# PERFORMANCE OF RABBITS (*ORYCTOLAGUS CUNNICULUS*) FED DIETS CONTAINING INDUSTRIALLY PRODUCED BREWERS DRIED GRAINS (BDG).

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**ABSTRACT**

*Seventy five weaned rabbits aged between 5 and 6 weeks and of mixed breeds and sex, 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 (BDG). The rabbits were allotted into five dietary treatments: $T_1$ (as the control diet), $T_2$, $T_3$, $T_4$ and $T_5$ (diets containing brewery by-products) 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 nutrient digestibility. Data generated from the study were subjected to analysis of variance (ANOVA) The variations in means were separated using the Duncan Multiple Range Test where there were significant ($P < 0.05$) differences. 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 of the nutrient digestibility showed significant ($P < 0.05$) differences in all the parameters measured. Based on these, BDG at 10 % gave the best performance and could be recommended as the best inclusion level of growing rabbits.*

**Keywords**: Brewers dried grain, weaned rabbit, growth and nutrient, digestibility

## 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 far below Food and Agriculture Organization of the United Nations (FAO) recommendation of 77g 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. He demanded that alternative feed resources must be identified and evaluated in order to meet this need.

The 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 food stuff. 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. 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. Sources of dairy 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, rich in protein, tender, of high culinary (cooking) yield and above all a source of healthy food as it is low in cholesteroll and good source of protein for 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 practiced 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 are also medium level protein feedstuff used in various animals' feeds, an excellent source of high quality protein and digestible fibre. Aduku (1993) reported that BDG contained reasonable amount of crude protein (27.30 %), fat (7.4 %), fibre (11.7 %) and metabolisable energy of 2513 kcal/kg metabolisable energy. 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.** In this research work, BDG from barley was used to evaluate the performance 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 savanna vegetation zone of Nigeria with mean annual rainfall of between 1100-1600 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)

### Test Ingredient

The test ingredient used was Brewers Dried Grain Meal (BDG) introduced at 0, 10, 20, 30 and 40% level of inclusion.

### Sources of Experimental Animals and Ingredients Used

The rabbits were obtained locally within Minna, BDGs from brewery industry at Abba, while Maize grain and ground nut cake, vitamin/ mineral premix, salt, bone meal were bought in Minna..

### Animals and Their Management

Seventy five (75) weaned rabbits of mixed breeds and of both sexes (forty-five females and thirty males), about five and six weeks old were randomly allotted to five treatments groups. Each treatment had three replicates with five rabbits per replicate (two males and three females) in a Completely Randomized Design (CRD). The rabbits were housed intensively in 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. The rabbits on all the treatments were kept under close observation for indication of ill-health. The rabbits were dewormed against endoparasites using ivermecin, Coccidiosis was treated using sulphadimidine while multivitamin soluble powder (Vitalyte) was given as anti-stress.

Prior to the start of the experiment, the animals were fed common diets and allowed an adjustment period of one week (seven days) to enable them get acclimatized to their cages and diets. The investigation lasted twenty (20) weeks after one week of adjustment.

### Experimental Diets

The diets formulated were designated T1 – T5 and had the test ingredients BDG incorporated into the ration at the level of 0, 10, 20, 30 and 40 % inclusion for the experiments. The feed ingredients in the formulated diets consisted of maize, ground nut 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. Cages were equipped with feeders and drinkers. Prior to the start of the experiment, the animals were fed common diets 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 experimental. .

### Proximate Analysis

Chemical composition of the Brewers Dried Grains (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 extra.

### Data Collection

Data on growth 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 using the following formulae according to Eustace *et al.* (2003):

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

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

### Digestibility Trial

A digestibility trial was conducted. Two rabbits were taken from each replicate group between $19^{th}$ and $20^{th}$ weeks of the experiment. Each day total droppings were collected separately from each replicate bulked and dried overnight at $80^{0}$C in an oven, ground and stored in air tight sample bottles. About 2 g of sub samples were taken for proximate analysis as recommended by (AOAC (2005). Apparent nutrient digestibility coefficient of the individual nutrients was calculated using the following formulae:

$$\frac{(\text{Amount of nutrient in feed consumed}) - (\text{Amount of nutrient in faeces})}{\text{Amount of nurient in fed consumed}} X100$$

Source**:** (Iyeghe – Erakpotobor *et al*., 2005).

**Data Analysis**

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

**RESULTS AND DISCUSSION**

The Proximate compositions of the experimental diets are presented in Table 1 indicate 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 level in the diets were 20.50 - 20.28. This is comparable to the submission of, Fasanya and Ijaiya (1997) who recommended a 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 increase in the trend of the result was probably due to levels of inclusion of BDG in the diets. This was however, lower than the value of 10-16 % by 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 Agbade and Alebor (2003), Ajit *et al.* (2010) and Fayemi *et al*. (2011).

