NSUK Journal of Science & Technology, Vol. 6: No. 2. 2016. pp. 52 - 57 ISSN: 1597- 5527

GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING RABBITS (*ORYCTOLAGUS CUNNICULUS*) FED GRADED LEVELS OF INDUSTRIALLY PRODUCED BREWERS DRIED GRAINS (BDG) MEAL

IBRAHIM, H.,[1]* ADAMA,[2] T. Z, AYANWALE,[2] B. A., AREMO[2]. A, ADEKOJO., S. A.[3] , AND NIRANJAN KUMAR[4]

[1]Department of Animal Production, Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria.

[2]Department of Animal Production, Federal University of Technology, Minna. Niger state. Nigeria.

[3]Department of Agriculture, Federal College of Education, Kontagora, Niger State, Nigeria.

[4]Department of Crop Production, Faculty of Agriculture, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria.

Corresponding Author: shehuski@gmail.com

ABSTRACT

Seventy five weaned rabbits aged between 5 and 6 weeks and of mixed breeds and sexes, with average initial weights of 450 g were used to investigate the growth performance and nutrient digestibility of rabbits. (*Oryctolagus cunniculus*) fed diets containing brewers dried grains. The rabbits were allotted into five dietary treatments; T_1 (0 % as the control diet), T_2, T_3, T_4 and T_5 (containing 10, 20, 30 and 40% brewers dried grains) of three (3) replicates with five (5) rabbits per replicate in a completely randomized design. Data were collected on body weight gain, feed intake, feed conversion ratio and carcass characteristics, the trial lasted twenty weeks. Data generated from the study were subjected to analysis of variance (ANOVA). The variations in means were separated using the Duncan Multiple Range. (Duncan,1955). The initial weight, final weight, total weight, feed conversion ratio and daily weight gain were not significantly ($P>0.05$) affected by the dietary treatments. The result showed that there were significant ($P<0.05$) differences in some of the carcass parameters measured. Despite the non significant differences observed on the growth performance parameters, brewers dried grains inclusion at 10 % gave the highest and best values of (1801.67 and 9.48 g) final weight gain and feed conversion ratio and could be recommended as the best inclusion level for growing rabbits.

Keywords :brewers dried grain, growing rabbit, growth and carcass characteristics

INTRODUCTION

The rapid increase in population of the world has resulted in a huge increase in the demand for animal protein which is essentially higher in quality than that of plant protein. The average protein intake in Nigeria is about 5.5g of animal protein per day which is low and far below Food and Agriculture Organization of the United Nations (FAO) recommendation of 77 g of animal protein per day (FAO, 2006). The nutritional requirement is particularly crucial in a developing country such as Nigeria where malnutrition and starvation are the major problems faced by millions of rural dwellers. The low protein intake is an indication of shortage of high quality protein food in the diet of Nigerians. Meat consumption has been estimated to be 1.6 metric tonnes (Tabor, 1990). Odunsi (2003) reported that the rapid growth of human and livestock population is creating an increase in the needs for food and feed in less developed countries. The author demanded that alternative feed resources must be identified and evaluated in order to meet this need.

FAO (2012) stated that Nigeria is a protein deficient country and characterized by low protein intake. The protein deficiency in the diets can be primarily remedied through the consumption of either protein rich plants or animal feed. Protein from animal sources is in short supply in Nigeria due to the rapid increase in human population. This is coupled with the decrease in livestock population due to several factors including diseases, deforestation, drought, scarcity and high cost of quality feeds among others (FAO, 2012). These factors have raised the cost of animal protein to a level that is almost beyond the reach of the ordinary citizen. This situation has therefore given rise to a considerable increase in the demand for fish to supplement the needed animal protein intake (Akankali *et al.*, 2011).

In recent times, nutritionists have highlighted the important role of animal protein in human health, particularly during pregnancy and early life on the subsequent development of children. Maternal protein intake throughout pregnancy is related to birth size, and therefore future viability of children. Where protein under-nutrition occurs, dietary protein from any source is important in human development; but increased intake of meat protein appears superior for future development (Waterlow, 1998). Sources of dietary protein, in particular, have had a greater effect on prenatal development and size of the new-born child (Moore, 2002).

