# GROWTH AND NUTRIENT DIGESTIBILITY OF GROWER RABBITS FED BAMBARA NUT WASTE AND RICE OFFAL-BASED CONCENTRATE WITH DIFFERENT BROWSE PLANTS

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## ABSTRACT

*Forty-eight (48) growing male rabbits of mixed breeds with an average weight of 927.5± 12.5g were used for a 42 days feeding trial to evaluate their performances on diets of a mixture of bambara nut waste and rice offal (2:1) as supplement to some browse plant (Bamboo, Gmelina, Senna and Teak). Animals in all the treatment groups were fed a mixture of bambara nut waste and Rice offal (2:1) at 50g/rabbit/day followed by 100g of browse per rabbit. Rabbits on treatments 1, 2, 3 and 4 were fed Bamboo (Oxytenanthera abyssinica), Senna (Senna siamea), Gmelina (Gmelina arborea) and Teak (Tectona grandis) leaves respectively at 100g/rabbit/day on cut and carry basis. All the animals were also served water everyday. The experimental design was completely randomized design. Data were analyzed using a one way analysis of variance. Performance parameters showed that feed intake, weight gain, browse intake, daily water intake and feed conversion ratio were significantly ($p < 0.05$) affected by treatments. Rabbits fed bamboo leaves (Treatment 1) had the optimal values for nearly all the parameters followed by rabbits fed teak leaves (Treatment 4), Senna leaves (Treatment 2) and those fed Gmelina leaves (Treatment 3). However, digestibility of dry matter, crude protein, crude fibre and nitrogen free extract were significantly different ($p < 0.05$) among the treatments. The animals fed bamboo leaves had the highest performance values for most of the parameters considered. Rabbits fed Senna leaves had the best digestibility values for almost all the parameters considered. Feed conversion ratio improved steadily in rabbits fed teak leaves (8.24) to those on bamboo leaves (7.27). Animals fed bamboo leaves (T1) had the highest water intake (180ml) while rabbits fed Gmelina leaves (T3) had the lowest water intake (150ml.). It was concluded that all the browse species supplemented with a mixture of bambara nut waste and rice offal at ratio 2:1 can be fed to growing rabbits for optimal or desirable growth performance.*

**Keywords:** Utilization, Rabbits, Browse plants, Bambara nut waste, Rice Offal.

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## INTRODUCTION

In Nigeria, the state of nutrition of the populace is predominantly marked by inadequate animal protein intake both in quantity and quality. Food and Agricultural Organization (FAO) in 2006 recommended 46g for women and 56g for men as the daily protein requirement for humans. However, the intake per average Nigerian is grossly inadequate (FAO, 2006) the shortage has given rise to high price of animal protein.

Therefore, efforts should be directed towards exploring all reasonable options to meet the recommended level at a reduced cost. Poultry production has been suggested as a means of meeting animal protein shortage but because of its high cost of production due to competition with man for some feed ingredients (e.g maize) this has not been very feasible.

Production of meat from rabbit is suitable because their feeding do not compete with human for feed ingredient and have some advantages over other animals in terms of short gestation period, high fecundity rate, low cost of investment and small body size which makes if affordable to poor Nigerians.

There is urgent need to search for supplements that are readily available cheap, nutritionally adequate and at the same time not in direct use by humans to support rabbit production. It is also expedient to search for fodder materials that are evergreen and do not bear fruits useful to humans. Bamboo, Teak, Gmelina and Senna are evergreen woody trees whose leaves serve as a potential dry season feed for animal and more over they do not bear fruit that are useful to humans.

Such Agro by-products that hold promise in Animal nutrition are bambara nut waste and rice offal. The processing of Bambara nut into flour results in the production of large quantity of waste that accounts for 20 – 22% of the total weight of the nut, however the utilization of the waste by livestock has not been well investigated (Onyimonyi and Onukwufor 2003). Bambaranut waste, rice offal and the browse species are readily available in large quantities in Anyigba and other neighboring villages\towns.

