Nigerian J. Anim. Sci. 2020, 22 (1): 42-49

Effects of feeding diluted diets on growth performance and morpho-metric body parameters of exotic and improved local chicks.

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***Target Audience**: Animal Breeder/ Nutritionist, Livestock Farmers, Regulatory Agency and Feed millers*

Abstract

Two hundred chicks consisting of one hundred exotic layers and one hundred improved local chicks of local and exotic (LXE) genotypes were investigated to determine the effect of diet dilution on performance and growth traits of chicks for a period of twenty eight days. Standard chick's diet was diluted with 20 percent wheat offal, palm kernel cake, baobab seed meal, respectively and fed to each chick's type ad libitum throughout the trial period in a 2x4 factorial experimental design. Data collected included feed intake (FI), weight gain (WG), feed conversion ratio (FCR), body weight (BW) and morphometric body parameters such as body girth (BG), body length (BL), shank length (SL), shank diameter (SD), thigh length (TL), keel length (KL), wing length (WL) and drumstick (DL) and analyzed using one way analysis of variance of SAS statistical package. FI, WG, FCR, BW and all the morphometric body parameters were significantly ($p<0.05$) affected by genotype and diet dilution. Significant interaction existed between chicken genotypes and diets type for all the morphometric body parameters measured. Dilution of recommended diets should not be encouraged as the chicks fed diluted diets had poorer performance compared to those fed non-diluted standard diet during the experimental period. Therefore, small scale farmers are advised against such practice.

***Keywords**: Diet dilution, Baobab seed meal, Genotype, palm kernel cake, Wheat offal.*

Description of Problem

Nutrition is one of the limiting factors in poultry production as the cost of feed alone account for about 70-80% of the total cost of production of commercial poultry in Nigeria (1). Shortage of feed resources in developing countries and Nigeria in particular is worsened by competition with human and growing livestock productions which in turns lead to increase in cost of feeding livestock and reduced profit for livestock farmers. With the present trend of rising price of feed ingredients, there has been a search for alternative feed ingredients that can be used to supplement the conventional feed stuff. Food and agricultural scientists are screening wild and under-utilized native plants for possible alternative sources of food in an attempt to widen the narrow food base for livestock (2; 3). Farmers are engaged in dilution of commercial diet with cheaper feed ingredients to reduce the cost of feeding. Researchers are however now investigating dilution of diet with low cost and locally available indigenous feed resources that do not attract competition with human beings as an alternative method of nutrient restriction with an advantage of attaining a more consistent growth pattern

within a flock (4). Diet dilution can be achieved by the use of local indigenous multi-purpose tree products and byproducts such as seed cakes and leaf meals (5), non-digestible ingredients such as fiber, wood charcoal and sands (6) and up to 40% whole grain (7). This study was therefore designed to evaluate the effect of feeding exotic layers and improved local chicks (LXE) with standard chicks mash (formulated to meet the nutrient requirement of chicks) and chick mash diluted with twenty percent (20%) each of baobab seed meal, palm kernel cake and wheat offal from day old to twenty eight days.

Material and Methods

Experimental Site

The experiment was carried out in the Animal Pavilion of the Department of Animal Production, University of Ilorin, Ilorin, Kwara State, Nigeria. The Proximate analysis of the feedstuff and diets were carried out at the Departmental Science laboratory. Ilorin is Located in the North Central region of Nigeria on latitude $8^0$30', and 8^0 50' N and longitude 4^0 20' and 4^0 35' E of the equator (8).

Experimental Chicks and Designs

Two hundred (200) chicks consisting of one hundred (100) day old of improved local chicks of both sexes obtained from crossing of local chickens with an exotic layers breeds at Kwara State University Farm (Malete, Kwara State), and one hundred (100) exotic day old chicks type (ISA Brown layer breed; 50 male vs.50 female purchased from Yammfy Farms (Ilemona, Kwara State) were used for this study. On arrival the chicks were allowed to stabilize by giving them glucose mixed with drinkable water (10g/4litres of water), after which they were wing tagged and grouped randomly per genotypes with 25 chicks per treatments (replicated 5 times with 5 birds per replicate) and housed in poultry cage partitioned per replicate throughout the experimental period. Feed and Water were provided for the chicks *ad libitum* and all the necessary vaccination and medication were administered accordingly (9). The experimental design was of 2 x 4 factorial with two chicks genotypes (exotic layers and improved local) and four diet types.