Rabbit is a good source of meat, which is of high quality with low cholesterol and therefore suitable for special diets. It has the advantage of being able to consume fibrous feedstuffs that are not utilized by humans because of the presence of their large caecum (Aduku and Olukosi, 1990). Meat from rabbit of any age has been reported to be highly appreciated for human consumption, tender, of high culinary (cooking) yield and above all a source of healthy food as it is good in coronary heart patients (Nodu *et al.*, 2003; Hernandez, 2004). Rabbit is required in a large number for medical and cosmetic industries (Dalle Zotte, 2002). Additional income on a sustainable basis can be generated from rabbits (Taiwo *et al*., 2005) It is also ideal in meeting the protein need of the developing countries because according to International Federation for Science – IFS (1978) rabbits are prolific and have relatively low incidence of epidemic diseases when careful management is practised with standard hygiene. Increased rabbit production is one way of meeting the animal protein

requirement of the Nigeria populace (Iyeghe- Erakpotobor *et al.,* 2002)

Industrialization has left us with a lot of waste materials in both urban and rural areas among which are grain wastes such as Brewers Dried Grain (BDG) and Sorghum Brewer Dried Grains (SBDG). These wastes results after the removal of the grains or seeds; which are either thrown away, burnt in air, or left to litter our environment, causing pollution.

BDG is the dried extract of barley malt alone or in mixture with other cereal grain from the manufacture of beer. It may contain pulverized dried spent chops in an amount not exceeding 3 % evenly distributed. BDG is also medium level protein feedstuff used in various animals' feeds, an excellent source of high quality protein and digestible fibre. Aduku (1990) reported that BDG contained reasonable amount of crude protein (CP) (27.30 %), fat (7.4 %), crude fibre (CF) (11.7 %) and metabolisable energy of 2513 kcal/kg . However, Amaefule *et al,* (2006) reported 19-25 % crude protein, 10-22 % crude fibre, 3030-3171 Kcal/kg metabolisable energy. The level of crude fibre usually recommended for all purpose rabbit ration is 12 to 14 % as fee**d.**

This study therefore evaluated the effects of BDG from barley on the carcass yield and organ characteristics of rabbits in the humid tropics of Nigeria

MATERIALS AND METHODS

Location of Experimental Site

The research was conducted at the Teaching and Research Farm of the Department of Animal Production, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State, Nigeria. Minna is situated between latitude 9^{o} 31 and longitude 9^{0} 45 North, and Longitude $6^{0}31$ and $6^{0}45$ East of the equator. The area falls within the Southern guinea savannah vegetation zone of Nigeria with mean annual rainfall of between 1100 and 1600 mm and a mean temperature of 30^{0}C. (Usman, 2011). The relative humidity is between 21 to 73 % (NSAMDA, 2012). Minna experiences two distinct seasons (dry from November to March and wet of rainy season, from April to October). The soil is full of ferruginous substances and gneiss and magnetic rocks. The town is situated on a large gentle depression with undulating hill and uplands flanking the north east side of the town (Menakaya and Floyd, 1980)

Sources of Test Ingredients, Experimental Animals and Their Management

The rabbits were obtained locally within Minna, Brewers Dried Grains from brewery industry at Aba, while Maize grain and ground nut cake, vitamin/ mineral premix, salt, bone meal were bought from Minna

Seventy five (75) weaned rabbits of mixed breeds and of both sexes (forty-five females and thirty males), aged between five and six weeks were randomly allotted to five treatments groups. Each treatment had three replicates with five rabbits per replicate (two males and three females) The rabbits were housed intensively in a well constructed hutches that were made of wire and woods with trays to collect the faeces as well as for easy cleaning of the hutches. The hutches were equipped with feeders and drinkers. The hutches were cleaned twice daily throughout the study period. Which lasted twenty weeks after one week of adjustment period? The rabbits on all the treatments were kept under close observation for proper monitoring indication of ill-health. The rabbits were dewormed against endoparasite using ivermecin, Coccidiosis was treated once using sulphadimidine and multivitamin soluble powder (Vitalyte) was given as an anti-stress.