Ocheja (2006) reported the proximate composition of Bambara nut waste to be 88.60 18.20, 16.89, 5.79, 55.03% and 4.12% for dry matter, Crude protein, Crude fibre, Ether extract, Nitrogen free extract and Ash respectively.

The use of rice offal in feeding animal may serve as a cheap and safer disposal method. Since rice offal is dumped indiscriminately in heaps in all rice growing and milling areas where they are usually burnt and blown into the sky by wind thereby constituting hazard to the environment. Rice offal is one of the most promising Agro by-products because it is available in large quantities in all rice growing and milling areas (Tegbe *et al.,* 1995). The proximate composition of rice offal as reported by Ocheja *et al.* (2008) was dry matter (90.07%), Crude protein (6.84%), Crude fibre (42%), Ether extract (5.45%), Ash (20.40%) and nitrogen free extract (25.30%).

Given the scarcity and low nutritive value of forage during the long dry season, it is expedient to search for browse species that tend to retain their leaves during the long dry season, four browse species that hold promise in the dry season feeding of rabbits are bamboo *(Oxytenanthera abbyssinica), teak (Tectona grandis), senna, (Senna siamea) and gmelina (Gmelina arborea).*

Bamboo (*Oxytenanthyera abbyssinica*) is a group of perennial evergreen in the family *Poaceae* that is available all through the year and does not bear fruit that is directly in use by human, it is one of the fastest growing plants in the

world (Aduku, 2000) . According to Aduku (2000) the leaves contain 2.5g protein, 0.3g fat, 4.0g carbohydrate 17mg calcium, 47mg phosphorus, 0.9mg iron and 400mg potassium in 100g edible portion.

Gmelina (*Gmelina arborea*) is a fast growing non-leguminous multipurpose tree which produce appreciable amount of forage even at the peak of the dry season in the tropics, thereby ensuring all year round supply of forage and fodder.

Adegbola *et al*. (1982) reported the chemical composition of *Gmelina arborea* leaves to contain crude protein, 20.78%; crude fibre, 16.40%; ether extract, 5.60%; moisture, 68.20%; nitrogen free extract, 42.0% and energy (4.73kcal\g). Senna (*Senna siamea*) is an evergreen tree commonly available all year round. The crown is usually dense and rounded at first and later becomes irregular and spread with branches. Alismith and Mathew (2009) report that the composition of the leaf was 14.01% ash, 17.93% carbohydrate, 7.67% crude fat and 16.62% protein. Teak (*Tectona grandis*) is one of the evergreen trees that hold promise in the dry season feeding of animals as it is available all through the year and does not bear fruit that are consumed by human beings. It is only the wood that is in direct use by humans. Data on the utilization of these agro by –products as well as these browse species by rabbits is scanty.

This study therefore aimed at evaluating the performance of grower rabbits fed some browse species supplemented with a mixture of bambara nut waste and rice offal.

## MATERIALS AND METHODS

**Location:** The study was carried out at the Teaching and Research farm of the Department of Animal Production, Kogi State University, Anyigba. Anyigba lies on the latitude $7^0$ $15^1$ and $7^0$ $29^1$ N of the equator and longitude $7^0$ $11^1$ and $7^0$ $32^1$ E of the Greenwich meridian (Ifatimehin, *et al*., 2009).

**House and hutch Preparation:** The house was properly cleaned, washed and disinfected before moving in the hutches. The feeders and drinkers were equally washed and dried. The animals were kept separately in hutches made of wood and net.

**Experimental feed materials:** Bambara nut waste, Rice offal and table salt were used to compound the concentrate feed that were served to all animals. The rice offal was purchased from Ankpa while the bambaranut waste was purchased from Anyigba market. The bambaranut waste and rice offal were sun-dried and mixed together to compound the experimental diet. The browse species were harvested from Kogi State University Campus, Anyigba, where they grow naturally.

