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LAYING PERFORMANCE OF JAPANESE QUAILS FED PROCESSED AFRICAN BREADFRUIT SEEDS IN NOTHERN GIUNEA SAVANNAH

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ABSTRACT

An experiment was conducted to see the effect of parboiled and varying levels of boiled African breadfruit seeds (ABS) fed to laying Japanese quails. The laying quails were assigned to six treatment groups (control, parboiled, 10, 20, 30 and 40 minutes boiled ABS) with each of the treatments replicated three times in a completely randomized design (CRD). The diets were formulated to be iso-nitrogenous (22% CP) and iso-caloric (2700 Kcal/kg ME). Water and feed were offered *ad libitum*. Results shows that all parameters at the performance of laying quails fed varying levels of boiled ABS were significantly ($P<0.05$) different with most of the significant level favouring the treatment T4 which is boiling at 20 minutes. Inclusion of boiled ABS into the diet of quails improved the internal and external egg quality of laying quails. It could therefore be concluded that ABS can serve as alternative nutritive source of nutrition in the diet of laying quails.

Key words: African breadfruit seed, performance, boiling.

INTRODUCTION

African breadfruit (*Treculia Africana*) seeds has been neglected and under exploited. It's a tropical tree belonging to the taxonomic family *Moracceae* (Osuji and Owei, 2010) found mostly along the guinea savannah to the forest zone of Nigeria and the tree is known by various tribal names in Nigeria (Okonkwo and Ubani 2012). For identification, Ugwu *et al*. (2001) described the plant to produce large, round, compound fruits covered with pointed outgrowths, with seeds buried in the spongy pulp. It is also known for its large fruit heads which is rich in energy, protein, minerals and vitamins (Osabor *et al*., 2009). The pulp is nutritious if adequately processed to reduce the levels of some anti-nutrients contained in the seeds which may interfere with the process of digestion and performance when fed to birds and animals (Amusa *et al*., 2002; Ijeh *et al*., 2010). When the seeds are in its raw form, it can be processed by boiling, toasting, fermentation before it can be incorporated into diet for poultry and rabbits to replace part of the carbohydrate or protein source in their diet (Oladunjoye *et al*., 2010; Oso *et al*., 2010). Also, report shows that the potential industrial uses of the bread fruit have not been sufficiently explored and investigated, even where it is used, determining what processing method and performance on livestock has not been evaluated other than attempts aimed at determining its chemical composition (Oso *et al*., 2010). The objective of this study therefore was to determine the effect of various boiling duration of ABS on the performance of laying Japanese quails.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Animal Science Teaching and Research Farm, Ahmadu Bello University, Zaria. The geographical location of Zaria is within the Northern Guinea Savannah

zone of Nigeria which lies between latitude, 11^0 14' 44' N and longitude 7^0 38' 65'E, at an altitude of 610 mm above sea level. The climate is relatively dry, with a mean annual rainfall of 700-1400 mm (Ovimaps, 2014).

Method of processing of African breadfruit seed

Raw African breadfruit seeds were parboiled at 100º C for 15 minutes to facilitate dehulling. The dehulled seeds were sun dried for about 48 hours. Batches of 20kg African breadfruit seeds sun dried were subjected to various durations of cooking time which includes: 10, 20, 30 and 40 minutes and each duration of boiling represents a treatment. For each boiling time, 40 litres of water was brought to boiling point in a 200- litre drum container. A batch of 25kg African breadfruit seed was then immersed into the boiling water. From this point, the specified time for boiling was taken. At the end of this period of boiling, excess water was drained off and the boiled seeds were sun-dried.

Formulation

Six experimental diets were formulated for the study. The African breadfruit seeds (ABS) were included at 5% level in the diets (Table 1).

Treatment 1: 0 inclusions of ABS

Treatment 2: Parboiled ABS

Treatment 3: ABS cooked for 10minutes

Treatment 4: ABS cooked for 20minutes

Treatment 5: ABS cooked for 30minutesTreatment 6: ABS cooked for 40minutes

Table 2 shows the proximate composition and energy levels of the laying diets.

