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PERFORMANCE OF GROWER RABBITS FED GRADED LEVELS OF SUNDRIED BREADFRUIT (*Artocarpus altilis*) PEEL MEAL IN SOUTH WESTERN NIGERIA

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Abstract

A total of thirty rabbits of mixed breeds and mixed sexes with an average initial weight of 0.8kg were used to evaluate the effect of varying inclusion levels of sundried breadfruit peel meal on growth performance, carcass attributes and economics of production of rabbits. The feeding trial which lasted for eight weeks was performed using the thirty rabbits which were divided into five experimental groups having six replicates per treatment in a completely randomized design. Five experimental diets were formulated such that sundried breadfruit meal replaced maize at 0, 15, 30, 45 and 60% levels for diets 1, 2, 3, 4 and 5 respectively. The parameters measured were feed intake and weight gain; Feed Conversion Ratio; carcass and offal attributes and economics of production. The results showed that maize replaced with breadfruit meal in diets of grower rabbits had no effect (P>0.05) on growth performance of the tested animals. No significant difference (P>0.05) was recorded in the feed intake (89.49-91.10g), weight gain (15.65-17.52g), feed conversion ratio. Also, weights of rabbit primal cuts and offals were not influenced (P>0.05) by the inclusion of breadfruit peel meal in rabbit diet. Replacing maize with sundried breadfruit peel meal in rabbit diet significantly (P< 0.05) reduced the cost of feed consumed and cost of rabbit meat produced. In conclusion, maize could be replaced with sundried breadfruit meal in rabbit diet up to 60% inclusion level.

Keywords: *Breadfruit Peel Meal, Carcass Attributes, Economics of Production, Feed intake, Growth Performance.*

INTRODUCTION

The rabbit (*Oryctolagus cuniculus*) has the potential as a meat producing animal particularly on subsistence type of Agriculture or as a backyard enterprise to meet the human requirement for the consumption of animal source of protein especially in developing countries such as Nigeria. The level of animal protein consumption in developing countries has been reported to be very low and, it influenced the health and wellbeing of the ever increasing population (Bamgbose *et al*., 2002). Characteristics such as small body size, relatively short generation interval, rapid growth rate and the ability to utilize forages and fibrous agricultural by- products are some of the attributes in favor of rabbit production (Odeyinka *et al.*, 2008). These attributes of rabbits, and others, rank it high on the preference scale of the desirable livestock to be raised in order to tackle the problem of low animal source protein in developing countries.

In the composition of the diet of rabbits, maize is the major feed ingredient required to formulate feed due to its high energy content and it is essentially required for rabbits under commercial intensive production management system. However, due to the competition among humans, animals and brewing industries, the price of maize had risen beyond what the livestock producers can afford. The rising cost of feeding rabbits calls for a search for alternative feedstuff sources that could be produced cheaply and readily available for most part of the year. Such feedstuff should not be a major food item for humans or a major raw material for agro-based industries and should be fairly high in nutrients (Olayemi, 2004).

Breadfruit, which belongs to the family *Moraceae*, is an energy rich fruit tree that

has been successfully introduced to the forest, savanna and derived savanna regions of Nigeria. It produces fruits 2 to 3 times in a year (Tindal, 1965) and the number of fruits produced is very high (Soetjipto and Lubis, 1981). This tree with a good biomass yield is often produced in surplus between March and May, leading to heavy loss due to its inability to store for long period (Amusan *et al.*, 2002).

Potential livestock uses of the breadfruit peel have not been sufficiently explored and investigated other than attempts aimed at determining its chemical composition. Breadfruit as alternative energy feedstuffs in rabbit nutrition has not been extensively explored although Ravindran and Silvakanesan (1995), Chochelim (1987) and Udoh (1981) reported that breadfruit could be processed into meal suitable for poultry. There is presently a dearth of information on the possible utilization of breadfruit peel as a source of energy in rabbit feeds. The present study, therefore, attempted to study the effect of varying inclusion levels of breadfruit peel meal on the growth performance, carcass characteristics and economics of production of grower rabbits.

MATERIALS AND METHODS

Study site

The experiment was carried out at the rabbitry Unit of the Teaching and Research Farm, Adeyemi College of Education Ondo in Ondo state, South-western, Nigeria. The study area is located between the Latitude 7˚1ˈN and Longitude 4˚83ˈE (Maps-street view, 2015). Ecologically, the area lies in the rain forest zone with two raining seasons from February-July and September –November.

Collection and Processing of Test Ingredient

Breadfruit peels were gathered from people eating the fruits as food in Ondo town, Nigeria. The peels were sundried for seven days to reduce the moisture content. The dried product was hammer milled to obtain a meal called Sundried Breadfruit Peel Meal (SBFPM).