**Table 1: Composition of experimental diets**

| Ingredients | Composition (%) |
|---|---|
| Bambaranut waste | 75.6 |
| Rice offal | 24.2 |
| Table salt | 0.20 |
| Total | 100 |

**Experimental animals:** A total of 48, 8-week old male grower rabbits of mixed breeds and with initial body weight ranging from 915g to 940g were randomly assigned to four experimental diets or treatments of twelve (12) rabbits per treatment in a completely randomized design. Twelve replicates with one rabbit each was allowed per treatment. The animals were conditioned to stability by feeding them adequately for 1 week with concentrate and the browse plants used for each treatment. The study lasted for 42 days after an adjustment period of 7 days.

All the animals were fed 50g/head/day of the concentrate mash in the morning and 100g/head/day of Bamboo (*Oxytenanthera abyssinica)*, Senna *(Senna*

*siamea),* Gmelina (*Gmelina arborea)* and Teak (*Tectona grandis*) leaves were fed to rabbits on treatments 1 (T1), 2 (T2), 3 (T3) and 4 (T4) respectively in the afternoon (5 hours later) on cut and carry basis every day. A known volume of clean drinking waster was equally given everyday *ad libitum*. Daily water intake was measured by using a beaker to supply a known volume of water every morning, taking into account water loss due to evaporation. Loss due to evaporation was measured by putting a known volume of water in a drinker (same as those used by the rabbits) in the morning within the rabbit house. The difference in the volume of water observed the next morning was used to estimate the volume of water evaporated. This volume was added to the left over water and deducted from the volume of water served for the day to determine the daily water intake.

Feed intakes were calculated from differences between absolute feed served and the left over the following day before feeding. From these the dry matter intake was calculated. The data collected were initial body weight, final body weight and feed intake from which the weight gain and feed conversion ratio were calculated.

**Digestibility study:** During the last 5 days of the experiment each animal was moved into a metabolic crate for feacal collection. The faeces collected were bulked per replicate and analyzed for their proximate constituents and thereafter used to compute digestibility of nutrients using the formula below:

$$\text{Digestibility} = \frac{\text{Quantity of nutrient in feed - quantity of nutrient in faeces}}{\text{Quantity of nutrient in feed}} \times \frac{100}{1}$$

Samples of experimental diet and faeces were prepared for analysis by grinding them through a 1mm screen in a laboratory mill.

**Laboratory analysis:** The dry matter content of the samples was determined by oven drying at 95$^{o}$C to constant weights. Crude protein was determined by Kjeldahl procedure, ether extract, Crude fribre, Ash content determination were according to AOAC, (2000). The Nitrogen Free Extract (NFE) was calculated by subtracting the sum of percentages of crude fibre, ether extract, crude protein and ash from 100.

The experimental design was a completely randomized design (CRD).

**Data analysis:** The data were analyzed by a one way analysis of variance (ANOVA) and treatment means were separated using Statistical Package for Social Science (SPSS, 2006).

## RESULTS AND DISCUSSION

The proximate composition of feed ingredients and experimental diets are presented in Table 2. The dry matter content of 94.61% for bambara nut waste was higher than 87% reported by Ocheja, (2006). The dry matter content of 92.60% for rice offal was almost the same as that obtained by Tegbe *et al.* (1995).

The crude protein content of 19.71% for bambara nut waste was slightly higher than 17.65 and 17% reported by Ocheja (2006) and Onyimonyi and Onukwufor (2003).

The crude fibre of 16.96% obtained for bambara nut waste was in line with 16.89% reported by Ocheja (2006). The crude fibre for rice offal (40%) was slightly lower than 42% reported by Ocheja *et al*, (2008). The crude protein and Nitrogen free extract of the concentrate were within the range recommended for grower rabbits in the tropics ARC (1980). The Ash content of

5.23% and 5.20% Ether extract were within the range reported by Ocheja, *et al.* (2008) and Onyimonyi and Ene (2003).