Experimental Design and management of experimental birds

Two hundred and seventy (270) quail hens were used for this study. The birds were assigned to six treatment groups (Table 1) with their average initial body weight taken. Each treatment group of 45 birds was further subdivided into three replicates of 15 birds per pen in a completely randomized design (CRD). Experimental diets and water were provided *ad libitum.* The diets were fed to the quail hens for a period of thirteen weeks. Body weight of birds in each replicate group was taken at the beginning then fortnightly till the end of the study. The percent change in body weight was calculated by subtracting the initial weight of birds from the final weight. Feed intake, weight of feed/bird/day was determined by obtaining the differences between the quantity of feed offered and the left over on 24 hour period. Egg production was recorded daily and pooled weekly to calculate hen-day egg production and hen-housed egg production. Feed conversion ratio was calculated weekly. Cost per dozen eggs was calculated based on the prevailing market prices of the feed ingredients. All eggs laid each day in a replicate group were weighed to determine average egg weight. Mortality record was recorded.

Table 1: Composition of diets based on raw African breadfruit seeds and African breadfruit seeds boiled at 100°C for varying length of time for laying quails (7- 20 weeks)

	Duration of boiling of breadfruit seeds (minutes)					
Feed Ingredients	**Control**	**PB(0)**	**10**	**20**	**30**	**40**
Maize	40.00	40.00	40.00	40.00	40.00	40.00
Groundnut cake	27.9	26.50	26.50	26.50	26.50	26.50
ABS	0.00	5.00	5.00	5.00	5.00	5.00
Soya bean cake	10.00	10.00	10.00	10.00	10.00	10.00
Maize offal	14.00	10.40	10.40	10.40	10.40	10.40
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	5.00	5.00	5.00	5.00	5.00	5.00
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Premix*	0.30	0.30	0.30	0.30	0.30	0.30
Lysine (%)	0.25	0.25	0.25	0.25	0.25	0.25
Methionine (%)	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated composition						
ME (Kcal/kg)	2700.00	2722.00	2722.00	2722.00	2722.00	2722.00
Crude protein (%)	22.00	22.00	22.00	22.00	22.00	22.00
Calcium (%)	2.41	2.41	2.41	2.41	2.41	2.41
Phosphorus (%)	0.39	0.41	0.41	0.41	0.41	0.41
Crude fibre (%)	4.85	4.52	4.52	4.52	4.52	4.52
Ether Extract (%)	4.42	4.85	4.85	4.85	4.85	4.85
Lysine (%)	1.11	1.13	1.13	1.13	1.13	1.13
Met+Cys (%)	0.86	0.83	0.83	0.83	0.83	0.83

*Bio-mix premix supplied per kg diet-vitamin A, 10,000.00 i.u; vitamin $D_3$2,000.00 i.u; Vitamin E 23,000.00mg; Niacin 27.5mg; Vitamin $B_1$1.800mg; Vitamin B_6 30mg; Vitamin B_{12}0.015mg, Vitamin K_3 200mg; Pantothenic Acid 7,500; Biotin H_2 0.06; Folic Acid 0.75mg; Chlorine Chloride 300.00mg; Cobalt 0.2mg; Copper 30mg; Iodine 1.00mg; Iron 200.00mg; Manganese 0.04mg; Selenium 0.2mg; Zinc 30mg; Antioxidant 1.25mg, PB= Parboiled.