Experimental Diets

The chicks were fed four (4) different types of diets; the standard Chicks Mash (CM) formulated according to (10), CM diluted with 20% processed Baobab seed meal (CMSMB), 20% wheat offal (CMWO) and 20% palm kernel cake (CMPKC), respectively. The diluents were selected based on availability, cheaper price and information on possible diluents commonly used by local farmers. The baobab seed was collected around the study area, soaked, sundried, and roasted, palm kernel cake and wheat offal were purchased from feed ingredients seller. The three items were grounded to 2mm before incorporating into the complete diet. The complete commercial diet was manipulated to accommodate 20% of the diluent as shown in Table 1. The four diets were fed *ad libitum* to the chicks per treatment for a period of twenty (28) days. Samples of the experimental diets were subjected to proximate analysis using the procedure outlined by (11) and the results were as shown in Table 2.

Table 1. Composition (%) and Cost of Experimental Diets (%)

Feed Ingredients	CM	CMBSM	CMPKC	CMWO
Maize	50	40	40	40
Maize Bran	7	5.6	5.6	5.6
Soybean Meal	23	18.4	18.4	18.4
Groundnut Cake	6	4.8	4.8	4.8
Fish Meal	10	8	8	8
DCP	2	1.6	1.6	1.6
Limestone	1	0.8	0.8	0.8
Methionine	0.25	0.2	0.2	0.2
Lysine	0.25	0.2	0.2	0.2
Vitamin Premix*	0.25	0.2	0.2	0.2
Common Salt	0.25	0.2	0.2	0.2
BSM	-	20	-	-
PKC	-	-	20	-
Wheat Offal	-	-	-	20
Total	100	100	100	100
Total Cost Per Kg (USD)	0.366	0.278	0.309	0.314

DCP: Di calcium Phosphate CM: Chicks Mash, BSM: Baobab Seed Meal, PKC: Palm Kernel Cake, WO: Wheat Offal:* Composition of Vitamin Premix per kg of feed: Vitamin A, 12,000IU; Vitamin D3, 2500,00IU; Vitamin E, 20,000IU; Vitamin K3, 2000mg; Vitamin B1, 2000mg;Vitamin B2,5000mg; Vitamin B6, 4000mg; Vitamin B12, as Niacin, 30000mg; pantothenic acid, 11000mg; Folic acid,1500mg; Biotin, 60mg; Choline chloride, 220,000mg;antioxidant, 1250mg; Manganese, 50,000mg; Zinc, 40,000mg; Iron, 20,000mg; Copper,3000mg; Iodine, 1000mg;Selenium, 200mg; Cobalt, 200mg.

Table 2. Proximate Composition of the Experimental Diets

DIETS	DM (%)	MC (%)	CP (%)	EE (%)	CF (%)	TA (%)
Chicks Mash (CM)	90.49	9.51	21.47	6.15	5.46	6.82
CM BSM	91.50	8.30	18.19	7.04	9.82	10.60
CM PKC	91.32	8.68	16.66	4.69	9.32	8.17
CMWO	90.62	9.38	19.72	4.32	9.12	7.69
BSM	92.05	7.95	20.12	11.49	11.50	6.09
PKC	90.40	9.60	14.66	7.49	13.40	8.26
WO	91.19	8.81	16.47	5.70	11.15	16.59

DM: Dry Matter, MC: Moisture Content, CP: Crude Protein, EE: Ether Extract, CF: Crude Fibre, TA: Total Ash, CM: Chicks Mash, CMBSM: Chick mash with 20% baobab seed meal, CMPKC: Chick mash with 20%palm kernel cake; CMWO: Chick mash with 20% wheat offal; BSM: Baobab seed meal, PKC: Palm Kernel Cake, WO: Wheat Offal.

Data Collection

Performance Evaluation

The initial body weight, weekly body weight, final body weight and daily feed intake were recorded per genotype, total feed consumed and total weight gain during the studied period was calculated. Feed conversion ratio was determined by dividing the total feed intake by the total weight gain during the period

Measurement of body parameters

Body weight and eight morphometric data vs. body length (BL), keel length (KL), shank length (SL), drumstick length (DL), thigh length (TL), wing length (WL), body girth (BG) and shank Diameter (SD) were taken on each bird on weekly basis. Body weight of individual birds was recorded in gram and determined by placing each one on the loading pan of the Mettler Toledo® PG5001 top loading scale of 5100g capacity with 0.1g readability. All the linear measurements were recorded in centimeters and determined using a Measuring Tape and Vernier calliper as described by (12).