Experimental Diets

The diets formulated were designated T1 – T5 and had the test ingredients brewers dried BDG incorporated into the diets at the level of 0, 10, 20, 30 and 40 % inclusion for the experiments. The feed ingredients in the formulated diets consisted of maize, groundnut cake , bone meal, salt and vitamin/mineral (premix) All the feed ingredients were ground in an Hammer mill, mixed and pelleted before being fed to the rabbits. The diets were supplemented with 100 g of *Amaranthus hybridus* as a source of forage in the evenings. The diets were formulated to give 20 % crude protein needed for rabbits growth. Prior to the start of the experiment, the animals were fed normal diet and allowed an adjustment period of one week to enable the animals get acclimatized to their cages and diets. The diets and fresh water were provided *ad-libitum* throughout the duration of the experiment

Proximate Analysis

Chemical composition of the BDG and the compounded experimental diets were determined using the AOAC (2002) method. The parameters determined were dry matter, crude protein, crude fibre, ash content and nitrogen free extract

Data Collection

Data on growth and other performance parameters were collected over a period of twenty (20) weeks using a Camry weighing scale for weekly weighing of the animals. Feed intake was determined on daily basis by weighing the feed offered to the animals and the quantity of feed left unconsumed by the following morning. The difference in weight between the two gave the quantity of feed consumed per day. Mean daily weight gain and feed conversion ratio were determined as:

$$\text{Daily weight gain} = \frac{\text{Final weight} - \text{initial weight (g)}}{\text{Number of days}}$$

$$\text{Feed conversion ratio} = \frac{\text{Quantity of feed consumed (g)}}{\text{Total Weight gain by the rabbits}}$$

Carcass Characteristics

At the end of the growth stage two rabbits male and female per replicate were selected to reflect the average weight of the group, the rabbits were tagged, fasted for 12 hours and weighted to determine the live weight of the animals. They were slaughtered by cutting the jugular vein to allow proper bleeding. Determination of the body weight was the difference between the live weight and slaughtered weight. The animals were dressed by removing the pelts. Evisceration was carried out immediately by removing the viscera and intestine. The weight of the carcass, head and internal organs were taken individually and expressed as percentage of the live weight. Evisceration was accomplished by cutting the flank region with a knife and removing the visceral organs such as the heart, lungs, kidneys, liver and weighed individually and expressed as percentage of the live weight.

Live weight (g)

The live weights of the rabbits were obtained before slaughter using a weighing scale. Slaughter Weight (g)

After slaughtering the rabbits were allowed to bleed properly and completely. The weight was taken and recorded. The blood loss weight was calculated using the formular as blood loss = live weight – slaughter weight.

Eviscerated Weight (g)

The external and internal organs of the rabbits were all removed and the remaining carcasses were weighed as the eviscerated weight.

Dressing Percentage

Dressing Percentage was obtained using the formula below;

$$\text{Dressing per centage} = \frac{\text{Eviscerated weight}}{\text{Live weight (g)}} \times 100$$

according to (Biya *et al*., 2003).

Data Analysis

Data generated from the study were subjected to analysis of variance (ANOVA) using statistical package (SAS, 2002). The variations in means were separated using the Duncans Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of the experimental diets presented in Table 1 indicated that they were sufficient to meet the nutrient requirements of growing rabbits. This is in line with the recommended values (Nworgu, *et al*., 2000). The crude Protein levels in the diets were 20.50-20.28 %. However, Fasanya and Ijaiya (1997) recommended range of between 16-20 % of CP levels for better performance of growing rabbits. The crude fibre levels of the diets were 5.20, 5.80, 6.20, 7.20, and 8.10 % (T1- T5), respectively. The level increased with increase in the levels of inclusion of BDG in the diets. This was however, lower than the value of 10-16% recommended by John-Delaney (2006). The energy levels of the diet were higher than the range of 2500 -2800 Kcal metabolisable energy level reported by Aduku and Olukosi (1990).

The proximate composition of the BDG (Table 2) showed that crude protein was 20.42 % which was within the range of 12 -30 % reported by Agbede and Alebor (2003) and Fayemi *et al.* (2011). The crude fiber value of 7.4 % obtained was also within the range of 5.8-9.0 % reported by Adama *et al.* (2007) but lower than 18.4% and 10.60 % reported by Lukerfahn and Cheeke (1991) and Johnson-Delaney (2006) for growth and 14-15 % in comparison with other monogastric animals (Okpanachi *et al.*, 2010).

