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Performance and egg quality parameter of laying birds fed varying levels of processed cassava starch effluents

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Abstract
A feeding trial was carried out to determine the effect of oven-dried cassava starch effluent (OCSE) and roasted cassava starch effluent (RCSE) on the egg production and quality of layers fed at varying inclusion levels. Five (5) were formulated such that, diets 1, 2, 3, 4 and 5 containing 50% OCSE, 100% OCSE, 50% RCSE, 100% RCSE fibre replacements and a control diet having 0% inclusion of processed cassava starch effluent. Two hundred and twenty-five (225) laying birds were used for this experiment. The birds were randomly divided into five treatments of forty-five (45) birds per group. Each treatment group was sub-divided into three replicates of 15 birds per replicate. The experiment lasted for 15 weeks. Daily egg production and daily feed intake were documented while Hen-day production was estimated and egg quality parameters were also collected. Data were analyzed using one-way analysis of variance of SPSS 2010 and means separated using Duncan's Multiple Range test of the same Statistical package. All the production performance indices considered were statistically (P>0.05) similar. However, RCSE was found to be better economically than OCSE and the control. No significant difference (P>0.05) was observed on Hen-day production, egg weight, egg shell index, haugh unit, shell surface area, percentage albumin, percentage yolk and percentage shell, while shell thickness and yolk index were observed to be significantly different (P<0.05) across the various inclusion levels. It can be concluded that roasted dried cassava starch effluent in varying fibre replacement levels has positive effect on the performance of laying birds with respect to egg quality and also brings about a reduction in the production cost. It can therefore be recommended that 100% RCSE fibre sources replacement in layer diet could be adopted.

Keywords: oven-dried, roasted, cassava starch effluent, performance, egg quality

Introduction

The acceptance of poultry birds in Nigeria is noteworthy and can be attributed to the unlimited advantage associated with poultry production and other value chain. (Heise *et al.*,2015) [6] argue that poultry birds are good sources of protein either as eggs or meat. They further explained that the production of poultry birds is relatively cost effective, thus, making it possible for low income farmers to start up the business. In addition to the benefits of the poultry, Ojo (2003) [9] and Aboki *et al.*, (2013) [1] remarked that poultry eggs and meat are more affordable for low income earners compared to other sources of animal protein. This adds to the relative importance of poultry to agriculture.

In recent years, the cost of feed ingredients has increased at an alarming rate due to competition with the human food industry, increased production of bio-fuel and droughts in some parts of Africa and invariably had impact on the feed industries (USDA, 2015) [14].

Not only regarding the price and the availability of feed ingredients that caused the challenge but also the ability to produce high quality products in a cost-effective manner. This calls for ever exploration of alternative cheaper feed resources in order, and to replace expensive and sometimes scarce feed ingredients for livestock production, in order to relieve the food-feed/Human-Animal competition in the future. In the coming years, poultry producers will definitely have to look beyond maize and other cereal grains because of their low availability; cost and inability to keep pace with the geometric increase in poultry production.

Cassava is one of the suppliers of energy among staple crops and can potentially completely replace maize as an energy source in poultry diets (Aderemi *et al* 2006) [2]. Cassava is believed to represent the future of food security in some developing countries. After adding value to the farm produce, varieties of products were obtained among which are fried cassava granules, cassava dough, fermented cassava flour, cassava chips, cassava flakes cassava starch etc. thus most time leads to having important by-products utilizable in the livestock sectors. One of such by-product is cassava starch effluent.

This by-product is usually enormous especially when starch is produced in large scale (Ikuemonisan *et al*., 2020) [8]. Therefore, this research was aimed at the use of cassava starch effluent as fiber sources in layers feed with special focus on animal performance in terms of egg production and egg quality.

Materials and Methods

The experiment was conducted at the poultry unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo state. Cassava Starch Effluent was gotten from Psaltry International Company Limited, Alayide-wasimi village, Ado-Awaye, Iseyin, Oyo State, Nigeria.

First part was oven-dried at 105^0C for 4 hours after which a constant weight was attained as described by Ahn *et al*., (2014) [3] to obtain Oven-dried Cassava Starch Effluent (OCSE). Second part was roasted in a very hot-flat frying pan. The roasting process was achieved at 120°C for 20 min (Sanni and Jaji, 2003) [13] to obtain Roasted Cassava Starch Effluent (RCSE).

