Asian Journal of Research in Zoology

4(3): 9-17, 2021; Article no.AJRIZ.69707
ISSN: 2582-466X

Comparative Studies of Growth Performance of Rabbits (*Ornyctolagus cunniculus*) Fed on Rabbit Feeds and Diverse Foodstuff in Captivity

N. P. Udeh[1*], J. J. Okeke[1], O. P. Okeke[1], C. Obudulu[1] and K. P. Okafor[1]

[1]Department of Zoology, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Authors NPU and JJO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OPO and CO managed the analyses of the study. Author KPO managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRIZ/2021/v4i330115
Editor(s):
(1) Dr. Golam Mustafa, Center for Resource Development Studies Ltd, Bangladesh.
Reviewers:
(1) Nadir Mohammedahmed Hassan, Red Sea University, Sudan.
(2) Mohammadreza Mohammadabadi, University of Kerman, Iran.
Complete Peer review History: http://www.sdiarticle4.com/review-history/69707

Original Research Article

Received 08 April 2021
Accepted 17 June 2021
Published 23 June 2021

ABSTRACT

The study was carried out to ascertain ways to increase protein for the teeming population of Nigerians. The specific objectives were to determine the growth performance of rabbits fed on rabbit feed and combination of agricultural by-product with forages and compare their feed utilization. It investigated the growth performances of rabbits; (*Orynctolagus cuniculus*) fed diverse ration (types A and B) in captivity for 12 weeks. A total of eighteen (18) weaner rabbits with an average initial weight of 350g – 370g and between 5 and 6 weeks old, were allotted into two treatments. Each treatment had three rabbits and three replicate in a completely randomized design. Rabbits in treatment one (A) were fed rabbit feed while the treatment two (B) were fed forage and diverse foodstuffs. Proximate analysis of these food ration types A and B showed that the ration type B was high in crude protein (23.88%), carbohydrate (53.29%) and fat (8.60%) and ration type A had the lowest crude protein (20.76%), carbohydrate, (52.49%) and fat (3.15%). Studies on the indices of ration utilization and growth performances showed that feed intake was highest in rabbit fed ration type A (94.28g) and lowest in ration B (90.98g). The diverse ration types although portrayed good weight gain, the highest was in rabbit fed ration type B (760.00g) and

**Corresponding author: Email: ndobabe2015@gmail.com;*

lowest in ration A (681.00g) and ration type B was significantly ($p<0.05$) different from ration A. The percentage weight gain and specific growth rate were highest in ration type B (210.50%), (4.097) and lowest in ration A (189.10%), (3.841). The best food conversion ratio was recorded for the rabbit fed ration type B (10.07g) and least in ration A (11.64g) and ration type A was significantly ($p<0.05$) different from ration B. Digestibility was highest in rabbit fed Ration A (93.33g) and lowest in ration B (92.67g) and were significantly different ($p<0.05$) from each other. The protein intake of ration B (21.73) was higher than those of ration A (19.57). The result also showed that the protein efficiency ratio of ration type A and B was not significantly different ($p>0.05$) from each other. Looking at the proximate composition of the diverse rations and indices of ration utilization, ration type B portrayed optimal nutrient content for rabbit growth.

Keywords: Rabbit; feed; growth and agricultural by-products.

1. INTRODUCTION

Daily protein intake is very important [1]. Most foods contain some protein. Protein deficiency is when intake is unable to meet the body's requirements. An estimated one billion people worldwide suffer from inadequate protein intake [2].

Protein deficiency causes many problems for the human body and this deficiency has a wide range of symptoms [3]. The most severe form of protein deficiency is known as kwashiorkor. It most often occurs in children in developing countries where famine and imbalanced diets are common [2]. Protein deficiency and low intake of protein may cause some health concerns. Some symptoms of lack of essential proteins (kwashiorkor) are: swelling (Edema), fatty liver which may lead to liver failure in children, skin disorders, infections and problems with the health of nails and human hair, and undesirable growth in children [4,5]. Low protein intake may also lead to muscle wasting and weakness and an increased risk of bone fractures [6]. Some evidence suggests that consuming too little protein can increase appetite and lead to obesity [7]. Deficiency is especially harmful for children whose body is growing [8]. Therefore, preparing animal protein for humans is one of the most important tasks of animal breeders [9].

