

## The effect of forage to concentrate ratios on the performance of weaner rabbits



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### Abstract

The effect of forage to concentrate ratios on the performance of weaner rabbits was investigated using twenty (20) weaner rabbits. They were randomly assigned to five treatment diets/with two replicates of two (2) rabbits per pen in a completely randomized design CRD). The experiment lasted for 56 days. T1 = forage 80%: concentrate 20%, T2 = forage 60%: concentrate 40%, T3 = forage 40%: concentrate 60%, T4 = forage 20%: concentrate 80% and T5 = forage 50%: concentrate 50% served as the control. Data were collected for feed intake, weight gain, carcass quality and the economics of the diet. The growth performance result was significantly different ( $p < 0.05$ ) for all the parameters considered except for total feed intake. Treatment 3 (T3) had the highest value for final weight (1423.0 g), total weight gain (925.5g) and daily weight gain (16.52 g), with the least feed conversion ratio of (2.58) among others. The cut parts results showed that there was significant difference ( $p < 0.05$ ) for all the parameters considered. T3 also had the highest value for the prime parts. The organ weights results did not follow any specific pattern that could be attributed to the effect of the test ingredients. The economics /gross margin showed that T3 was favoured among others (₦731.38, ₦929.18, ₦1045.78, ₦828.81, ₦825.39), T3 (forage 40%: concentrate 60%) was therefore recommended.

**Keywords:** Effect, Forage :Concentrate ratios ,performance, weaner rabbits

### Introduction

In developing countries like Nigeria, with its increasing population the level of animal protein intake by Nigerians has continued to decline over the years. Onyimonyi and Ene (2003) reported that the average consumption of animal protein in the country is 4.5g/head/day as against the minimum requirement of 35g/head/day recommended by the Food and Agricultural Organization of the United Nations (1992). These are attributed to the high cost of animal products due to high cost of production arising from high cost of conventional feedstuffs (Akinmutimi *et al.*, 2000) and concentration of animal production on poultry (Ezea, 2004).

Two viable options to the solution of the above problems were suggested. These are the use of poultry and micro- livestock like rabbit for meat production (Akinmutimi

and Ezea, 2006) and the adoption of feeding strategy that maximize the use of under utilized feed resources and waste in our environment (Akinmutimi *et al.*, 2002). Rabbit production has enormous potential in alleviating the problem of animal protein supply in developing countries (Biobaku and Dosumu, 2005).

Taiwo *et al* (2003) and Odimba (2006) advocated that the prolific nature of rabbits coupled with its short gestation period, generation interval and cheap cost of production makes rabbits the choice animal for and easy way of meeting the demand for animal protein. According to Rao and Chavan (1979) and Cheeke (1986) rabbit meat is tasty, nutritious, low in fat content, sodium and cholesterol level when compared to other common meat sources. The above advantages make it a choice animal for bridging the gap of animal

protein intake. However intensive livestock farming including rabbit production in Nigeria has been greatly affected by high cost of feed and feeding ingredients especially the conventional protein and energy ingredients like soybean meal, groundnut cake and maize (Ani and Adiegwu, 2005). This has been blamed on the competition between man, industry and livestock for conventional feedstuffs (Akinmutimi, 2004).

According to Aduku and Olukosi (1990), the ability of rabbits to thrive on forages, which are abundantly available all the year in high rainfall areas, makes rabbit production cheap and possible. This has necessitated the use of forages like *Aspilia africana*, *Panicum maximum*, *Tridax procumbens*, *Centrosema pubescens* and *Calopogonium mucunoides* e.t.c. Rabbits are known to perform better when fed with the mixture of forage and concentrate diet (Ojewola *et al.*, 1999). But the appropriate combination of forages to concentrate ratio for their optimum performance is yet to be established, hence the importance of this study.

## **Materials and Method**

### *Experimental Site*

The experiment was carried out at the rabbitary unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.. Umudike is located on Latitude 5°29' and 7°33' North and South of the Equator and about 123m above the sea level. Its annual rainfall is about 2169.8mm; relative humidity in the wet season is about 72%, monthly ambient temperature is between 27°C and 30°C.

### *Experimental Animals and Management*

Twenty (20) weaner rabbits of 6 weeks of

old were used for the experiment. They were randomly assigned to five treatment diets. Four (4) rabbits were assigned to each of the five treatments with two (2) rabbits per pen. The experimental design used was the completely randomised design (CRD). The experiment lasted for 56 days. Before the commencement of the experiment, the rabbits were treated for internal and external parasites using ivermectin (Ivomec).