Diets were formulated while Corn bran and wheat offal were replaced with oven dried cassava starch effluent and roasted cassava starch effluent at the rate of 50%, 100% as shown in table 1.

Two hundred and twenty-five (225) birds was used, which was divided into five (5) treatments of fifty (45) birds per treatment and further divided into three replicates containing fifteen (15) birds per replicate, while the birds were housed at the rate of three (3) birds per cell in the 3 tiers cage system used. The experimental design employed was Completely Randomized Design.

Data on daily feed intake and egg production were documented and used to estimate the hen-day production (HDP) and cost of production. Sample eggs (5) per replicate were randomly selected on weekly basis and used for egg analysis. Parameters measured are; egg weight (g), egg length (cm), egg width (cm), shell weight (g), egg shell thickness (mm), albumen height (cm), yolk height and diameter (mm) and used to estimate; egg shape index, yolk and albumen weight (%), shell surface area (SSA), yolk index and haugh unit (HU). All data obtained were subjected to analysis of variance (ANOVA) using SPSS 2010 software package. Where differences occur among the means, it was separated using new Duncan multiple range test of same software.

Table 1: Experimental diet laying birds at varying of processed cassava starch effluent

Feed Ingredients	50% OCSE	100% OCSE	50% RCSE	1000% RCSE	Control
Fixed Ingredients	59	59	59	59	59
Soya Bean Meal	5	5	5	5	8
GNC	15	15	15	15	12
W/O	2.5	0	2.5	0	5
Corn Bran	8	0	8	0	16
OCSE	10.5	21	-	0	0
RCSE	-	0	10.5	21	0
	100	100	100	100	100
Crude Protein (%)	17.6	17.2	17.6	17.2	17.8
Energy (Kcal/kg)	2636.2	2609.1	2636.2	2609.1	2637.2

Fixed ingredients: Maize 45, Fish (72%) 3, Bone 4, Oyster Shell 6, Salt 0.25, Lysine, 0.25, Methionine 0.25, Premix 0.25

OCSE; Oven-dried Cassava Starch Effluent, RCSE; Roasted Cassava Starch Effluent

Results and Discussion

Results

There is no significant (P>0.05) difference in all parameters measured under performance characteristics of the birds as shown in the Table 2, although the control happens to be the most expensive in comparison with other treatments with varying inclusion. It was also observed that diet having roasted cassava starch effluent, was having better values in feed cost per 30 eggs, feed cost per 12 eggs, than oven-dried cassava starch effluent-based diets, Hen Daily Production was observed to be very high under treatment with zero inclusion. There was absolutely no significant (P>0.05) different in feed intake per kg of egg laid across the varying levels of cassava starch effluent inclusion. In as much as statistically, no difference was observed between the inclusion levels. Spartial differences was recorded with respect to data collected as at 50% OCSE fibre replacement level, economic benefit was evident as costs of production of feed was lower compared to costs at 0% inclusion.

Table 2: Performance Indices of Laying Birds Fed Oven Dried and Roasted Cassava Starch Based Diets

Parameters	50% OCSE	100% OCSE	50% RCSE	100% RCSE	0%	SEM
HDP	76.83	76.06	76.76	73.21	78.29	1.00
FeedIntake/kgEgg	2.68	2.69	2.52	2.66	2.64	0.042
FeedCost/kg	530.64	524.91	494.27	524.84	532.38	9.32
FeedIntake/egg	0.15	0.15	0.14	0.14	0.15	0.00
FeedCost/30egg	893.61	880.43	820.21	825.22	846.90	13.43
Feedcost/12eggs	357.88	352.17	328.33	330.09	339.46	5.37
Feedcost/kg	194.58	193.65	195.29	196.48	201.88	1.49

^{abc}mean with different superscript are significantly different p>0.05

HDP; Hen-day production, OCSE; Oven-dried Cassava Starch Effluent, RCSE; Roasted Cassava Starch Effluent

Egg quality parameter follows the same trend except for the egg weight, shell thickness and yolk index that were observed to be significantly (P<0.05) different across the various fibre replacement levels (Table 3). Egg weight was observed to be higher at treatments with roasted cassava starch effluent while the least value (54.46) was recorded from the control though statistically (P>0.05) similar to oven dried cassava starch effluent-based diets, while other egg quality parameters happened to be similar (P>0.05) all through. More so, inclusion of OCSE and RCSE at 100% fibre replacement appeared to favour overall egg protein quality as seen in the haugh unit vaue (91.35 and 90.85 respectively).