Table 2: Proximate composition and energy levels of experimental diets based on parboiled African breadfruit seeds (ABS) and ABS boiled at 100°C for varying length of time for laying quails (7-20 weeks)

	Boiling durations of ABS (minutes)					
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**
Parameters (%)	**Control**	**PB(0)**	**10**	**20**	**30**	**40**
Dry matter	93.36	93.48	94.44	92.82	92.77	93.48
Crude protein	21.52	21.56	20.98	20.88	21.43	22.01
Crude fibre	5.86	6.04	6.23	5.49	5.38	5.77
Ether Extract	4.76	4.89	5.20	5.58	4.78	5.99
Ash	7.67	7.39	8.04	8.21	7.67	7.98
NFE	60.19	60.12	59.55	59.84	60.74	58.25
Energy (MJ/Kg)	13.42	18.40	15.66	19.66	18.60	16.33

NFE= Nitrogen Free Extract, PB= Parboiled

RESULTS AND DISCUSSION

Table 3 shows the effect of duration of boiling of African breadfruit seeds on the performance of laying quails during the experimental period. The result showed significant ($P<0.05$) difference in all parameters measured for hen performance and egg production as well as weight of egg. The diet cooked for 20 minutes had the best performance and was similar to parboiled diet and diet cooked for 30 minutes in most parameters compared. However, finial body weight was higher in the treatment boiled for 20 minutes, which was similar to those cooked for 10 minutes, while the raw and parboiled treatments yielded the lowest body weights while daily feed intake and total feed intake increased as the boiling durations increased. Quails fed the raw ABS diet had significantly reduced growth rate (evidenced by body weight changes) compared to those fed the boiled (10, 20, 30 and 40 minutes) ABS diets. This observation is consistent with the report of Kaankuka *et al*. (2000) and Amaefule and Obioha (2001). These authors reported that raw and improperly heated legume seeds fed as the main source of protein in diets for monogastrics can depress growth and efficiency of feed utilization. However, the general improvement in weight gain as the duration of boiling of ABS increased in the present study also agreed with the reports of Kaankuka *et al*., (2000), Amaefule and Obioha (2001) and Bawa *et al*. (2003). There were improvements in feed intake, weight gain, and feed conversion ratio in the quails fed cooked ABS when compared to the raw ABS in the laying phase and this may have led to the improvement of the efficiency of protein utilization. This observation is in consonance with the reports of Tuleun and Patrick (2007) that the nutritive value of mucuna seeds was improved when subjected to cooking. These were attributed to better protein absorption, detoxification of antinutritional factors, higher palatability and availability of amino acids in the diets.

Table 4 showed effect of duration of boiling of African breadfruit seeds on external egg quality characteristics of Japanese quail birds from 7-20 weeks of age. The result showed significant ($P<0.05$) difference in all parameters (egg weight, egg shell weight, egg diameter, shell thickness egg specific gravity amongst others) measured except egg height. Treatment cooked for 20 minutes was significantly ($P<0.05$) higher in all parameters measured except for egg height and weight. Diet cooked for 20 minutes recorded highest in egg shell weight which was similar to 10 minutes and 30 minutes cooked diets. Lin *et al*. (2004), Bawa *et al*. (2011) and Tuleun *et al*. (2013) reported that egg mass or weight can be used as criterion in assessment of nutritional value especially if they are obtained from birds of the same age, breed and health status. The egg weight recorded from this study of feeding quails with ABS is higher than those reported by Tuleun *et al*. (2013). The values obtained for shell, egg weight, shape index, egg shell thickness in this study is in consonance with the reports of Nazligul *et al*. (2001), Orhan *et al*. (2001) and Zita *et al*. (2013) who reported an increase in egg weight and its component parts at 20 – 25 weeks of age and that the age of quails influenced egg weight.