Table 1: Composition of the Experimental Diets Brewers dried Grains Inclusion levels (%)

Ingredients (%)	T1	T2	T3	T4	T5
	0	10	20	30	40
Maize	57.00	51.00	45.00	38.00	32.00
BDG	0.00	10.00	20.00	30.00	40.00
Groundnut cake	38.00	34.00	30.00	27.00	23.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Salt	0.50	0.50	0.50	0.50	0.50
Premix*	2.00	2.00	2.00	2.00	2.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated values					
ME Kcal/kg	2918.78	2862.84	2806.90	2741.22	2685.98
Crude Protein (%)	22.20	22.68	23.13	23.6	24.39
Crude fibre (%)	2.95	3.84	4.77	5.57	6.42
Ether extract (%)	5.76	5.89	6.03	6.21	6.35
Ash (%)	2.83	3.01	3.20	3.42	3.61
Calcium (%)	0.09	0.11	0.13	0.15	0.18
Phosphorus (%)	0.40	0.44	0.49	0.53	0.58
Lysine (%)	0.81	0.81	0.82	0.83	0.84
Methioniine (%)	0.30	0.32	0.34	0.38	0.41

*Provided per kilogram of diet: vitamin A, 10000 IU (retinyl acetate); cholecalciferol, 3000 IU; vitamin E, 8.0 IU (DL-a-tocopheryl acetate); K, 2.0 mg; thiamine, 2.0 mg; pyridoxine, 1.2 mg; cyanocobalamin, 0.12mg; niacin, 1.0 mg; pantothenic acid, 7.0 mg; folic acid, 0.6 mg; choline chloride, 500 mg; Fe, 60 mg; Cu, 8.0 mg; Zn, 50mg; Co 0.45 mg; $I_2$0 mg; Se, 0.1 mg.

Initial weight, final weight, total weight gain, total concentrate intake, total forage intake, weekly feed intake and feed conversion ratio presented in Table 4 showed no significant differences (P> 0.05) between the treatments (T1-T5). The result conform with that of Abdulmalik (1997) who conducted a similar experiment with rabbits fed brewers waste and obtained similar results in all the growth performance parameters measured. However, T2 (10 %) BDG had the highest final body weight of 1801.1g followed by T4, T3, T1, and T5 respectively (1789.33, 1771.00, 1729.3 and 1771.00g). Abdulmalik (1997) recommended 20 % inclusion level of sorghum brewers waste for better performance of rabbits. The highest daily feed intake was observed in T5 (102.30 g), this could be due to high level of inclusion of BDG. This contradicts the report of Cheeke and Patton (1986) which stated that, when dietary fiber levels were increased, rabbits consumed greater quantity of feed in order to compensate for the loss of endogenous protein. The lowest concentrate intake observed in T1 (control) could be due to non inclusion of BDG in the diet, hence maize was not replaced with BDG and excess consumption of maize (starch) in the diet may lead to enteritis and possible death, (Tisch, 2006). High values obtained in T5 (40 % BDG) 12924.30 g total concentrate intake may likely be due to presence of high crude fiber in the diets and the highest inclusion level of Brewers Dried Grains.

Table 2: Proximate Composition of the Experimental Diets on Dry matter basis

Composition	Levels of Brewers dried Grains (%)				
	TI	T2	T3	T4	T5
	0	10	20	30	40
Crude Protein	20.50	20.42	20.35	20.30	20.28
Crude fiber	5.20	5.80	6.20	7.20	8.10
Ether extract	8.90	9.08	8.50	8.20	7.80
Ash	7.40	7.80	8.10	7.70	8.90
Nitrogen free extract	58.00	56.90	56.85	55.60	54.92
Total	100.00	100.00	100.00	100.00	100.00

The non significant difference P> 0.05) in forage intake in all the treatments group conform with the report of Cheeke and Patton (1986) who attributed the effective utilization of forage or roughages due to the presence of a caecum and microbial activities in the hindgut, among other factors. Daily weight gains were 9.10, 9.70, 9.40, 9.60 and 9.10g (T1, T2, T3, T4, and T5). T5 (40 % BDG gave the highest value in feed conversion ratio compare to other treatments (T1 –T4). There was a significant difference in the feed conversion ratio within treatments. The results showed that feed conversion ratio increased with increase in BDG. This might have been as a result of the crude protein in the diet was made available for convertibility into tissue due to the high metabolisable energy. The lowest feed conversion ratio (9.50) was recorded in T2 while the highest (11.30) was obtained in T5. Akinmutimi and Anakebe (2008) observed that higher feed conversion ratio of a diet is an indication of inferority of the diet. It showed that the lower level of inclusion of BDG produced better feed conversion ratio.