Protein requirement depends on many factors, including body weight, muscle mass, physical activity and age. Body weight is the most important determinant of protein requirements. The recommended daily allowance (RDA) is 0.4 grams of protein for each pound of body weight (0.8 grams per kg). Scientist estimated this should be enough for most people. RDA is currently the same for old and young adults, studies indicate it is underestimated and should be raised to 0.5 to 0.7 grams per pound of body weight (1.2–1.5 grams per kg) for older [2].

There can be some adverse effects associated with long-term high protein/high meat intake in humans such as disorders of bone and calcium homeostasis, disorders of renal function, increased cancer risk, disorders of liver function, and precipitated progression of coronary artery disease [10].

The demand for the protein of animal origin in developing countries like Nigeria has far outstripped the supply [11]. However, two viable options to the solution of the above problems were suggested. These are the use of poultry and mini-livestock like a rabbit for meat production [12]. Rabbit production has enormous potential in alleviating the problem of animal protein supply in developing countries [13].

Taiwo et al. [14] and [15] advocated that the prolific nature of rabbits coupled with its short gestation period, generation interval and cheap cost of production makes it the choice that could help alleviate this problem of protein intake. According to Pote et al. [16] rabbit meat is tasty, nutritious, and low in fat content, sodium and cholesterol level when compared to other common meat sources.

Since the human population grows at the rate of 3.0 – 3.3% per annum, while the 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 rearing of rabbit may help in this accept due to their fast growth and short generation interval [17]. The problem for most producers, however, is the high cost of concentrates for rabbit feed production. This has necessitated the need to seek alternative forages

which could be available all year round and cheap to process. This is especially so because of the availability of forage and the ability of rabbits to convert forage into meat for human consumption [18]. The use of forage and by-products of agriculture and food processing to substitute concentrate feed may be an alternative means of reducing the high cost of production associated with all concentrate feeding system [19]. This study therefore, is aimed at assessing the growth performance of rabbits in captivity fed on Rabbit feed and other diverse foodstuff. The specific objectives were to determine the growth performance of rabbits fed on rabbit feed and combination of agricultural by-product with forages and also compare their feed utilization.

2. MATERIALS AND METHODS

2.1 Experimental Site of the Study

The experiment was carried out at the animal house of the Zoology Department, Nnamdi Azikiwe University, Awka in Awka South Local Government Area of Anambra State. It falls within the geographical coordinates of $06^{0}14^{1}$ 58^{11} N and 7^{0} 6^{1} 59^{11} E. It is a humid area, has an average rainfall of 2169.8mm, and an average ambient temperature of 29^{0}C and 34^{0}C. The vegetation is of the Guinea Savannah.

2.2 Experimental Design

The experimental design used was completely randomized. In this experiment, a total of eighteen (18) weaner rabbits of 5 – 6 weeks old, weighing between 350g – 370g were used. These rabbits were randomly assigned to two treatment diets: diet A - rabbit feed and diet 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 de-wormed thoroughly using $ESB_{3}12$ drugs to ensure that the animals were in good health condition.

2.3 Animal Feed Formulation and feeding

In this study, one standard of experimental ration type with dietary crude protein of 24% was formulated. The formulation was based on the Pearson square method [20]. The proximate composition of the ingredient was assessed before the commencement of the ration formulation to enable one to know the crude protein content of the different ingredients for use in Pearson's square method. The nutrient requirement value was determined from the National Research Council publication for a specific livestock [20]. The protein requirement is based on the animal's class, production stage and level. The Pearson square method is most effective when only two feed ingredients were used. In this, Pearson square method procedures were taken step by step to arrive at the desired protein content and quantity of each ingredient.

In the course of the formulation of the ration type (forages) the preferred plant materials (elephant grass, guinea grass, pumpkin stem, *Amarantus* stem) were gathered from Nnamdi Azikiwe University and environs, chopped into pieces, dried and milled with a hand-operated meat mincer. The plant protein component of the diverse foodstuff was boiled for about 30 minutes and air-dried at room temperature to destroy growth inhibitors and enhance digestibility; the feed materials were also milled. The diverse foodstuff and the forage were measured out and mixed in a large bowl, pelleted, air dried, bagged and stored at 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 diverse foodstuff, forage and agricultural by-products are shown in (Table 1).