Experimental Animals and their Management

Thirty rabbits of cross breed and mixed sexes with an average initial weight of 0.8kg were used for the feeding trial. The animals were housed in a large wooden wire mesh cage. The cages were further partitioned into mini cages such that each hutch consists of one rabbit. The cages were arranged in a pen whose dwarf wall was made of blocks as a base and the upper part made of wire mesh to permit flow of ventilation and the pen was roofed with iron sheet.

Individual animal was weighed and randomly distributed into five groups of six animals. Each group was randomly assigned to the five diets in a Completely Randomized Design (CRD) at the end of the acclimation period of two weeks.

Experimental Diets

Five experimental diets were formulated in such a way that Sundried Bread Fruit Peel Meal (SBFPM) replaced maize at 0, 15, 30, 45 and 60% for diets 1, 2, 3, 4 and 5, respectively. The rabbits were fed with their respective experimental diets *ad-libitum* for eight weeks experimental period.

Data Collection

Data were collected on feed intake and weight gain. Feed intake was estimated as the difference between feed served and the left over. Initial weights of rabbits were recorded at the beginning of the experiment and at the end of every week to determine the weight gain. At the end of 8^{th} week feeding trial, two rabbits were selected from each treatment making a total of ten rabbits. These were weighed, starved overnight and slaughtered. Bleeding was carried out by the neck slit using sharp knife. Carcass was prepared according to the norms of the World Rabbit Science Association (WRSA) (Blasco and Ouhayoun, 1996). Carcass

were eviscerated, cut into primal parts and weighed and expressed as percentage of dressed carcass weight. The internal and external offals were also weighed and the weights of primal parts were expressed as percentage of dressed weight. Feed conversion ratio was determined from daily feed intake and daily weight gain.

$$\text{Feed Conversion Ratio} = \frac{\text{Daily Feed Consumed}}{\text{Daily Weight Gain}}$$

Data Analysis

Data collected were subjected to Analysis of variance while means were separated using Duncan Multiple Range Test with the aid of Statistical Package for Social Sciences (SPSS, 2001).

RESULTS AND DISCUSSION

The result of growth performance and economics of production of rabbits fed varying inclusion levels of Sundried Breadfruit Peel Meal as presented in Table 2 shows that there was no significant difference (P>0.05) in total, feed consumed by the rabbits meaning that the inclusion of sundried breadfruit peel meal did not influence feed consumption in the rabbits. Also, no significant effect (P>0.05) was recorded in the total, weight gain for the animals across the diets. There were no significant differences in feed to gain ratio of rabbits fed control diet when compared with other treatment diets. The cost per kg of the experimental rabbits, likewise, had no significant difference among the treatments but a significant reduction in the cost per kg of feed was recorded among the treatments as the inclusion levels of sundried breadfruit peel meal in the diets of the rabbits was gradually increased.

The result of the carcass characteristics and organ weight of the rabbits fed maize replaced with sundried bread fruit meal diet showed that there were no significant differences (P>0.05) in the live weight (1625.00-1775.00g) of the rabbits fed control diet when compared with rabbits fed tested diets. However dressed carcass weight (g) was significantly lower (P<0.05) in rabbit fed control diet (724.00g) when compared with rabbits fed 15% level of sundried bread fruit meal diet (850.00g). It is important to remark that dressed carcass were significantly (P<0.05) or numerically higher among rabbits fed breadfruit peel meal based diets compared to those placed on the control diet.

The test diets did not confer any significant effect (P>0.05) on the rabbits' carcass length (31.50-33.25cm), thigh (37.36-40.40g), shoulder (25.21-27.80g) and ribs (9.50-12.07g) weights of rabbits fed control diet compared with those on test diets.

The results showed no significant difference (P>0.05) in the loin weights of rabbits fed the control diet and other test diets, except those fed 30% breadfruit peel meal that was significantly higher (P<0.05) (21.88g). This therefore suggests that the inclusion of breadfruit peel meal in rabbit diet did not confer any negative effect on the weight of rabbit primal cuts.

The weights of rabbits' internal and external offals as influenced by varying inclusion levels of sundried breadfruit meal diets presented in Table 4 showed that the pluck weight (kg) was significantly lower (P<0.05) in rabbits fed test diets (0.31-0.41kg) when compared with rabbits fed control diet (0.66kg). The result of the heart, intestine, pelt and head weights showed that there was no significant difference (P>0.05) in the rabbits fed control diet when compared with rabbits fed test diets. This result suggests that the inclusion of breadfruit peel meal in rabbits' diets is not deleterious. The liver weight was significantly higher (P<0.05) (3.33) in rabbits fed 60% SBFPM compared with those on 0-40% SBFPM based diets (2.64-2.76). This could probably be attributed to the residual effect of anti-nutritional contents in breadfruit peel meal.