Table 3: Proximate Composition of Brewers Dried Grains on Dry matter Basis

Items (%)	BDG
Crude protein	20.42
Crude fibre	9.69
Ash	14.03
Ether extracts	12.19
Nitrogen free extracts	43.69
Energy kcal/kg	3435.70

The results of the carcass yield of rabbits fed diet containing varying levels of BDG meal are presented in Table 5 The result showed non-significant (p>0.05) effect on live weight, slaughter weight, eviscerated weight, dressing percentage, fore leg, hind leg, lumba sacral region and tail expressed as percentage live weight. The value obtained for cervical thorax and neck were significantly different (p<0.05). The weight of cervical thorax ranged from 7.63% in T5 and 11.89% in T2. The highest value for neck was recorded in T5 with 3.28% and lowest in T4 with 2.74%. These values are similar with those reported by Igwebuike *et al.* (1995) who fed Sorghum waste to growing rabbits.

The results of the organ weights expressed as percentage live weight are presented in Table 6 Significant (p<0.05) differences were observed on intestine, spleen, gall bladder, lungs, kidney and liver except the heart that recorded no significant (p>0.05) effect with highest values of 0.34% in both T2 and T3 followed by T5 with a value of 0.29% and lowest values were in T1 and T4 (0.25% and 0.26%) respectively). The value of liver obtained in this study is lower than 3.47 % obtained by Adekojo (2015) who fed rabbits *Leucaena leucacephala* leaf meal processed with different methods

The result of carcass by-products of rabbits fed BDG expressed as percentage of live weight recorded a significant (p<0.05) difference as presented in Table 7. Fore limbs, head, skin and abdominal fats expressed as percentage of live weight recorded a significant (p<0.05) difference. The result showed that T5 recorded the highest value of 1.07% of forelimbs and lowest value of 0.90% in T3. Head recorded a value range of 8.98% to 10.18% in T2 and T4 respectively. Abdominal fat (lipid) recorded a highest value in T2 (4.00%) and the lowest in T5 (1.98%). The values obtained in this study were higher than 1.41 % obtained by Udedibe *et al* (2012) when laying hens were fed sun-dried cassava tuber meal, brewers dried grains and palm oil to simulate maize.

Table 4. Growth performance of rabbits (*Oryctollagus cunniculus)* fed graded levels of Brewers dried grains

Parameters	Levels of Brewers dried grains (%)							
	T1	T2	T3	T4	T5			
	0	10	20	30	40	SEM	CV	LS
Initial weight (g)	451.67	449.00	452.00	453.67	449.00	2.65	1.01	NS
Final weight (g)	1729.33	1801.67	1771.00	1789.33	1728.67	64.67	6.35	NS
Total weight gain (g)	1279.33	1351.67	1321.00	1339.33	1278.67	64.67	8.52	NS
Daily weight gain (g)	9.14	9.71	9.44	9.57	9.13	0.46	8.52	NS
Total conc. Intake (g)	11190.70	11466.70	11407.00	11902.70	12924.30	591.11	8.60	NS
Total forage intake (g)	1400.00	1400.00	1400.00	1400.00	1400.00	0.00	0.00	NS
Total feed intake (g)	12590.70	12866.70	12807.00	13302.70	14324.30	591.11	7.77	NS
Daily feed intake (g)	89.93	91.91	91.50	95.01	102.32	4.22	7.77	NS
Feed Conversion Ratio	9.81	9.48	9.69	9.92	11.29	0.61	10.55	NS

SEM = Standard Error Mean; CV = Coefficient of Variation; LS = Level of Significance; NS = Not Significance (P > 0.05) .