Table 3: The effect of duration of boiling of African breadfruit seeds (ABS) on the performance of laying quails (7-20 weeks)

Parameters	Duration of boiling of African breadfruit seeds (minutes)							
	T_1	T_2	T_3	T_4	T_5	T_6		
	Control	PB (0)	10	20	30	40	SEM	LOS
Initial weight (g/bird)	176.67	176.67	176.67	176.67	176.67	176.67	-	
Final weight (g/bird)	178.06^{c}	177.40^{c}	185.21^{ab}	186.07^{a}	182.78^{b}	181.18^{bc}	1.39	*
Change in body weight (%)	1.39^{c}	0.73^{c}	8.54^{ab}	9.40^{a}	6.11^{b}	4.51^{bc}	1.39	*
Daily feed intake (g/bird/day)	23.47^{c}	23.56^{c}	23.72^{bc}	24.64^{ab}	25.13^{a}	24.01^{b}	0.50	*
Total feed intake (g/bird/day)	2464.10^{c}	2476.41^{c}	2491.03^{bc}	2587.18^{ab}	2638.46^{a}	2521.28^{b}	53.13	*
FCR (feed/g egg)	3.24^{b}	2.99^{a}	3.24^{b}	3.06^{ab}	3.22^{ab}	3.34^{c}	0.09	*
FCR/dozen egg	2.99^{b}	2.76^{a}	2.99^{b}	2.83^{b}	2.98^{b}	3.08^{c}	0.08	*
Hen-day egg production (%)	75.80^{a}	75.79^{a}	66.80^{c}	75.15^{ab}	69.25^{bc}	74.47^{b}	2.98	*
Peak egg production (%)	88.57^{a}	90.79^{a}	83.81^{b}	89.21^{a}	88.89^{a}	87.62^{ab}	1.91	*
Hen house egg production (%)	67.28^{b}	70.58^{a}	65.21^{c}	70.14^{a}	69.25^{ab}	64.11^{c}	1.35	*
Age at peak production (day)	59.67^{bc}	55.33^{a}	57.33^{b}	54.00^{a}	56.00^{ab}	61.00^{c}	2.03	*
Average total number of eggs	70.64^{b}	74.11^{a}	68.47^{bc}	73.65^{a}	72.71^{ab}	67.31^{c}	1.42	*
Average total weight of eggs (g)	660.22^{b}	717.79^{a}	666.67^{b}	733.69^{a}	709.73^{a}	663.89^{b}	13.35	*
Average egg weight (g)	9.35^{c}	9.69^{b}	9.74^{ab}	9.95^{a}	9.76^{ab}	9.86^{ab}	0.11	*
Mortality (%)	1.67^{b}	1.00^{ab}	0.33^{a}	1.00^{ab}	0.33^{a}	2.00^{c}	0.41	*

^{abc}= means with different superscript on the same row are significantly different ($P < 0.05$), SEM= Standard Error of Mean, LOS (*) = Level of significance ($P < 0.05$),
FCR = Feed Conversion Ratio, PB= Parboiled

Table 4: The effect of duration of boiling of African breadfruit seeds (ABS) on External egg quality characteristics of Japanese quail birds at 7-20 weeks of age

	Duration of boiling of ABS (minutes)							
	T_1	T_2	T_3	T_4	T_5	T_6		
Parameters	**Control**	**PB (0)**	**10**	**20**	**30**	**40**	**SEM**	**LOS**
Egg weight (g)	9.87^{b}	10.32^{a}	10.47^{a}	10.57^{a}	10.59^{a}	10.27^{a}	0.196	*
Egg height (mm)	31.57	32.00	32.20	32.00	32.30	31.73	0.46	NS
Egg diameter (mm)	24.43^{b}	24.67^{a}	24.57^{b}	24.97^{a}	24.83^{a}	24.63^{a}	0.17	*
Egg shape index	0.77^{a}	0.77^{a}	0.76^{b}	0.78^{a}	0.77^{a}	0.77^{a}	0.006	*
Egg shell weight (g)	1.01^{c}	1.09^{b}	1.12^{a}	1.14^{a}	1.12^{a}	1.08^{b}	0.02	*
Egg shell thickness (mm)	0.20^{c}	0.21^{b}	0.21^{b}	0.22^{a}	0.20^{c}	0.21^{b}	0.003	*
Egg shell percentage (%)	10.26^{b}	10.52^{ab}	10.70^{a}	10.76^{a}	10.62^{ab}	10.51^{ab}	0.91	*
Egg shell index	3.28^{b}	3.37^{ab}	3.42^{a}	3.44^{a}	3.39^{ab}	3.36^{ab}	0.06	*
Egg specific gravity	1.090^{b}	1.096^{a}	1.10^{a}	1.10^{a}	1.096^{a}	1.096^{a}	0.002	*