The high crude fiber (CF) content of breadfruit peel (9.01%) according to Bakare *et al.* (2012) which might have possibly influenced the CF levels of the experimental diets must have increased the feed intake of the rabbits as opined by Adeniyi (2003). However, the results of this study which showed no significant difference (P>0.05) in the total feed consumed of the rabbits fed varying inclusion levels of sundried breadfruit peel meal is contrary to the findings of the author but similar to the findings of Ayoola (2014) who reported that dietary treatment did not have effect on total, weekly and daily feed intake when replacing maize with sun-dried rice straw meal. However, the result of the total weight gain among the treatments which expresses no significant difference (P>0.05) shows that the inclusion of breadfruit peel meal did not depress growth performance. This result is in conformity with the report of Ogunsipe and Agbede (2012) that there was no significant difference (P > 0.05) in average weight gain when replacing maize with millet offal but contrary to the opinion of Abimbola *et al.* (2010) that the powdery nature of sundried breadfruit meal could affect feed intake, digestibility, resulting in respiratory infection and consequently reduction in growth. This result also contradicts the report of Ortiz *et al.* (2011) that the live weight, and feed conversion were impaired significantly (P<0.01) with 20 % inclusion of the breadfruit tree meal in fattening swine diets.

The no significant difference in the feed conversion ratio of the rabbits among the treatment is in agreement with that of Olagunju (2001) who replaced maize with sun-dried cassava peel meal in growing rabbit diet and Ayoola and Akinbani (2011) who reported that diet had no effect (P> 0.05) on feed conversion when replacing maize with yam peel meal. Oladunjoye and Ojebiyi (2011) also reported that the weight gain and feed conversion efficiency of grower rabbits fed maize replaced with cooked breadfruit peel meal up to 50% recorded no significant effect. The result of the dressed carcass weight and length obtained in this study was similar to that reported by Abimbola *et al.* (2010) when they fed rabbit with maize replaced with sundried breadfruit meal (SBFM). The significantly or numerically higher dressed carcass weight of rabbits on test diets over those on control diet was in concert with the report of Lebas and Laplace (1991) who stated that variation in nutritional status and requirement of growing rabbits modify the anatomical equilibrium of the carcass, composition of carcass tissues and components of the muscle.

The results of the weight of the hearts of the tested rabbits which shows no significant difference along the treatment compared with the control contradicts the previous study reported by Oladunjoye and Ojebiyi (2011) which recorded significant increase (P<0.05) in the weight of the hearts of rabbits fed maize replaced with cooked breadfruit meal diet. The increase was attributed to the anti-nutritional factors in the meal. However, the significant difference (P>0.05) in the weight of the liver of the rabbits along the treatment showing highest value at the 60% inclusion level of SBFPM can be attributed to the presence of residual anti nutritional factors in the meal which possibly trigger the physiological response of the liver to detoxify the anti-nutritional components. Uchegbu *et al.* (2004) attributed similar increase observed in the heart and liver of chicken fed raw *Napoleona imperialis* seed meal to anti nutritional factors.

The cost implication of rabbits fed maize replaced with breadfruit peel meal showed that the price per kg feed reduced significantly (P<0.05) with gradual increase in the inclusion levels of sundried breadfruit peel meal in the diets. This reduction is achieved because the procurement of breadfruit peel is almost at no cost due to the fact that it is a by-

product and not consumed by man. It is also readily available around. Price per kg of rabbits produced was significantly lower in rabbits fed maize replaced with bread fruit peel meal diets when compared with maize based diet. The results showed that replacing maize with breadfruit peel meal in rabbit diet significantly ($P< 0.05$) reduced the price of the feed and cost of the rabbit meat produced. However, economics of production revealed lesser cost of feed/kg rabbit fed breadfruit peel meal diet compared to those on maize based diets from 15-60% SBFPM inclusion levels. This agreed with various authors on the use of alternative energy source to replace maize in rabbit diet.

CONCLUSION

It could be concluded from this study that maize could be replaced with sundried breadfruit meal in rabbit diet up to 60% inclusion level. Maize replaced with Sundried Breadfruit Peel Meal up to 60% in rabbit diet did not influence the growth performance negatively. However the enlargement of the liver of experimental animals suggests the presence of anti-nutritional factor which may be eliminated through processing like soaking or cooking before its inclusion in the diet. The substitution of maize with Sundried Breadfruit Peel Meal has also reduced the cost of feed and eventually the cost of rabbit meat produced. This suggests that it is economical to replace maize with Sundried Breadfruit Peel Meal in rabbit diet. This will reduce the cost of the feed needed to produce rabbit.