Table 5: Carcass Yield (%) of rabbits (*Oryclollagus cunniculus*) fed BDG

Parameters	Levels of Brewers dried Grains (%)							
	T1 0	T2 10	T3 20	T4 30	T5 40	SEM	CV	LS
Carcass Yield								
Live wt(g)	1750.00	1766.70	1725.00	1666.70	1766.70	93.54	9.34	NS
Slaughter wt (g)	1675.00	1625.00	1600.00	1583.30	1700.00	85.23	9.02	NS
Eviscerated wt (g)	866.70	795.00	825.00	775.00	866.70	90.69	19.02	NS
Dressing %	60.57	61.47	56.63	56.10	60.23	3.65	10.71	NS
Fore leg %	8.47	9.36	8.71	9.11	9.02	0.31	6.05	NS
Hind leg %	13.28	13.55	13.83	12.86	13.30	0.45	5.79	NS
Cervical thoracic %	9.12^{b}	11.89^{a}	8.21^{b}	9.19^{b}	7.63^{b}	0.67	12.53	*
Lumber sac region	14.44	16.37	16.09	14.62	14.59	0.67	7.60	NS
Neck %	2.93^{c}	3.56^{a}	2.75^{c}	2.74^{c}	3.28^{b}	0.08	4.74	*
Tail %	0.29	0.29	0.29	0.31	0.31	0.54	32.03	NS

^{abc}= Means with the same letter in the same rows are not significantly (P>0.05) different, *= P<0.05
SEM = Standard Error Mean; CV = Coefficient of Variation.

Table 6: Internal Organs weight of rabbits fed BDG

Parameters	Levels of Brewers dried Grains (%)							
	T1 0	T2 10	T3 20	T4 30	T5 40	SEM	CV	LS
Intestine %	19.63^{a}	13.60^{b}	18.20^{a}	17.45^{a}	18.56^{a}	0.98	9.75	*
Spleen %	0.04^{b}	0.06^{a}	0.07^{a}	0.05^{ab}	0.05^{ab}	0.01	18.29	*
Gall bladder%	0.05^{ab}	0.07^{a}	0.04^{b}	0.05^{ab}	0.07^{a}	0.01	34.99	*
Heart %	0.25	0.34	0.34	0.26	0.29	0.03	19.02	NS
Lung %	0.62^{bc}	0.51^{d}	0.78^{a}	0.56^{bc}	0.69^{ab}	0.04	9.57	*
Kidney %	0.86^{ab}	0.73^{b}	0.94^{a}	0.75^{b}	0.86^{ab}	0.51	10.68	*
Liver%	2.21^{c}	2.42^{bc}	2.86^{a}	2.42^{ab}	2.93^{a}	0.12	7.9 2	*

^{abc}= Means with the same letter in thesame rows are not significantly (P>0.05) different; *= P<0.05
SEM = Standard Error Mean; CV = Coefficient of Variation

Table 7: Carcass by-products of rabbits fed BDG

Parameters	Levels of Brewers dried Grains (%)							
	T1 0	T2 10	T3 20	T4 30	T5 40	SEM	CV	LS
Blood %	3.07	2.89	2.95	2.91	2.96	0.13	7.53	NS
Fore limb %	0.96^{ab}	0.92^{b}	0.9^{ab}	0.99^{ab}	1.07^{a}	0.04	7.51	*
Hind limb %	2.19	2.03	2.29	2.13	2.23	0.12	9.77	NS
Head %	9.72^{ab}	8.98^{c}	9.08^{bc}	10.18^{a}	9.42^{bc}	0.23	4.19	*
Skin %	9.27^{bc}	8.70^{c}	9.83^{b}	10.91^{a}	11.06^{a}	0.27	4.64	*
Abdominal fat %	2.88^{ab}	4.00^{a}	2.05^{b}	2.61^{b}	1.98^{b}	0.35	22.62	*

^{abc}=Means within the same letter in the rows are not significantly (P>0.05) different; * = Significant at P<0.05
SEM = Standard Error Mean;CV = Coeffient of Variation; NS = Not Significance; LS = Level of Significance; NS = Not Significance

CONCLUSION

The present findings suggest that diets containing BDG up to 10% might be used as alternative sources of both protein and energy for growing rabbit without negative effects on the growth performance and carcass characteristics, because higher final weight and lower feed conversion ratio were recorded at this treatment level of BDG inclusion.

REFERENCES

Abdulmalik, M. E. (1997). Evaluation of brewers sorghum residue for growth and reproduction on rabbits, Paper presented at NAPRI Seminar Series on 10th June, 1997.