### *Experimental Housing, Diets and Forages*

The experimental hutch is made of wood and wire netting of 120cm x 50cm x 40cm length, breadth and height respectively in a three-tier hutch system. The hutch was housed in a well-ventilated rabbitary unit. The hutch was disinfected using a disinfectant (Morigard solution) four (4) days prior to the stocking of the animals for the experiment. Each of the pens in the hutch has a faecal tray, which allows for easy faecal and urine collection and disposal, a feeder and drinker were also provided in each of the hutches.

The experimental diet consisted of five (5) dietary treatments of forage (F) to concentrate (C) ratios in percentages (%) of F80:C20, F60:C40, F40:C60 and F20:C80 while F50:C50 served as the control diet and were represented as T1, T2, T3, T4, and T5 respectively. The green forages used in the experiment were *Panicum maximum* (grass) energy source and *Centrosema pubescence* (legumes) as protein source. The composition of the basal diet is as shown in Table 1.

### *Data Collection and Method*

For growth performance, data were collected on quantity of feed given, the left over, initial weight and final weight from where the following were calculated -Mean daily weight gain/ rabbit, feed intake per rabbit/day and feed conversion ratio.

**Table 1: - The Calculated Composition of the Concentrate**

Ingredients	%
Maize	24
Maize offal	34
Groundnut cake	15
Palm kernel cake	20
Fishmeal	2
Bone meal	2.5
Oyster shell	2.0
Salt	0.3
Premix	0.2
Total	100.00
Crude protein (%)	17.02
ME (Kcal/kg)	2805.31
Crude fibre (%)	10.31
Calcium (%)	1.72
Phosphorous (%)	0.75

**Carcass and organ weights evaluation**

This involved random selection of three rabbits per treatment. They were fasted for about 24 hours, but water was given *ad-libitum* to ease flaying and reduce the bacterial load of the gastro-intestinal tract. They were slaughtered by severing the jugular vein and soft tissues of the neck. They were flayed, cut open and eviscerated. The dressed carcass was weighed and then cut into thigh, loin, forearm, shoulder, breast and back cuts. according to Akinmutimi *et al.* (2006). The organs that include liver, heart, spleen, kidney and lungs were weighed with a torsion scale while the cut-parts were weighed with Hana<sup>®</sup> power 5kg scale. Both organs and cut-parts weights were expressed as percentage of the dressed weight.

**Gross Margin Analysis**

The cost per kilogram weight gain was determined based on the feedstuff cost as at June/July 2007 in Umuahia, Abia State, Nigeria. The gross margin was calculated

according to Sonaiya *et al.* (1986) where

Cost of production = Cost/kg weight gain x Mean weight gain

Revenue = Price (N/kg) meat x Mean weight gain.

Gross margin = Revenue from sales - Cost of production.

**Chemical Analysis and Statistical Analysis**

The basal diet and forages were analysed for proximate composition using the procedure of A.O.A.C(1990). The gross energy was determined using GallenKamp<sup>®</sup> Ballistic Bomb Calorimeter. The anti-nutrients of the forages such as tannin, phytate, saponin were determined according to the method of Maga (1982), Lucas and Markakas (1975), and Spectrophotometric method of Brunner (1984) respectively

The data were subjected to analysis of variance (ANOVA) in accordance with Steel and Torrie (1980). Separation of significantly different means was carried out using Duncan's Multiple Range Test according to Duncan (1955).

**Results and Discussion**

Table 2: Shows the proximate composition and the gross energy value of the basal diet and the test forages. The proximate composition of the basal diet and its crude protein value falls within the nutrient requirement of rabbit (Akinmutimi and Ezea, 2006). The proximate composition shows that *Centrosema pubescence* is more promising in rabbit feeding than *Panicum maximum* in terms of higher values of crude protein.

The anti-nutritional factors in the test forages are as shown in Table 3. *Centrosema pubescens* has higher quantity of phytate and saponin than *Panicum maximum* but the reverse is the case of tannin making *Panicum maximum* the better forage in

terms of anti - nutritional content. The presence of anti-nutrients in all the forages is in support of earlier reporters who reported that forages contain anti-

nutritional factors (D' Mello and Devendra, 1995; Akinmutimi and Akufu, 2006).