The rabbits were fed 100g of the ration types A and B two times daily at 8.00 am and 6.00 pm. Plastic troughs and feeder were made for feeding and providing water for the animals. The animals were provided with fresh water every morning and evening for the three months of study.

2.4 Data Collection

The following data were collected; Daily food intake, weekly Weight gain (WG), Percentage weight gain (PWG), Specific growth rate (SGR), Food Conversion Ratio (FCR), Digestibility, protein efficiency ratio (PER).

Table 1. The Composition of the Rabbit feed in ration a and combination of forages and diverse foodstuffs in Ration 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	Pumpkin stem	10
Rice bran	10	Amarantus stem	10
Sunflower cake	10	Groundnut meal	15
Cotton seed cake	5	Maize grain	5
Fish meal	2	Sorghum	5
Beans	10	Soya bean meal	14
Bone meal	1	Bone meal	5
Limestone	0.5	Blood meal	5
Salt	0.5	Salt/NaCl	0.5
Mineral premix	1	Mineral/Vitamin premix	0.5
Total	**100g**	**Total**	**100g**

Daily feed intake = food fed - feed leftover (gm)

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

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

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

Where;

$w_{1=} initial\ mean\ weight$

$w_2 = Final\ mean\ weight$

$T_1 = Initial\ time$

$T_2 = Final\ time$

$log = logarithm.$

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

Food remains and faecal droppings in metal trays placed under the cage of each animal were collected daily, oven- dried and weight to the nearest 0.01g. The daily food consumed and food left over was also recorded. All the data collected were used to calculate the digestibility thus:

$$Digestibility = \frac{Dry\ weight\ of\ feed\ consumed - faecal\ dry\ weight}{Dry\ weight\ of\ feed\ consumed}$$

The digestibility coefficient was computed using the formula;

$$Digestibility\ coefficient = \frac{Dry\ weight\ of\ feed\ consumed - faecal\ dry\ weight}{Dry\ weight\ of\ feed\ consumed} \times \frac{100}{1}$$

$$PER = \frac{Mean\ weight\ gain\ by\ Rabbit\ (g)}{Weight\ of\ crude\ protein\ fed\ (g)}$$

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 [21].

2.5 Statistical Analysis

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

3. RESULTS

The result of feed utilization indices and growth performance of rabbits fed on diverse feed diets (A and B) for 12 weeks are presented in tables and figures below. (Table 2) shows the proximate composition of experimental diverse ration types (A and B) respectively while (Table 3) shows the summary of the daily feed intake of the Rabbits (*Orynctolagus cuniculus*) fed on diverse ration types A and B for 12 weeks. The result shows that Rabbits fed on ration type A (94.28 ± 0.17) consumed more of their feed than those fed on ratio type B (90.98±0.61).

Weekly mean weight gain of Rabbit (*Orynctolagus cuniculus*) fed on the types of diet respectively for 12 weeks shows that the highest mean final weight gain was recorded by the rabbits fed on ration type B (760.00g) while the least was recorded by those fed on ration A (681.00g) (Table 4).

Mean percentage weight gain of rabbits fed on the diets respectively for 12 weeks shows that rabbits fed on ration type B (forage and diverse foodstuff) had the highest (210.50±8.74) mean percentage weight gain while the least (189.10±6.92) mean percentage weight gain was recorded by those fed on ration type A (Rabbit feeds). Mean specific growth rate of Rabbit (*Orynctolagus cuniculus)* fed on two types of diet respectively for 12 weeks also showed that rabbits fed on ration B were significantly different ($P<0.05$) from those fed on ration A (Fig. 1).

Table 2. Proximate composition of experimental diverse ration types (A and B) respectively

Proximate composition	A Rabbit Feed (%)	B Forage and diverse foodstuff (%)
Crude protein	20.76	23.88
Crude fat	3.15	8.60
Carbohydrate	52.49	53.29
Total Nitrogen	6.90	10.13
Ascorbic acid	2.40	1.53
Moisture content	7.75	6.20
Dry Matter	90.30	94.80
Ash content	5.99	26.40
Crude fibre	6.25	12.00
Food energy	2550.00	2640.02

Table 3. The summary of the daily feed intake of the Rabbits (*Orynctolagus cuniculus*) fed on diverse ration types A and B for 12 weeks