Adama, T.Z. and Nma, Y. B. (2002). An evaluation of feeding value of five types of forages fed to growing rabbits. *Journal of sustainable Tropical Agriculture Research, 4;45-49*

Adama, T. Z., Ogunbajo, S. A, and Mambo, M. (2007). Feed intake, growth performance and Nutrient Digestibility of Broiler Chicks Fed Diets Containing Varying Levels of Sorghum Dried Brewers' Grains. *International Journal of Poultry Science,* 6 (8): 592-59.

Adekojo, S. A. (2015). Effects of different methods of processing *Leucaena leucocepphala* leaf meal on growth, carcass and reproductive performance of rabbits.(*Oryctolagus cunniculus*). Ph.D. Thesis. Department of Animal Production. Federal University of Technology, Minna, Nigeria.

Aduku, A. O. and Olukosi, J. O. (1990). *Rabbit Management in the Tropics*. Living Book Series. First Edition. GV Pub. Abuja. FCT, Nigeria. *monogastrics and ruminant nutrition*. Davon Computers and Business Bureau. Samaru, Zaria, pp. 95-102.

Aduku, A. O. (2004). *Animal nutrition in the tropics; Feeds and feeding, pasture management, monogastrics and ruminants.* Publications. Abuja. FCT, Nigeria. *nutrition* . Davon Computers and Business Bureau. Samaru, Zaria, pp. 31-33.

Agbede, J. O. and Aletor, V. A. (2003). Chemical characterization and protein quality evaluation of leaf protein concentrates from *Glyricidia septum* and *Leucaena leucocephala, International Journal of Food Science and Technology,* 39(3): 253-261.

Akankali, J. S., Seiyaboh,,E. I. and Abower, J. F. N. (2011). *International Journal of Animal and Veterinary Advances*, 3(3): 144-155

Akinmutimi, A. H. and Anakebe, O. C. (2008). Performance of weaner rabbits fed graded levels of yam and sweet potato peel meal in place of maize-based diet. *Pakistan Journal of Nutrition*. 7(5): 700-704.

Amaefule, K. U., Onwudike, O. C., Ibe, S. N. and Abasiekong, S. F. (2006). Performance, Cost Benefit, Carcass Quality and Organ Characteristics of Pigs Fed Breeding in Nigeria.

AOAC, (2002). Association of Analytical Chemist. Official methods of analysis, 13th edition, Washington

Biya, A. J ., Kannan, A., Murgan, M. and Anil, K. K. (2003). Effect of different feeding system on the carcass characteristics of Newzealand White rabbit. Department of Livestock Production Management. College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerela. Royal, UK: CAB Editors *Nutrition and nutritional diseases*. In ; Manning , P.J., Ringler, D.H.and Newcorner, C.E.(Ed). *The biology of the laboratory rabbit*, 2nd ed. Academic Press, New York

Cheeke, P. R. and Patton, N. M. (1986). Effect of Alfalfa and dietary fiber on the growth performance of weaner rabbits". *Laboratory Animal Science*, 28:167-172.

Dalle Zotte, A. (2002). Main factors influencing the rabbit carcass and meat quality *Proceeding of the 7th World Rabbit Congress*, pp. 1-32. Valencia, Spain.

Duncan, D. B. (1955).New Duncans Multiple Range and Multiple F- test. *Biometrics* 11: 1-4

Fasanya, O. O. A. and Ijaiya, A. A. (1997). Effect of graded levels of dietary protein on growth and carcass characteristics of rabbits. *Paper presented at the 33rd Conference of the Agricultural Society of Nigeria* (ASN). NCRI, Baddegi, Nigeria.

Fayemi, P. O., Onwuka, C. F., Isah, O. A., Jegede, A.V., Arigbede, O. M. and Muchenje, V. (2011). Effects of mimosine and tanni toxicity on rabbits fed processed Leucaena leucocephala (Lam) De. Wit leaves. *African Journal of Agriculture Research*, 6(17): 4081-4085.

FAO. (2006). *Conference on protein from Animal Sources* Food and Agricultural Organization, Rome , Italy.

FAO. (2012). *Production Year Book* Vol, 40. Food and Agriculture Organization, Rome, Italy.