**Table 2: Proximate Composition and Gross Energy of the Concentrate and the Test Forages (*Centrosema pubescence* and *Panicum maximum*)**

Test	C.P	E.E	C.F	Ash	DM	NFE	GE(Kcal/g)
Forages							
Basal diet	18.62	3.50	3.69	8.31	88.68	65.90	3.10
<i>Centrosema pubescence</i>	22.53	2.38	34.81	6.86	88.41	33.43	3.65
<i>Panicum maximum</i>	11.06	2.60	36.41	12.87	87.61	37.08	3.93

**Table 3: Anti-Nutritional Factors of the Forages (%)**

Forages Used	Tannin	Saponin	Phytate
<i>Centrosema pubescence</i>	0.024	0.630	0.086
<i>Panicum maximum</i>	0.035	0.305	0.030

**Table 4: Performance characteristics of rabbits fed different ratios of forage to concentrate**

PARAMETERS	T1	T2	T3	T4	T5	SEM
Initial weight (g)	505.00	495.00	497.50	500.00	512.50	11.86
Final weight (g)	1129.50 <sup>c</sup>	1299.50 <sup>b</sup>	1423.00 <sup>a</sup>	1047.50 <sup>d</sup>	1269.00 <sup>b</sup>	21.61
Weight gained (g)	624.50 <sup>c</sup>	804.50 <sup>b</sup>	925.50 <sup>a</sup>	547.50 <sup>d</sup>	756.50 <sup>b</sup>	17.79
Daily weight gain (g)	11.13 <sup>c</sup>	14.32 <sup>b</sup>	16.52 <sup>a</sup>	9.83 <sup>d</sup>	13.50 <sup>b</sup>	0.31
Total feed intake (g)	2070.00	2136.00	2390.00	2147.00	1482.00	285.46
Daily feed intake (g)	36.96 <sup>c</sup>	38.63 <sup>b</sup>	42.85 <sup>a</sup>	38.34 <sup>bc</sup>	37.76 <sup>bc</sup>	0.46
FCR*	3.32 <sup>b</sup>	2.65 <sup>d</sup>	2.58 <sup>d</sup>	3.92 <sup>a</sup>	2.79 <sup>c</sup>	0.44

a, b, c and d means with different superscript in the same row are significantly different (p<0.05).

FCR\* = Feed conversion ratio.

Table 4: Shows the growth performance of weaner rabbits fed different ratios of forage to concentrate. There was significant difference (p<0.05) for all the parameters considered, except for the total feed intake. Treatment 3 (T3) had the highest final weight (1423.0g) that was significantly different (p<0.05) from other treatment means. T2 and T5 values were (p>0.05) similar (1299.5g and 1269.0g) but were significantly heavier than T1 (1129.5g and T4 (1047.50g).The total weight gain and daily weight gain followed similar pattern. This implies a better combination of forage

to concentrate ratio than others (Onwudike, 1995, Ojewola *et al.*, 1999). The daily feed intake of T3 had the highest value (42.85g) that was significantly higher (p<0.05) than others. T3 also had the least feed conversion ratio (2.58) that was significantly lower than others. This implies better utilization of the feed (Akinmutimi, 2006) this is followed by T2, T5, T1 and T5. It then indicates the superiority of T3 among other treatments since the lower the feed conversion ratio, the better the diet (Ogbonna *et al.*, 2000).

**Table 5: Mean weight of cut parts of rabbits fed different ratios of forage to concentrate diets (as a percentage of dressed weight).**

PARAMETERS	T1	T2	T3	T4	T5	SEM
Live weight (g)	1098.67 <sup>b</sup>	1130.00 <sup>b</sup>	1250.00 <sup>a</sup>	1003.33 <sup>c</sup>	1160.00 <sup>ab</sup>	32.65
Dressed weight (g)	483.33 <sup>d</sup>	536.67 <sup>cd</sup>	796.72 <sup>a</sup>	556.67 <sup>c</sup>	633.33 <sup>b</sup>	21.36
Dressing %	42.47 <sup>c</sup>	47.48 <sup>c</sup>	66.53 <sup>a</sup>	55.40 <sup>b</sup>	54.53 <sup>b</sup>	1.920
Thigh	14.61 <sup>d</sup>	13.26 <sup>d</sup>	23.05 <sup>a</sup>	17.37 <sup>c</sup>	21.07 <sup>b</sup>	0.498
Loin	9.46 <sup>a</sup>	6.12 <sup>d</sup>	8.77 <sup>b</sup>	6.08 <sup>d</sup>	8.05 <sup>c</sup>	0.192
Shoulder	11.41 <sup>ab</sup>	9.56 <sup>bc</sup>	13.81 <sup>a</sup>	8.00 <sup>c</sup>	12.72 <sup>ab</sup>	0.977
Back cut	30.33 <sup>b</sup>	29.76 <sup>b</sup>	37.25 <sup>a</sup>	28.26 <sup>bc</sup>	27.12 <sup>c</sup>	0.800
Forearm	2.50 <sup>bc</sup>	2.13 <sup>c</sup>	3.40 <sup>a</sup>	2.35 <sup>bc</sup>	2.92 <sup>ab</sup>	0.024
Breast cut	12.40 <sup>b</sup>	13.33 <sup>b</sup>	15.80 <sup>a</sup>	12.95 <sup>b</sup>	13.20 <sup>b</sup>	0.391

<sup>a,b,c,d</sup> means with different superscript in the same row are significantly different ( $p < 0.05$ ).