Table 3: Quality Indices Eggs Collected from Laying Birds Fed Oven Dried and Roasted Cassava Starch Based Diets

Parameters	50% OCSE	100% OCSE	50% RCSE	100% RCSE	0%	SEM
Egg Weight (g)	54.63^{b}	54.48^{b}	57.29^{a}	57.70^{a}	54.46^{b}	0.59
Shell Thickness (mm)	0.47^{b}	0.47^{b}	0.52^{a}	0.51^{ab}	0.48^{ab}	0.01
Egg Shape Index	0.52	0.53	0.50	0.50	0.50	0.01
Hugh Unit	89.01	91.35	90.66	90.85	89.81	0.84
Shell Surface Area	70.04	69.87	72.30	72.65	69.88	0.50
Yolk Index	0.51^{ab}	0.54^{ab}	0.50^{b}	0.55^{a}	0.50^{b}	0.01
%Albumin	62.67	60.55	57.33	61.98	62.93	0.87
% yolk	23.37	26.00	28.10	24.31	24.25	0.75
% Shell	10.60	10.97	10.89	10.48	10.27	0.15

^{abc} mean with different superscript are significantly different p>0.05

Discussion

It was observed from the results that the test ingredients (oven-dried cassava starch effluent and roasted cassava starch effluent) utilization, irrespective of the inclusion level has no significant effect on Hen-day production as shown in Table 2 above which happens to be in accord with the findings of Herwig *et al.*, (2019) [7]. The reduced production cost and same production strength at 21% inclusion level of processed cassava starch effluent, established the improved or better utilization of the material, contrary to decreased feed intake and poor utilization of whole cassava meal at 25% inclusion level which was attributed to high dietary fiber level and/or residual level of hydro cyanide in the diets (Aderemi *et al.*, 2006) [2].

Non-significant (P>0.05) contained from feed intake indicated that the acceptability of feeds with test ingredient and similarity in their nutritional quality. Monogastric animal will consume diets in which maize portion has been partially or wholly replaced by agro-industrial by-products until energy requirement is fulfilled (Donkoh and Attoh-kotoku, 2009) [4].

Egg shape index, haugh unit, shell surface area, percentage albumin, percentage yolk and percentage shell were statistically similar (p>0.05) across the various inclusion levels, the significant different (P<0.05) observed with respect to egg weight, shell thickness and yolk index were even in favour of RCSE based treatments. This denotes that nutrients supplied by the diets or ingredients were comparably utilized by the birds across all treatments, nutrient deficiency especially metabolizable energy and crude protein usually and significantly affect egg size, and egg quality (Oluyemi and Robert, 2000) [10]. Contrary to decrease feed intake as the level of whole cassava meal (WCM) inclusion increased which was attributed to poor utilization of WCM due to either high dietary fiber level or residual level of hydro cyanide in the diets reported by Salami and Odunsi (2003) [12], the processing (starch extraction together with Oven-drying and/or roasting) might have greatly influenced the degree of elimination of limiting factors such cyanide far below the tolerance level which could have impaired the growth rate (Fasuyi, 2005) [5]. Anti-nutritional factors of feed ingredient reduce by subjection of agro industrial by-products various processing methods and fortification of diet with various feed additive (Rafiu *et al*., 2016) [11], thus made the nutrients readily available for the birds, and therefore enhanced their productivity.

Conclusion and Recommendation

The production strength is an indication that the inclusion of processed cassava starch effluents in layer diets up to 21% adequately maintained body weight, helps in sustaining efficiency of egg production, better egg weight, haugh unit and yolk index recorded. 100% replacement of fibre source could therefore be adopted.

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