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ANALYSIS OF GROWTH PERFORMANCE OF RABBIT (*Orynctolagus cuniculus*) FED WITH RABBIT FEED AND DIVERSE FEED STUFF.

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ABSTRACT

This study was carried out to evaluate the effect of combination of agricultural by product with forages on the growth performance of the growing rabbits (*Orynctolagus cunniculus*). A total of thirty rabbits, aged 5-6 weeks with an initial weight ranging between 400g and 450g, were randomly assigned to two treatments (A and B). Rabbits in treatment one (A) were fed rabbit feed while the treatment two (B) were fed forage and diverse foodstuffs. Each treatment had three rabbits and three replicate in a completely randomized design and the experiment lasted for Twelve weeks. The following growth indices were monitored; weight gain, percentage weight gain, specific growth rate, and feed conversion ratio. The proximate analysis of the experimental diets revealed that Treatment B had higher levels of crude protein (21.69%) and crude fat (14%) compared to Treatment A (16.10%) and (8%). Treatment B also had a higher carbohydrate content (64.22%) and Treatment A (53.95%) The results showed that rabbits in Treatment B was highest in weight gain (660.67), percentage weight gain (161.14%) and specific growth rate (5.95) compared to those in Treatment A (337.33g), (80.98), and (3.67g) and Treatment B was significantly difference from Treatment A in each of the dietary treatments. The best food conversion ratio was recorded for the rabbit fed ration type B (16.32g) and least in ration A (31.26g) and ration type A was significantly ($p<0.05$) different from ration B. In conclusion, incorporating forages and concentrates in the diet of rabbits resulted in improved growth performance, and these findings suggest that forages and diverse feedstuff can be a valuable component of rabbit diets to optimize their growth and feed utilization.

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Rabbit; feed; growth and agricultural by-products.

INTRODUCTION

In a developing country like Nigeria with its increasing population, the level of animal protein intake has continued to decline over the years. Meats are major sources of protein and are derived from animals. Meat is a valuable source of nutrients that are beneficial to health and required for growth and development as part of a balanced diet (Aminu *et al*., 2020). As small livestock with significant economic potential, rabbits have been recognized. Due to its high concentration of micronutrients, which are lacking in leguminous cereals, rabbit meat has many health benefits. Due to their high-quality protein, rapid development, prolificacy, and quick generation time, rabbits can be an important part of the world's solution to the animal protein shortage. In the developing nations where it is raised, improvement and population growth have a key influence in reducing poverty. A significant portion of the people in rural regions is employed by the rabbit industry (Anoh *et al*., 2022). Rabbits are considered to be solely herbivorous animals. However, certain Leporidae members consume animal items in their diets when living in the wild. Therefore, adding animal-derived feeds as sources of protein, fat, and minerals to the diets of rabbits raised for food seems biologically justified (Gugołek and Kowalska, 2022). Since human population grows at the rate of 3.0 – 3.3% per annum, while livestock population grows at the rate of 1-2% per annum, this sub-optimal animal protein intake may persist unless drastic measures are taken to boost animal protein supply from non-conventional sources. The problem for most producers however, is the high cost of concentrates for the rabbit feed production. This has necessitated the need to seek for alternative forages which could be available all year round and cheap to process. This is especially so because of the availability of forage and ability of rabbits to convert forage into meat for human consumption (Aliyu, 2001).

Rabbit production is however, constrained by a number of factors, prominent among them which is high cost of feed and management. This has generated concern to rabbit farmers and has consequently opened research interest in the use of non-conventional protein source for rabbit's production (Ahamefule *et al*., 2007). Use of forage and by-products of agriculture and food processing to substitute concentrate feed maybe an alternative means of reducing the high cost of production associated with all concentrate feeding system (Uguru, 2005). This study is a part of ongoing research from my PhD work and is also designed towards evaluating the utilization of combinations of concentrate, grasses (forages) on performance and growth rate of rabbit for increased protein for the teaming population of Nigeria

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Animal House of the Biochemistry Department, Nnamdi Azikiwe University, Awka in Awka South Local Government Area of Anambra State. It falls within the geographical co-ordinates of $06^{0}15^{1}\ 10^{11}$ N and $7^{0}\ 6^{1}\ 50^{11}$ E and humid area, average

rainfall of 2169.8 mm, and average ambient temperature of 29^0C and 34^0C. The vegetation is of the Guinea Savannah.

Experimental Design

The experimental design used, was completely randomized design. In this experiment, a total of thirty (30) weaner rabbits of 5 – 6 weeks old, weighing between 400g – 450g were used. These rabbits were randomly assigned to two treatment diets of A – Rabbit feed and B - conventional feedstuff and forages. Each treatment had three replicates. Animals in the various groups were of homogenous body weight. The rabbits were managed under the intensive system with rabbits housed in individual cages made of wooden frames and wire gauze of 90 ×60 × 30cm. Before the experiment, the rabbits were dewormed thoroughly using $ESB_3$12 drugs in order to ensure that the animals are in good health condition. The study lasted for a period of Twelve weeks weeks besides one week of acclimatization.