RECOMMENDATIONS

From this study, it is recommended that breadfruit peels should either be soaked or cooked and properly sun-dried before use. Feeding rabbit with maize replaced with breadfruit meal up to 60% level of inclusion is preferred and people should be encouraged and educated on the possibility of replacing maize with Sundried Breadfruit Peel Meal in rabbit diet as this will also help to reduce the competition for maize between man and the livestock industries.

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Table 1: Composition of experimental diets

	Inclusion Levels (%)				
Ingredients	0	15	30	45	60
Maize	32	27.2	22.4	17.6	12.8
Sundried Breadfruit Peel Meal	-	4.8	9.6	14.4	19.2
Soya-bean Meal	9	9	9	9	9
Bone Meal	3.5	3.5	3.5	3.5	3.5
Wheat Offal	6	6	6	6	6
Fish Meal	5	5	5	5	5
Palm-kernel Cake	16.5	16.5	16.5	16.5	16.5
Corn-bran	27.5	27.5	27.5	27.5	27.5
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

Table 2: Growth Performance and Economics of Production of Rabbits fed graded levels of Sundried Breadfruit Peel Meal Diets.

	Levels of Inclusion (%)					
Parameters	**0**	**15**	**30**	**45**	**60**	**SEM**
Total Feed Consumed (g)	4463.67	4385.17	4404.83	4415.00	4425.17	33.51 ^{NS}
Total Weight Gain (g)	808.33	858.33	791. 67	779.17	766.67	27.08 ^{NS}
Feed Gain Ratio	5.56	5.16	5.68	5.70	6.16	0.25 ^{NS}
Cost Per Kg Feed (₦)	109.46^{e}	105.14^{d}	100.82^{c}	96.50^{b}	92.18^{a}	1.13*
Cost Per Kg Rabbit (₦)	608.60	542.35	572.32	570.15	567.98	23.23 ^{NS}

^{a,b,c,d,e} Mean values within row carrying different superscript differ significantly ($P<0.05$)

***** = Significant

NS = Not Significant

SEM = Standard Error of Mean

Table 3: Carcass Characteristics and Organ Weight of Rabbits fed varying inclusion levels of Sundried Breadfruit Peel Meal Diet.

	Levels of Inclusion (%)					
Parameters	**0**	**15**	**30**	**45**	**60**	**SEM**
Live weight (g)	1750.00	1775.00	1700.00	1775.00	1625.00	25.00 ^{NS}
Dressed carcass (g)	724.00^{a}	850.00^{b}	800.00^{ab}	800.00^{ab}	800.00^{ab}	15.86*
Carcass length (cm)	31.50	32.75	33.00	32.50	33.25	0.41 ^{NS}
Thigh (%)	40.21	40.46	39.75	39.25	37.56	0.89 ^{NS}
Shoulder (%)	27.80	25.21	26.88	26.50	25.25	0.47 ^{NS}
Loins (%)	15.39^{a}	18.27^{ab}	21.88^{b}	21.75^{ab}	19.89^{ab}	0.94*
Ribs (%)	12.07	11.95	12.00	11.25	9.50	0.47 ^{NS}
Hind and Fore Limb (%)	2.58^{b}	2.18^{ab}	1.97^{a}	1.87^{a}	2.59^{b}	0.11*

^{a,b} Means within row carrying different superscripts differ significantly (P<0.05)
* = Significant
NS = Not Significant
SEM = Standard Error of the Mean

Table 4: Weight of Rabbit Internal and External Offals (in % of dressed weight) as influenced by varying inclusion levels of Sundried Breadfruit Peel Meal Diet.

Parameters (%)	Level of Inclusion (%)				SEM
	0	15	30	45	
	60				
Pluck	0.66^{b}	0.39^{a}	0.41^{a}	0.37^{a}	0.05*
Heart	0.31^{a}				0.02^{NS}
Liver	0.23	0.23	0.12	0.17	0.09*
Intestine full of content	0.19				1.42 ^{NS}
Pelt	2.75^{a}	2.64^{a}	2.76^{a}	2.65^{a}	0.38 ^{NS}
Head	3.33^{b}				0.27 ^{NS}
	25.82	19.68	23.55	19.87	
	27.65				
	9.97	9.25	10.10	8.93	
	10.71				
	12.81	11.27	11.78	11.29	
	12.31				

^{a,b} Means within row carrying different superscripts differ significantly (P<0.05)
* = Significant
NS = Not Significant
SEM = Standard Error of the Mean