Food types		Total food fed (a)	Total food left over (g) (b)	Total food consumed (g) (a-b) = c	Daily feed intake (g) C/ 84days	Daily mean feed intake (g)± SE
A	1	8400	445.60	7954.40	94.69	
	11	8400	501.50	7898.50	94.03	94.28 ±0.17[a]
	111	8400	492.90	7907.10	94.13	
	Total	25200	1440.00	23760.00	282.85	
	Mean	8400	480.00	7920.00	94.28	
B	1	8400	870.10	7529.90	89.64	
	11	8400	654.20	7,745.80	92.21	90.98 ±0.61[b]
	111	8400	749.30	7650.70	91.08	
	Total	25200	2273.60	22926.40	272.93	
	Mean	8400	757.86	7642.13	90.98	

Table 4. Weekly mean weight gain of Rabbit (*Orynctolagus cuniculus*) fed on diverse rations A and B respectively for 12 weeks

Ration types	Initial weight (g)	Wk 1(g)	Wk 2(g)	Wk 3(g)	Wk 4(g)	Wk 5(g)	Wk 6(g)	Wk 7(g)	Wk 8(g)	Wk 9(g)	Wk 10(g)	Wk 11(g)	Wk 12(g)	Weight gain (g)
A	360.10	425.56	453.33	524.44	612.22	682.22	738.88	798.89	854.44	902.22	950.00	1002.22	1041.05	681.00±18.4[b]
B	361.11	413.33	459.99	501.11	581.11	652.22	731.11	800.00	874.44	932.22	993.33	1047.77	1121.11	760.00±20.1[a]

Table 5. Food conversion ratio of rabbit (*Orynctolagus cuniculus)* fed on diverse ration types A and B 12 weeks

Food types	Replicate	Mean initial wt (g)(a)	Mean final wt (g)(b)	Mean wt different (g)(b-a=c)	Food consumed (g)(d)	FCE (d/c)	Mean±SE
A	1	350.60	1066.67	716.07	7954.40	11.10	
	11	364.62	1046.47	681.85	7898.50	11.58	11.64±0.0003[a]
	111	365.10	1010.00	644.90	7907.10	12.26	
	Total	1080.32	3123.14	2042.82	23760.00	34.94	
	Mean	360.10	1041.05	681.00	7920.00	11.64	
B	1	352.00	1150.00	798.00	7529.90	9.43	
	11	360.67	1110.00	749.33	7745.80	10.33	10.07±0.0008[b]
	111	370.68	1103.33	732.65	7650.70	10.44	
	Total	1083.35	3363.33	2279.98	22926.40	30.20	
	Mean	361.11	1121.11	760.00	7642.13	10.07	

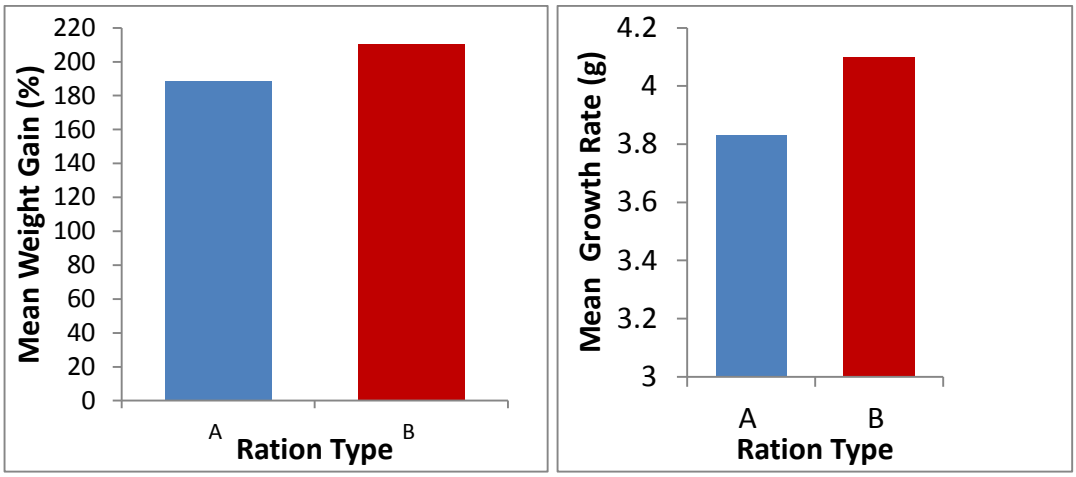

Fig. 1. The mean percentages weight gain and mean specific growth rate of Rabbit *(Orynctolagus cuniculus*) fed on diverse ration A and B for 12 weeks respectively

Table 5 shows the food conversion ratio of rabbits (*Orynctolagus cuniculus)* fed on diverse ration types A and B within 12 weeks was determined and the result shows that rabbit fed on rations type A had a significant (11.64 ± 0.0003^{a}) ratio ($P<0.05$) compared to those fed ration B (10.07 ± 0.0008^{b}).