^{ab}= means with different superscript on the same row are significantly different ($P < 0.05$), SEM= Standard Error of Mean, LOS (*) = Level of significance ($P < 0.05$), PB= Parboiled

Table 5 showed the effect of duration of boiling African breadfruit seeds on internal egg quality characteristics of Japanese quail birds. The results revealed significant ($P<0.05$) differences in all parameters (yolk weight, yolk height, albumen weight, albumen height, haugh unit amongst others) measured. Inclusion of cooked ABS at various time showed significant differences when compared with the control due to the better utilization of the diets. The value observed from this study in most parameters as shown on the table agrees with the values obtained from the reports of Nazligul *et al*. (2001), Orhan *et al*. (2001), Tuleun *et al*. (2013) and Zita *et al*. (2013). The differences in some of the internal egg quality traits of Japanese quails in this study from other reports may be due to age of the birds as it affects eggs and storage length.

Table 5: The effect of duration of boiling of African breadfruit seeds (ABS) on internal egg quality characteristics of Japanese quail birds at 7-20 weeks of age

	Duration of boiling of ABS (minutes)							
	T_1	T_2	T_3	T_4	T_5	T_6		
Parameters	**Control**	**PB (0)**	**10**	**20**	**30**	**40**	**SEM**	**LOS**
Albumen height (mm)	44.67^{b}	45.33^{a}	40.33^{b}	42.33^{b}	42.67^{b}	44.00^{b}	2.49	*
Albumen width (mm)	34.73^{ab}	34.20^{b}	34.90^{ab}	35.53^{ab}	36.03^{a}	35.50^{ab}	0.79	*
Albumen weight (g)	4.91^{b}	4.98^{b}	4.89^{b}	5.18^{a}	5.12^{a}	5.04^{ab}	0.09	*
Albumen index	1.29^{b}	1.33^{a}	1.16^{b}	1.19^{b}	1.19^{b}	1.24^{b}	0.57	*
Albumen percentage	49.64^{a}	48.3^{b}	46.78^{c}	49.02^{ab}	48.35^{b}	49.08^{ab}	1.06	*
Yolk height (mm)	10.30^{a}	10.27^{a}	10.20^{a}	10.40^{a}	10.20^{a}	10.07^{b}	0.13	*
Yolk diameter (mm)	28.50^{a}	25.57^{b}	25.93^{b}	25.73^{b}	26.10^{b}	26.07^{b}	1.06	*
Yolk weight (g)	3.42^{b}	3.57^{b}	3.62^{a}	3.62^{a}	3.70^{a}	4.21^{a}	0.31	*
Yolk index	0.37^{b}	0.40^{a}	0.39^{ab}	0.41^{a}	0.39^{ab}	0.39^{ab}	0.12	*
Yolk percentage	34.59^{b}	34.60^{b}	34.52^{b}	34.23^{b}	34.81^{b}	41.08^{a}	2.95	*
Haugh unit	90.84^{a}	90.79^{ab}	87.97^{b}	88.99^{ab}	89.01^{ab}	90.17^{ab}	2.84	*

^{ab}= means with different superscript on the same row are significantly different ($P < 0.05$), SEM= Standard Error of Mean, LOS (*)= Level of significance ($P < 0.05$), PB= Parboiled

CONCLUSION AND APPLICATION

1. The inclusion of boiled African breadfruit seed in the diets of laying quails did influenced their performance.
2. Boiled African breadfruit seed diets did not show any negative effect on both external and internal egg quality parameters.

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