**Table 1: Proximate composition of the experimental diets (BDG) on dry matter basis**

| | Levels of Brewers dried Grains (%) | | | | |
|---|---|---|---|---|---|
| Composition | T1<br>0 | T2<br>10 | T3<br>20 | T4<br>30 | T5<br>40 |
| Crude Protein | 20.50 | 20.42 | 20.35 | 20.30 | 20.28 |
| Crude Fibre | 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 |
| Calculated protein | 20.33 | 20.19 | 20.05 | 20.55 | 20.08 |
| ME ( Kcal/100 g) | 392.10 | 383.80 | 387.20 | 368.31 | 401.80 |

**Table 2. Proximate composition of Brewers dried Grains (BDG) on dry matter Basis**

| Items | BDG (%) |
|---|---|
| Crude protein | 20.42 |
| Crude fibre | 9.69 |
| Ash | 14.03 |
| Ether extract | 12.19 |
| NFE | 43.69 |
| Energy kca/100 g | 343.57 |

The Crude Fibre 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 Cheeke (1991). Initial weight, final weight, total weight gain, total concentrate intake, total forage intake, weekly feed intake and feed conversion ratio presented in Table 3 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 non significant differences in all the growth performance parameters measured. Treatment two (T2) 10% BDG had the highest final body weight of 1801.1 g followed by T4, T3, T1, and T5 (1789.33, 1771.0, 1729.3 and 1771.0 g). This does not agree with the report of Abdulmalik (1997) who suggested 20% inclusion level of sorghum brewers waste for better performance of rabbits. The highest daily feed intake was observed in T5 (102.3 g), which could be due to high level of inclusion of BDG. This contradicts the report of Cheeke and Patton (1980), which stated that, when dietary fibre 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, high values obtained in T5. (12924.3 g), total concentrate intake may likely be due to presence of high Crude Fibre in the diets and the highest inclusion level of BDG. The non significant difference P<0.05) in forage intake in all the treatments group conform to the report of Cheeke, (1986) who attributed the effective utilization of forage or roughages to the presence of caecum and microbial activities in the hindgut, among other factors. Daily weight gains were 9.1, 9.7, 9.4, 9.6 and 9.1 g (T1, T2, T3, T4, and T5). These were lower to the value of 10.8 g obtained by Adama and Nma (2002) when groundnut leaves were fed to rabbits. Olabanji *et al.* (2007) also obtained similar value when sunflower leaf meal was fed to rabbits. T5 gave the highest value in feed conversion ratio compared 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 inclusion. This might be as a result of the crude protein in the diet not being made available for convertibility into tissue due to the high metabolisable energy. The lowest feed conversion ratio (9.5) was recorded in T2 while the highest (11.3) was obtained in T5. Akinmutimi and Anakebe (2008) observed that higher feed conversion ratio of a diet is an indication inferiority of the diet. It showed that the lower level of inclusion of BDG produced better feed conversion efficiency.

**Table 3. Performance of rabbits (*Oryctollagus cunniculus)*** fed BDG

| | Levels of Brewers dried Grains (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | | | |
| Parameters | 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 | 8.6 | 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 | 12866.7 | 12807.0 1 | 3302.70 | 14324.30 | 591.11 | 7.77 | NS |
| Daily feed intake (g) | 89.93 | 91.91 | 91.51 | 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 |

[abc] Means with the same letter in the same rows are not significantly (P>0.05) different
SEM = Standard Error Mean; CV = Coefficient of Variation; LS = Level of Significance
NS = Not Significance

**Table 4. Nutrient digestibility of rabbits fed BDG**

| | Levels of Brewers dried Grains (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T5 | | | |
| Parameters | 0 | 10 | 20 | 30 | 40 | SEM | CV | LS |
| Dry matter | 70.28[a] | 68.01[ab] | 67.28[ab] | 66.35[ab] | 65.02[b] | 1.31 | 3.44 | * |
| Crude protein | 80.37[b] | 82.25[a] | 80.79[b] | 80.51[b] | 79.72[b] | 0.43 | 0.93 | * |
| Crude fibre | 24.99[d] | 38.22[c] | 43.99[b] | 58.28[a] | 59.71[a] | 1.11 | 4.31 | * |
| Ether extract | 80.37[b] | 84.39[a] | 84.21[a] | 84.52[a] | 84.77[ab] | 1.17 | 2.44 | * |
| Ash | 21.08[b] | 24.89[ab] | 24.39[ab] | 25.73[a] | 25.67[a] | 1.21 | 8.65 | * |
| Nitrogen free extract | 77.68[a] | 71.92[a] | 72.61[b] | 72.52 [b] | 71.97[b] | 0.81 | 1.87 | * |

[abc] Means with the same letter in the same rows are not significantly (P>0.05) different
SEM = Standard Error Mean; CV = Coefficient of Variation; LS = Level of Significance
NS = Not Significance

Nutrient digestibility values were significantly different in all the treatment groups. The lower values obtained for dry matter, crude protein and nitrogen free extract at 40 % level of inclusion of BDG could be attributed to higher fibre in the diet as suggested by NRC (1981). A high level of crude fibre (CF) increase hypomotility of the caecum resulting in prolonged retention time as fibre was discovered to stimulate hindgut motility; hence the digestive and metabolic importance of fibre to rabbits. The reduction in the nutrient digestibility of crude fiber fed 10, 20, 30 and 40 % BDG is not in agreement with the findings of Hechman and Mehner (1977) who reported better feed utilization by rabbit fed 20 % CF than those fed 5 % CF . The higher level of Crude Protein digestibility observed in rabbit fed 10 % BDG is in agreement with earlier findings of Kuit (1987) who reported that dietary fibre levels did not adversely affect the digestible CP and that when fibre level increased they consumed greater quantities of feed to meet with energy need.

## CONCLUSIONS

The findings of this study revealed that

1. Excluding diet 1 which had 0 % Brewers-dried grain, feeding rabbits at varying levels (10, 20, 30 and 40 %), final weight gain and feed intake were observed to improved at treatments 2 (10 % BDG) and 5 (40 % BDG) levels of inclusion.
2. Nutrient digestibility was improved with brewers' dried grains inclusion in the diet hence there were significant differences in all the treatment groups.

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