of 115.11 g. The daily feed intake decreased as the level of Indomie® waste increased in the experimental diet. Since, the experimental diets were isocaloric and isonitrogenous, the reduction in feed intake could be due to the higher fat 16.38% and higher metabolizable energy 3464 kcal kg^{-1} of the Indomie® waste in the diets. This trend in feed intake could be related to the energy content of the diets. Birds are known to eat to satisfy their energy requirements (Atteh, 2004).

There were significant differences ($p<0.05$) in body weight gain among the 5 treatments. Treatment E had the highest weight gain/bird while treatment A (the control diet) had the least weight gain. There seem to be a direct relationship between body weight gains and the level of Indomie® waste inclusion in the diets. As the level of Indomie® waste increased in the experimental diets, weight gained also increased. This is an indication that Indomie® waste is well utilized by the birds.

There were significant differences ($p<0.05$) in the percentage egg production in all the treatments. The highest percentage egg production of 79.88% was recorded in treatment C (50% of indomie waste replacing maize in the diet) while the lowest percentage egg production 71.13% was recorded in treatment E (with 100% Indomie® waste replacing maize). The control diet (treatment A) had a better percentage egg production than treatments D and E (with 75 and 100% of Indomie® waste replacing maize, respectively). These results suggest that Indomie® waste could replace maize at a level from 25-50% without adversely affecting the percentage egg production of the birds. There were significant differences ($p<0.05$) in egg weight in all the treatments. The values of egg weights ranged from 60.95-64.25 g. These values were higher than 58 g average egg size reported by Oluyemi and Robert (2000). Treatments D and E had the least egg weights and there was no significant difference ($p<0.05$) in their egg weights. However, treatment A (the control diet) with the highest feed intake 125.06 g had the highest egg weight (64.25 g).

The value of egg yolk coloration ranged between 4.0 and 6.0. The highest egg yolk colouration was observed in treatment E (100% Indomie® waste inclusion), while the least egg yolk coloration was observed in treatment A (the control diet). In order to really ascertain, the effect of Indomie® waste on egg yolk colour, white maize and vitamin-mineral premix without yolk colorant was used. From the result of this study the egg yolk colouration improved with the increasing level of Indomie® waste in the experimental diets. The improvement in egg yolk coloration as the level of Indomie® waste increased in the diets indicates the presences of carotene (a vitamin-A precursor) which could be traced to the refined palm oil used in the production of Indomie®.

The values obtained ranged from 0.3350 mm in treatment A to 0.3750 mm in treatment E. There was an increase in eggshell thickness as the level of Indomie® waste in the diet increased. This may be due to the high mineral content of indomie waste (Ash 13.6%) since all the experimental diets contained the same amount of bone meal and oyster shell. The values of egg shell thickness obtained from this study were greater than 0.30-0.36 mm range given by Oluyemi and Robert (2000).

Treatments C, D and E were not significantly different and they had the best feed conversion ratio. Treatment A (the control diet) and treatment B were not significantly different. This indicated that birds in treatment C, D and E with 50, 75 and 100% (Indomie® waste replacing maize), respectively utilized the diet more efficiently than treatments A and B.

No mortality was recorded in all the treatments. This implies that Indomie® waste has no toxic effects or any anti-nutritional factor in it since Indomie® is safe for human consumption.

CONCLUSION AND RECOMMENDATIONS

The idea of feeding different levels of Indomie® waste as an energy source in layers ration arose because of the need to look for cheaper alternative sources of feedstuff that will reduce cost of feeding and competition between man, animal and brewery for conventional sources of dietary nutrients. The results obtained on the performance of birds as related to feed intake, weight gained, egg weight, percentage egg production, egg yolk colour scores, egg shell thickness and feed conversion ratio showed significant differences. These results favour

Indomie® waste as a good replacement for maize from 25-75% levels without any negative effect. Also, the cost of production is cheaper in all the diets containing Indomie® waste compared with treatment A (the control diet).

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