Hernandez, P. (2004). Calidad nutrcional de la came de conejo, Cunicultura 1:17-21quality and major factors influencing the rabbit carcass and meat quality. *Livestock Production Science*. 75:11-32.

IFS, (1978). International Federation for Science Workshop on rabbit husbandry in Africa. Monogor-Tanzania. December. 16-21, 20 p.

Igwebuke, J. O., Alade N. K. and Anyi, H. D. (1995) Effects of feeding graded levels of sorghum waste on the performance and organ weight of growing rabbits E. *African Journal Agriculture*, 60(40): 193-200.

Iyeghe, Erakpotobor G.T Ndolym Oyedipe E.O. Eduvie L.O., and Ogwu D. (2002). Effect of Protein Flushing on Reproduction Performance of Multifarious doe *Tropical Jounal Animal Science*, 5(1): 123-129.

Johnson-Delaney, C. A. (2006*). Anatomy and physiology of Rabbit and Gastrointestinal System, 2006* proceedings of UK; British Small Animal Association.

Lukefahr, S. D. and Cheeke, P. R. (1991). Rabbit project development strategies on subsistence farming systems through research applications. *World Animal Review*, 60: 26-35.

Menakanya, J. C., and Flord, B. N. (1980). Macmillan junior atlas for Nigerian secondary schools, 214 p.

Moore., K. J. and Jung., H. J. G. (2002). Lignin and fiber digestion . *Journal of Range Management*. 54: 420-430.

Nodu, M. B., Oguzor, N. S. and Onwunrah, F. (2003). Problem associated with rabbit farming in Ogba community of River State. *Proceedings of the 8th Annual Conference of Animal Science of Nigeria. (ASAN)*. Sept. 16-18, Federal University of Technology. Minna Niger State, Nigeria.

NSAMDA (2012). *Niger State Agricultural Mechanization Development Authority. Quarterly Report*, October – December, 58-59. *Newsletter*, 82(2): 44-45.

Nworgu, F. C., Osayomi, F.O., O.J. and Yusuf,,A.A. (2000). Economic importance of broilers fed varying levels of protein . *Proceeding of the 27th Annual conference of NSAP. March 17-21sy. FUTA-Nigeria. 235-238.*

Odunsi, A. A. (2003). Assessment of Lablab (*lablab purpureu*) leaf meal as a feed ingredient and yolk colouring agent in the diet of layer. *International Journal of Poultry Science*, 2(1): 71-74.

Okpanachi, U, Aribido, S. O. and Daikwo, I. S. (2010). Growth and haemotological response of growing rabbits to diets containing graded levels of sun-dried bovine rumen content. *Africa Journal of Food. Agriculture, Nutrition and Development.* 10(11) :57.

Olabanji, R. O,. Farimu, G. O., Akinlade, J. A. and Ojebiyi, O. O. (2007). Growth performance and haemotological characteristics of weaner rabbits fed different levels of sunflower mixture. *Proceedings of 32nd Annual Conference of the Nigerian Society for Animal Production*, March, 18-21 2007. University of Calabar, Nigeria.

Statistical Analysis System (SAS). (2002).Compter Software , Version 9 Statistic SAS institute Inc.cary, N.C. 27513, U.S.A.

Taiwo, A. A ., Adejuyigbe, A. D., Adebowale, E. A., Oshotan, J. S. and David, O. O. (2005). Performance and nutrient digestibility of weaned rabbits fed forages supplemented with concentrates. *Nigerian Journal of Animal Production*, 32, 74-78.

Tabor, J .G. (1990). The Fishing Industry in Nigeria: Status and Potential for Self-sufficiency in Production. National Institute of Oceanography and Marine. *Research Technical Paper*, 22: 1-8.

Udedibie, A., Chukwurah, B. I., Glory, O. J., Enyenihi, E., Helen O. Obikaonu & Okol, I.c. (2012) The use of sun-dried cassava tuber meal, Brewers' dried grains and palm oil to simulate maize in the diet of laying hens. *Journal of Agricultural Technology* . Vol. 8(4): 1269-1276

Usman, H. I. (2011). Effect of time of intercropping soy beans on weed suppression and performance of upland rice in southern guinea savanna of Nigeria. Ph..D. Thesis, Department of crop production . Federal University of Technology Minna. Pp 24.