Animal feed Formulation and feeding

The proximate composition of the ingredient were assessed before the commencement of the ration formulation to enable one know the crude protein content of the different ingredients for use in the Pearson's square method. The nutrient requirement value is usually, determined from the National Research Council publication for a specific livestock or from producer experience NRC (2001). In the course of the formulation of the ration types (forages) the preferred plant materials elephant grass , guinea grass , lead plant, cassava leaf, pawpaw leaf, cabbage, blood meal , bone meal , mineral / vitamin premix were gathered from Nnamdi Azikiwe University and environs chopped into pieces, dried and milled in a hand operated meat mincer was used to pellet the feed. The plant protein component of the diverse foodstuff were boiled for about 20 minutes and air dried at room temperature to destroy growth inhibitors and enhance digestibility and the feed materials were milled. The diverse foodstuff and the forage were measured out and mixed in a large bowl, pelletted, air dried, bagged and stored at a room temperature to avoid spoilage and deterioration.

The composition of rabbit feed obtained from Umudike Research Institute of Agriculture, Umudike Abia State and the composition of forage and agricultural by products are shown in (table 1).The rabbits were fed 200g of the ration types A and B two times daily at 8.00am and 6.00pm. Plastic troughs and feeder were made for feeding and providing water for the animals.

Performance Indices/ Parameters

Weight of the animals

The animals were weighed using a weighing balance. They were weighed individually at the beginning of the experiment and subsequent weights were taken at weekly interval. The weight

of the animals was obtained by calculating the difference between the total weight and handling cage and recorded to the nearest 0.01gm.

Indices of feed utilization

The following data were collected; weekly weight gain (WG), percentage weight gain (PWG), Specific growth rate (SGR), food conversion Ratio (FCR).

Daily feed intake = food fed- feed left over (gm)

Weekly weight gain= weekly final mean weight (g) - weekly initial mean weight (g)

$$\text{PWG} = \frac{\text{Mean final weight} - \text{mean initial weight}}{\text{mean initial weight}} \times \frac{100}{1}$$

$$\text{SGR} = \frac{\log w^2_e - \log w^1_e}{T_2 - T_1} \times \frac{100}{1}$$

Where; $w_{1=}$initial mean weight

$w_2 =$ Final mean weight

$T_1 =$ Initial time

$T_2 =$ Final time

log = logarithm.

$$\text{FCR} = \frac{\text{Food consumed by Rabbit (g)}}{\text{Mean weight gain by Rabbit (g)}}$$

Proximate analysis

The Proximate Analysis of Ration type B was analysed for Moisture Content, Ash Content, Carbohydrate Content, Determination of Crude Fibre, Crude Fat Content, Crude Protein Content and Determination of Food Energy using the methods of the Association of official Analytical chemist (A.O.A.C 1990).

Ethical Approval

In this study, there was an ethical clearance from the ethical committee of Nnamdi Azikiwe University, Awka for approval of proper handling of the animal.

Statistical Analysis

The data obtained from the indices of growth and feed utilization were subjected to Analysis of variance (ANOVA) and significant difference was analysed using least significant difference (LSD) (SPSS 2013).

RESULT

Feed utilization / performance of rabbits fed on diverse rations A and B.

The composition of the each of the experimental diets are presented in Table 1 below, while the result of the proximate composition, vitamins and mineral analysis are presented in Table 2, 3,4 respectively.

Feed utilization indices and growth performance results of rabbits fed on diverse feed diets (A and B) for 8 weeks are presented in the Tables below.

The highest mean weight gain was recorded by rabbits fed on ration B (660.67g) while the least was recorded by those in Treatment A (337.33g). Table 5. The highest percentage weight gain was attained by the rabbits fed on ration B (161.14%) while the least was recorded by those in Treatment A (80.98%) Table 5. The specific growth rate followed the same trend as the percentage weight gain, Treatment B (5.95) while Treatment A (3.67) Table 5. The analysis of variance result showed that Treatment B was significantly difference from Treatment A in each of the dietary treatments ($P<0.05$). The best food conversion ratio was recorded for the rabbit fed ration type B (16.32g) and least in ration A (31.26g) and ration type A was significantly ($p<0.05$) different from ration B, Table 5.