Statistical Analysis

Data obtained were subjected to Multivariate General Linear Model Analysis of (13) . Significant differences of the means were separated by Duncan multiple range test (14) of the same package using the statistical model:

$y_{ij} = \mu + a_i + bj + (ab)_{ij} + eij$

yij =overall measurement of i^{th} genotype fed j^{th} diet

μ = overall mean

$a_{i=}$ effects of i^{th} genotype

b_j = effects of j^{th} diets

$(ab)_{ij}$ = interactions effects of i^{th} genotype and j^{th} diets

e_{ijk}= random residual error

Results and Discussion

Initial body weight, final body weight, total weight gained, total feed intake and feed conversion ratio were significantly ($p<0.05$) affected by genotype and diet types. Improved local chicks (LXE) had weight gain that was 86.37g significantly ($p<0.05$) higher than those of exotic genotypes, consumed feed that was 170.7g significantly ($p<0.05$) lower than those of exotic genotype and had a significantly better feed conversion ratio of 2.61 at the end of the experimental period. The results also showed that chicks fed non-diluted standard diet consumed less feed, gained more weight and had better feed conversion ratio than those fed diluted commercial diets. There were significant interactions ($p<0.05$) in performance of chicks and different diluted standard diets and non-diluted diet with those fed non-diluted standard diet performed better with a feed conversion ratio of 2.59 (Table 3). Body weight and morphometric body parameters were also significantly ($p<0.05$) affected by genotypes and diets at four weeks of age; the interaction between the two genotypes of chicks fed diluted standard diets was also significant ($p<0.05$) when their morphometric traits were considered as the value obtained for the morphometric body parameters between the two genotypes differed significantly with respects to diets fed (Table 4) The improved local (LXE) had significantly higher value ($p<0.05$) for body weight and morphometric body parameters at the end of the experiment, but chicks fed wheat offal diluted diets had significantly higher value for body weight .and other morphometric parameters measured when diets and genotype interactions were considered at 28days of age as shown in Table 4.

This findings showed that dilution of chicks' diet with baobab seed meal, palm kernel cake and wheat offal reduced the cost of producing a kilogram of chicks' diet by 24.59, 15.57 and 12.21%, and crude protein content

of feed by 3.28, 4.81 and 1.75% respectively; but it increased the crude fiber of the chicks diet by 4.36, 3.86 and 3.65% (Table 1 and 2). Significant effects of genotype on performance and growth traits obtained in this study indicated that genetic differences exist between exotic layers and improved local chicks (LXE) with the improved local being superior in performance compared to their pure exotic counterparts, and this is in line with the fact that genotype affects body weight, weight gain, feed intake and feed conversion ratio of chickens as asserted by (15) and (16). Higher feed intake by chicks fed diluted diets agree with the facts that birds consumed more to satisfy their energy requirement as asserted by (17), and also with the fact that feed intake increase in birds with reduced crude protein content of their feed (18). However, higher feed consumption by exotic layers and improved local chicks fed diluted diets in this study contradicts the findings of (19), (20) and (6) where the authors reported that broiler chicks fed diluted diets consumed less feed because of the bulkiness of the feed, the contradiction observed here might be as a result of genetic differences of the experimental chickens. Little improvement in feed conversion ratio of chicks fed diets diluted with wheat offal in this study might be due to a reduction in overall maintenance requirement which is caused by a transient decrease in metabolic rate of chicks fed such diluted diets and corresponds with the reports of (21). Also, with that of (22) where it was stated that inclusion of moderate amount of fiber might improve the performance and nutrient digestibility in young chicks.

Table 3. Effects of early feeding of diluted diets on performance of two chick genotypes from week one to four.