4. DISCUSSION

The daily mean feed intake shows that the rabbit fed on ration type A and consumed more of their feed than those fed on ratio type B. The rabbits fed on ration A was significantly different ($p<0.05$) from those fed on ration B. The highest mean final weight gain was recorded by the rabbits fed on ration type B (760.00g) while the least was recorded by those fed on ration A (681.00g). The higher 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). This finding is in line with the work of Nzekwu [22] who reported that protein quality is important in rabbit nutrition for proper growth.

The highest percentage weight gain was recorded by the rabbits fed on ration type B while the least was recorded by those fed on ration type A. The percentage weight gain was not significantly different ($p>0.05$) among the ration types A and B, they all portrayed good weight increase. The higher mean weight gain and percentage weight gain in ration B shows that the ration contained a good level of nutrients for the growth of rabbit in captivity. The specific growth rate followed the same trend as the weight gain. The rabbits fed on ration type B showed a higher specific growth rate and was significantly different ($P>0.05$) from those of rabbits fed on the other ration type A. 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. The highest food conversion ratio was recorded in the rabbits fed on the ration type B while the least was recorded in the rabbits fed on ration type A. Ration A was significantly different ($P>0.05$) from those of ration type B.

Although the rabbits fed on ration type A had a good food conversion ratio, the best was recorded with those fed on ration type B because they were able to convert their feed into tissues and muscles which gave them good growth [23].

The study also showed the proximate analysis of the diverse rations (A and B). The values of the crude protein (CP) for the diverse rations (A- 20.76% and B- 23.88%) obtained was found to be adequate for the normal growth of the rabbits. Their values were in line with the finding of Nworgu et al. [24] who observed that rabbits could be maintained at a crude protein of 19.38% – 24.25%.

The crude fibre content value was high in ration B while the lowest was in ration A. The difference was a result of the components/ingredients used in the composition of the Ration type B which was composed of forages (grasses) and diverse foodstuff. The crude fibre (CF), dry matter (DM) and crude protein (CP) contents conform to the required amounts for ruminants and mono-

gastric rodents for good digestibility as reported by Okwu [25]. These levels of crude fibre in the rations (B) contributed very much as a useful source of roughage for proper digestibility in the rabbits.

5. CONCLUSION

This study has provided yet another insight and the solution for the rearing of rabbits which is the most recent hope in mini livestock production for sustainable protein. The diverse ration types gave a good growth performance but ration type B is most recommended as a complete diet at all levels of growth for the rabbits in captivity.