Table 1. The Composition of the Experimental Diets (A and B)

Feed Components/Ingredients

Ration A	**Quantity in g/kg**	**Ration B**	**Quantity in g/kg**
Maize	30	Elephant grass	15
Wheat	20	Guinea grass	15
Wheat bran	10	Lead plant	10
Rice bran	10	Cassava leaf	5
Sunflower cake	10	Pawpaw leaf	5
Cotton seed cake	5	cabbage	10
Fish meal	2	maize	5
Beans	10	Sorghum	5
Mineral premix	1	Groundnut meal	10
		soyabeans	14
		blood meal	3
		bone meal	2
		Mineral/Vitamin premix	1
Total	**100g**	**Total**	**100g**

Table 2: Proximate Analysis of the Experimental Diets (A and B)

Proximate Composition (%)	Treatment A	Treatment B
Moisture (%)	8.75 ± 0.25	1.00 ± 0.00
Ash (%)	8.00 ± 1.00	9.00 ± 0.00
Crude protein (%)	16.10 ± 0.01	21.69 ± 0.01
Crude fibre (%)	8.10 ± 0.10	6.10 ± 0.10
Crude fat (%)	8.00 ± 1.00	14.00 ± 3.60
Carbohydrate (%)	53.95 ± 1.05	64.22 ± 3.49

Table 3: Vitamins composition of the experimental feed (A and B)

Vitamins	Treatment A	Treatment B
C (mg/g)	93.25±0.25	93.10±0.90
A (µM)	0.41±0.12	0.41±0.07
B6 (g/g)	0.03±0.00	0.03±0.00
B3 (g/g)	0.21±0.00	0.19±0.00
B1 (mg%)	0.28±0.00	0.19±0.00
B2 (mg%)	0.27±0.00	0.28±0.02
D (mg/g)	0.69±0.03	0.73±0.04
E (µM)	17.94±1.08	16.91±0.15

Table 4: Minerals composition of the Experimental feed. (A and B)

Sample	**Zinc (ppm)**	**Iron (ppm)**	**Magnesium (ppm)**	**Calcium (ppm)**
Treatment A	0.239	0.075	0.519	0.712
Treatment B	0.174	0.428	0.428	0.371

Table 5: Growth Performance/ Feed Utilization Indices of Rabbits Fed on Diet Treatments

parameters	Treatment A	Treatment B
Weight gain	337.33	660.67
Percentage Weight Gain	80.98	161.14
Specific Growth Rate	3.67	5.95
Feed conversion ratio	31.2	16.32

DISSCUSION

The proximate analysis of Treatment A, and Treatment B (Table 2) were analyzed to determine their components. The moisture content of Treatment A (8.75%) was higher than that of Treatment B (1.00%). According to Esmail (2021), the moisture content of Treatment B falls within the adequate range for preventing mould and promoting the optimal shelf life of rabbit feeds. It is therefore not susceptible to microbial attack and does not lead to feed deterioration. The result of the Vitamins content of all the treatments (Table 3) showed a reasonable amount of Vitamin C, treatment A (93.25±0.25), and Treatment B (93.10±0.90). Table 4 shows the maximum amount of minerals (zinc, iron, magnesium and calcium). The forages are a rich source of Calcium and iron and these minerals are essential for rabbit health and disease prevention (Enyenihi *et al.* (2019).

From the result of this study, The highest mean final weight gain was recorded by the rabbits fed on ration type B (660.67g), and the least was recorded by those fed on ration A (337.33g) Table 5. The better weight gain recorded in ration B could be due to high protein quality in the ration of the rabbit which also could have resulted from the ration utilization (ratio of feed intake to weight gain) and this finding is in line with the work of Nzekwu (2004) who reported that protein quality is important in rabbit nutrition for proper growth. The increased weight could have resulted from the anti-oxidant property of forages that was included in the feed formulation as well as the extra nutrients it supplied, since forages contain appreciable amounts of proteins, minerals, and fibre. Ukorebi *et al*. (2019) also reported that forages have a high nutrient content of ash, which is required for optimum growth of rabbits.

Although, all the ration types had good weight gain and percentage weight gain, the highest percentage weight gain was recorded by the rabbits fed on ration type B (161.14%) while the least was recorded by those fed on ration type A (80.98%), Table 5. The percentage weight gain in ration type B was significantly different ($p>0.05$) among the ration type A. This, better weight gain and percentage weight gain in ration B show that the ration contained a good level of nutrients for the growth of rabbits in captivity.

The specific growth rate followed the same trend as the weight gain and percentage weight gain. The rabbits fed on ration type B showed a higher specific growth rate and were significantly different ($P>0.05$) from those of rabbits fed on the other ration type A Table 5. This difference in specific growth rate could be a result of the nutrient composition of the different rations. Ration type B had higher protein content which was utilized well for the formation and deposition of muscles in the rabbit and this is in line with the work of Udeh *et al*. (2021) which reported that a diet that contains forages gives a high level of nutrients for the growth of the rabbits.

The best food conversion ratio was recorded in the rabbits fed on ration type B (31.2g) while the least was recorded in the rabbits fed on ration type A (16.32g) Table 5. Although the rabbits fed on ration type B and A had good food conversion ratio, but the best was recorded with those fed on ration type B because they were able to convert their feed well into tissues and muscles which gave them good growth. Okeke *et al*. (2013) also observed the same trend of food conversion ratio with the rabbits fed on substituted levels of soya bean meal with *Leuacena leucocephala* (lead plant) leaves.

Conclusion

This study has provided yet another insight and the solution for the rearing of rabbits which is the most recent hope in minilivestock production for sustainable protein. It is therefore suggested that ration type B should be preferred to the other ration type A for optimum rabbit growth and rabbits rearing in captivity.

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