Factor		IBWg/bird	FBWg/bird	TWGg/bird	TFIg/bird	FCR
Chicks Genotype (CG)	Exotic Layers	36.73^{a}	359.11^{b}	322.38^{b}	1239.2^{a}	3.84^{a}
	Improved Local (LXE)	31.78^{b}	440.53^{a}	408.75^{a}	1068.5^{b}	2.61^{b}
SEM		0.240	5.430	5.436	0.488	0.06
Diet (D)	CM	34.63^{a}	430.37^{a}	396. 07^{a}	1028.60^{d}	2.59^{c}
	CMBSM	34.09^{a}	438.32^{a}	404.23^{a}	1282.09^{a}	3.17^{ab}
	CM PKC	34.09^{a}	391.86^{ab}	357.77^{ab}	1207.80^{b}	3.37^{a}
	CMWO	33.68^{b}	432.73^{a}	399.05^{a}	1177.80^{c}	2.95^{c}
SEM		0.340	0.060	0.060	0.386	0.068
Interaction	CG*D	**	**	**	*	*

*Mean within column having different superscripts (a-d) differs at p<0.05.*** Significant at p<0.01; *Significant at p<0.05; IBW: Initial body weight; FBW: Final Body weight; TWG: Total weight gain; TFI: Total Feed Intake; FCR: Feed Conversion ratio; SEM : Standard Error of the mean; CM: Chick mash; CMBSM: Chick mash with 20% baobab seed meal; CMPKC: Chick mash with 20% palm kernel cake; CMWO: Chick mash with 20% wheat offal; CG*D: Chicks Genotype and Diet Interaction.

Table 4. Effects of early feeding of diluted diets on body weight and morphometric body parameters of two chicks' genotypes at four weeks of age.

Factor		BW	BG	BL	DL	KL	SD	SL	TL	WL
Chicks Genotype (CG)	Exotic Layers	359.11^{b}	15.59^{a}	22.55^{a}	7.04^{a}	5.88^{a}	2.65^{a}	5.73^{a}	6.01^{a}	11.18^{a}
	Improved Local (LXE)	440.53^{a}	14.79^{b}	21.21^{b}	6.70^{b}	5.61^{b}	2.47^{b}	5.26^{b}	5.67^{b}	10.52^{b}
SEM		1.526	0.095	0.053	0.024	0.018	0.031	0.023	0.023	0.042
Diet (D)	CM	206.94^{c}	15.15^{b}	22.00^{b}	6.98^{b}	5.75^{c}	2.67^{a}	5.51^{b}	5.79^{c}	10.64^{c}
	CMBSM	170.66^{d}	14.10^{c}	20.52^{c}	6.08^{c}	5.12^{d}	2.43^{c}	5.17^{c}	5.20^{d}	10.26^{d}
	CM PKC	230.49^{b}	15.52^{ab}	22.17^{b}	7.12^{a}	5.94^{b}	2.53^{bc}	5.52^{b}	6.03^{b}	11.08^{b}
	CMWO	241.60^{a}	15.88^{a}	22.77^{a}	7.07^{ab}	6.03^{a}	2.62^{ab}	5.84^{a}	6.21^{a}	11.52^{a}
SEM		2.158	0.135	0.075	0.034	0.025	0.043	0.032	0.033	0.05
Interaction	CG*D	*	*	*	*	*	*	*	*	*

*Mean within column having different superscripts (a-d) differs at p<0.05.** Significant at p<0.05;
BW: Body weight; BG: Body girth; BL: Body Length; DL: Drumstick length; KL: Keel length; SD: Shank Diameter; SL: Shank Length; TL: Thigh Length; WL: Wing Length; SEM: Standard Error of the mean; CM: Chick mash; CMBSM: Chick mash with 20% baobab seed meal; CMPKC: Chick mash with 20% palm kernel cake; CMWO: Chick mash with 20% wheat offal; CG*D: Chicks Genotype and Diet Interaction.

Conclusions and Applications

1. Diets diluted with processed Baobab seed meal have the lowest cost per kg of feed.
2. Genotypes have significant effect on performance and growth traits of chicks fed different diets at early stage of life.
3. Dilution of diets with 20% baobab seed meal, palm kernel cake and wheat offal increased the total feed intake and caused poorer better feed conversion ratio when compared with the control diets in both exotic layers and improved local chicks.
4. Chicks fed diet diluted with 20% wheat offal gave comparable feed conversion ratio to the control diets results in both genotypes of chicks studied but still poorer than that of standard diets.
5. Dilution of standard diets is not recommended for chicks and should be discouraged.

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