The differences observed in the proximate composition of these by products were in line with the views of Ocheja *et al* (2008) who reported that the composition of these by-products differs due to source and variety and that each producer has their different methods and the extent of extracting the primary product which may affect their composition.

The crude protein content of 15.25% obtained for *Senna* was slightly higher than 14% reported by Allismith and Matthew (2009).

The dry matter of 53.57% and 59.27% Nitrogen free extract obtained was slightly higher than 45% dry matter and 42.8% nitrogen free extract reported by Asaolu *et al* (2011) for bamboo leaves, while 14.5% crude protein, 2.25% Ether extract and 23.3% crude fibre were slightly higher than 10.69% crude protein, 1.45% ether extract and 18.45% crude fibre obtained by Asaolu, *et al.,* (2011).

The Nitrogen free extract of 63.69% obtained was higher than 56% reported by Okagbare *et al.* (2004) for Gmelina leaves. Also the value (14.02%) obtained for crude fibre was equally lower than 48.6% reported by Okagbare *et al.,* (2004). These differences may be due to varieties of leaves, soil composition as well as differences in the season in which experiments were conducted. .

**Table 2: Proximate Composition of Dietary Ingredients and Experimental Diets (%DM)**

| Parameters | Bamboo leaves | Gmelina leaves | Senna Leaves | Teak leaves | Bambaranut waste | Rice offal | Concentrate |
|---|---|---|---|---|---|---|---|
| Dry matter | 53.57 | 25.97 | 34.15 | 39.45 | 94.61 | 92.60 | 88.91 |
| Crude protein | 10.69 | 12.38 | 15.25 | 10.13 | 19.71 | 6.01 | 16.30 |
| Crude fibre | 18.75 | 14.02 | 16.67 | 10.97 | 16.96 | 40.10 | 19.41 |
| Ether extract | 1.45 | 2.35 | 2.71 | 2.10 | 5.20 | 5.31 | 5.22 |
| Ash | 10.14 | 7.56 | 5.26 | 9.17 | 5.23 | 20.40 | 7.33 |
| NFE | 59.27 | 63.69 | 60.11 | 68.13 | 54.32 | 26.30 | 51.66 |

The performance characteristic of grower rabbits was summarized in Table 3 below. The total weight gain and daily weight gain were both significantly ($p < 0.05$) affected by treatments, and the treatment means of T1 and T4 were statistically different but treatment means of T2 and T3 were similar ($p > 0.05$). Treatment had no significant ($p < 0.05$) effect on daily supplement intake as they all consumed same quantity of the supplement. Daily browse intake and total daily feed intake (DM) were both significantly ($p < 0.05$) different and the treatment means of T1 and T4 were statistically different while T2 and T3 were similar for daily dry matter and water intake. Feed conversion ratio showed significant ($p < 0.05$) difference with rabbits fed Bamboo leaves (T1) having the least and optimal value. Optimal results for all parameters measured were obtained for Rabbits on Treatment 1 (T1) and this could be due to the significantly ($p < 0.05$) higher feed intake (browse). The water consumption of the experimental rabbits fed the different diets showed significant ($p < 0.05$) difference with T1 having the highest (180ml) feed intake also followed a similar trend and was in line with the result of Okagbare *et al*. (2004), who reported that water consumption of grower rabbits increased as the level of feed intake increased.