ETHICAL APPROVAL

All authors hereby declare that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed, as well as specific national laws where applicable. All experiments have been examined and approved by the appropriate ethics committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mohammadabadi M, Bordbar F, Jensen J. Key Genes Regulating Skeletal Muscle Development and Growth in Farm Animals. Animals. 2021;11(3): 835.
2. Atli, A. 8 Signs and Symptoms of Protein Deficiency. Available:https://www.healthline.com/nutrition/protein-deficiency-symptoms
3. Pour Hamidi S, Mohammadabadi MR, AsadiFoozi and Nezamabadi-pour H. Prediction of breeding values for the milk production trait in Iranian Holstein cows applying artificial neural networks. Journal of Livestock Science and Technologies. 2017;5 (2):53-61.
4. Gholamhoseini FG, Mohammadabadi MR, AsadiFozi M. Polymorphism of the growth hormone gene and its effect on production and reproduction traits in goat. Iranian Journal of Applied Animal Science. 2018;8(4):653-659.
5. Mohammadabadi M Soflaei M. Tissue-specific mRNA expression profile of BMP15 gene in goat. Agric Biotechnol J. 2020;12:191-208.
6. Gooki FG, MohammadabadI M, Fozi MA and Soflaei M. Association of Biometric Traits with Growth Hormone Gene Diversity in Raini Cashmere Goats. Walailak Journal of Science and Technology (WJST). 2019:16(7):499-508.
7. Khorshidi M, Mohammadabadi MR, Esmailizadeh AK, Barazandeh A and Babenko OI. Comparison of artificial neural network and regression models for prediction of body weight in Raini Cashmere goat. Iranian Journal of Applied Animal Science. 2019:9(3):453-46.
8. Ghotbaldini H, Mohammadabadi MR, Nezamabadi-pour H, Babenko OI, Bushtruk MV, Tkachenko SV. Predicting breeding value of body weight at 6-month age using Artificial Neural Networks in Kermani sheep breed. Acta Scientiarum. Anim Sci. 2019;41:45282.
9. Mohammadabadi M. Tissue-specific mRNA expression profile of ESR2 gene in goat. AgricBiotechnol J. 2021;12(4):167-181.
10. Delimaris, I. Adverse Effects Associated with Protein Intake above the Recommended Dietary Allowance for Adults. ISRN Nutrition. 2013;126-929. Available:https://doi.org/10.5402/2013/126929
11. Ani OA, Adiegwu II. The feeding value of velvet bean *(Muwna prenups)* to weaned rabbits. Nigeria Society of Animal Production proceedings held at Nsukka. 2005;186-189.
12. Akimutimi AM, Onwukwe CC. Effect of potash on proximate composition, mineral and anti-nutritional factors of lima bean. An Agricultural Biotechnology and Environment. 2002;1(2):1-3.
13. Biobaku WO, Dosumu EO. Growth response of rabbits fed graded levels of processed and undulled sunflower seed. Nigerian Journal of Animal Production. 2005;30(2):179-184.
14. Taiwo AA, Adejuyigbe AD, Talabi EO, Ekwumankama G, Adebowale EA. Effects of raw and cooked mucuna seed mealbased diets on the performance and haematology of weaned rabbits. Proc. 8th Annual Conference of Animal association of Nigeria, Federal University of Technology Minna, Niger State; 2003.
15. Odimba, NE. Influence of forage legumes (*Centrocema testicular pubescens, Calopogomum phasloides*) rabbits' semen characteristics and dimension. B. Agric

student thesis, college of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike. 2006; 33.
16. Pote LN, Cheeke PR, Pathon NM. Utilization of diet high in alfalfa by weaning rabbits. Journal of Applied Rabbit Research. 2009;3(4):15-203.
17. Iyeghe-Erakpotobor GT. Evaluation of growth rates of three breeds of rabbits raised in the Northern guinea savannah of Nigeria. Journal of Animal Production Research. 2002;17(1-2):78-88.
18. Aliyu R. Evaluation of concentrate, grass and legume combinations on performance and nutrient digestibility of grower rabbits under tropical condition. African Journal of Biotechnology. 2001; 4(20):04-18.
19. Uguru JO. Determination of optimum concentrates and forage combination for smaller holder feeding of rabbits. Tro. J. Amm. Sci. 2005;5(1):181-1.
20. National Research Council (NRC). Nutrient requirement of rabbits 2nd Revision National Academy of sciences. National Research Council, Washington, U.S.A; 2001.
21. Association of official analytical chemists (A.O.A.C). Official methods of analysis A.O. A, C., Inc Arlington, Virginia U.S.A. 1990;1094.
22. Nzekwu E. The production of xerophthalmia in the rabbit. A.M.J. Physiol. 2004;51:530-535.
23. Okeke JJ, Ijuh II, Mogbo TC, Ezeaonyejiaku DC, Nwosu M. Growth performance of rabbit (*Orynctolagus cuniculus*) fed on substituted levels of soya bean meal with *Leuacena leucocephala* (lead plant) leaves. African Journal of Agricultural Research and Development. 2013;6(2):63-69.
24. Nworgu FC, Ogbosuka GE. Ripe plantain (*Musa paradise*) peels meal as an alternative energy source for weaned rabbits. Nigeria society Animal production proceedings. 2003;348.
25. Okwu DE. Evaluation of the chemical composition of indigenous spices and favouring agents. Global Journal Pure and Applied Science. 2001;7(3):455-459.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/69707