**Table 3: Performance characteristics of experimental animals**

| **Treatments** | **1** | **2** | **3** | **4** | |
|---|---|---|---|---|---|
| **Forage leaves** | **BL** | **SL** | **GML** | **TL** | **SEM** |
| *Parameters* | | | | | |
| Initial body weight (g) | 915.00 | 925.00 | 930.00 | 940.00 | 3.30 |
| Final body weight (g) | 1425.00 | 1256.00 | 1261.33 | 1351.67 | 23.06 |
| Daily weight gain (g) | $12.15^{a}$ | $7.88^{c}$ | $789^{c}$ | $9.80^{b}$ | 0.56 |
| Daily supplement intake (g) | 44.46 | 44.46 | 44.46 | 44.46 | 0.00 |
| Daily browse (DM) intake (g) | $43.9^{a}$ | $18.77^{c}$ | $19.5^{b}$ | $36.3^{b}$ | 3.14 |
| Total daily feed (DM) intake (g) | $88.36^{a}$ | $63.23^{c}$ | $63.96^{c}$ | $80.7^{b}$ | 3.19 |
| Daily water intake (ml) | $180^{a}$ | $155^{c}$ | $150^{c}$ | $172^{b}$ | 4.11 |
| Feed conversion ratio | $7.27^{b}$ | $8.02^{b}$ | $8.12^{a}$ | $8.24^{a}$ | 0.38 |

[a-d]Means on the same row with different superscript differ significantly ($p < 0.05$).
SEM = Standard Error of Mean. BL = Bamboo leaves; SL = Senna leaves; GML = Gmelina leaves; TL = Teak leaves.

The results of the dry matter and nutrient digestibility (%) of growing rabbits fed concentrates and forage leaves is as shown in Table 4.The digestibilities of dry matter, crude protein, crude fibre, ether extracts, and nitrogen free extract were all significantly ($p < 0.05$) affected by treatments effect, with T2 having the highest dry matter, crude protein and nitrogen free extract digestibilities. This could be due to the fibre content and composition of the diet as well as the browse. The superior digestibility values for rabbits fed Senna leaves (Treatment 2) may be due to the fact that Senna is a legume. This result was in line with that obtained by Gabynada *et al.* (1998), who recorded superior digestibility coefficients of leguminous plants over non-leguminous plants. Animals fed senna leaves (Treatment 2) appeared to have about the best array of nutrients, (from proximate composition), rabbits fed Gmelina leaves (Treatment 3) had the second best digestibility values, yet its overall performance was second to last ($3^{rd}$). This could be due to sub optimal utilization of the nutrients in the *Gmelina*. This was also in line with the report of Gabynada *et al.* (1998) that for animals to utilize properly the available nutrients in *Gmelina arborea* there is need to supplement the leaves.

**Table 4: Nutrient digestibility of growing rabbits fed concentrates and browse leaves**

| **Treatments** | **1** | **2** | **3** | **4** | |
|---|---|---|---|---|---|
| **Forage leaves** | **BL** | **SL** | **GML** | **TL** | **SEM** |
| Parameters | | | | | |
| Dry matter | $51.24^{d}$ | $68.25^{a}$ | $61.46^{b}$ | $56.97^{c}$ | 3.71 |
| Crude protein | $67.00^{c}$ | $80.00^{a}$ | $66.78^{c}$ | $75.94^{b}$ | 3.10 |
| Crude fibre | $16.80^{c}$ | $40.73^{a}$ | $19..89^{b}$ | $21.97^{b}$ | 4.98 |
| Ether extract | $83.10^{c}$ | $85.16^{b}$ | $78.06^{d}$ | $87.34^{a}$ | 2.12 |
| NFE | $60.00^{b}$ | $74.22^{a}$ | $65.53^{b}$ | $72.81^{a}$ | 3.17 |

[a-d]Means on the same row with different superscript differ significantly ($p < 0.05$).
SEM = Standard Error of Mean. BL = Bamboo leaves; SL = Senna leaves; GML = Gmelina leaves; TL = Teak leaves.

## CONCLUSION AND RECOMMENDATIONS

- The rabbits fed with bamboo leaves elicited optimal performance in terms of feed utilization and growth.
- Senna leaves with highest digestibility coefficients was more digested by rabbits than other browse leaves.
- The mixture of bambara nut waste and rice offal (2:1) as supplement to browse plant supported optimal performance of grower rabbits.
- The four browse plants used in this study may be recommended as dry season feeds for Rabbits alongside a mixture of Bambara nut waste and rice offal (2:1) as supplement.
- Further research using higher levels of these browse leaves as well as different classes of Rabbit is very necessary.

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