Table 5 presents the cut parts as percentage of dressed weight of weaner rabbits fed different ratios of forage to concentrate. There were significant differences for all the parameters considered. T3 had the highest value that was significantly better than other treatments in terms of percentage ( $p < 0.05$ ), for dressed weight, % dressed weight, thigh, back cut, forearm and breast

cut except for forearm in T5. T3 also had the highest value for shoulder (13.81) that was higher than the values of others except for T1 and T5. This shows that T3 had better ability to deposit tissues for all these parameters (Abiola, 1999; Akinmutimi, 2004). It also implies that, it will have better economic value since many of the parameters are prime parts (Akinmutimi, 2006).

**Table 6: Organ weight of rabbits fed different ratios forage to concentrate**

Organ weight	T1	T2	T3	T4	T5	SEM
Spleen	0.125 <sup>b</sup>	0.166 <sup>ab</sup>	0.183 <sup>a</sup>	0.133 <sup>ab</sup>	0.153 <sup>ab</sup>	0.0170
Liver	5.86 <sup>b</sup>	5.15 <sup>b</sup>	7.14 <sup>a</sup>	6.21 <sup>ab</sup>	5.97 <sup>b</sup>	0.330
Heart	0.510 <sup>b</sup>	0.500 <sup>b</sup>	0.596 <sup>a</sup>	0.433 <sup>b</sup>	0.506 <sup>b</sup>	0.000
Kidney	1.68 <sup>ab</sup>	1.44 <sup>b</sup>	1.84 <sup>a</sup>	0.79 <sup>c</sup>	1.53 <sup>ab</sup>	0.300

<sup>a-c</sup> means with different superscript in the same row are significantly different ( $p < 0.05$ ).

**Table 7: The economics of the diet**

Parameters	T1	T2	T3	T4	T5	SEM
Cost of feed consumed (₦)	68.62 <sup>c</sup>	70.82 <sup>b</sup>	79.20 <sup>a</sup>	71.18 <sup>b</sup>	70.10 <sup>b</sup>	0.889
Cost/kg of feed (₦)	33.15	33.15	33.15	33.15	33.15	0.00
Revenue (₦)	800 <sup>d</sup>	1000 <sup>b</sup>	1125 <sup>a</sup>	900 <sup>c</sup>	1050 <sup>ab</sup>	29.58
Gross margin (₦)	731.38 <sup>b</sup>	929.18 <sup>ab</sup>	1045.78 <sup>a</sup>	828.81 <sup>ab</sup>	825.39 <sup>ab</sup>	75.25

<sup>a-d</sup> means with different superscript in the same row are significantly different ( $p < 0.05$ ).

The organ weight (expressed as % dressed weight) of weaner rabbits fed different ratios of forage and concentrate is as shown in Table 6. There were significant differences for all the parameters measured ( $p < 0.05$ ). The values obtained did not follow any specific pattern that could be attributed to the effect of the treatment. This

implies any of the diet could be considered. Table 7, revealed the profitability (gross margin) of weaner rabbit fed different ratio of forage to concentrate. There were significant differences ( $p < 0.05$ ) for all the parameters considered except for cost/kg of feed. The non-significant value for cost/kg of feed could be attributed to the fact that

the same basal diet was given to all treatments. The cost of feed consumed was significantly higher ( $p < 0.05$ ) for T3 among others. This probably may be due to higher values of total feed intake for T3 when compared to others.

The revenue value for T3 was significantly higher ( $p < 0.05$ ) than others except for T5. This probably may be due to higher weight gain of T3 in relation to other treatments (Akinmutimi, 2006). The gross margin values for T3, T2, T4 and T5 were statistically similar ( $p > 0.05$ ). T3 value was significantly higher than that of T1

The gross margin observed favoured T3 since the higher the numerical value for gross margin the better the economic benefits (Akinmutimi, 2006).

#### Conclusion

Considering the growth performance (daily weight and feed conversion ratio), superior carcass quality, comparable organ weight and superior gross margin for treatment 3 (T3), T3 (F60:C40) is recommended as a suitable combination of forage:concentrate ratio for weaner rabbits.

#### References

- A.O.A.C, 1990. Association of official of analytical chemists. Method and analysis (15<sup>th</sup> edition), published by the association of official analytical chemists, Washington D.C. USA.
- Abiola, S.S 1999. Comparative utilization of Toasted and Cooked Soyabean in Broiler Rations ProceedingS of 24<sup>th</sup> Annual Conf.of. Nigerian society of Animal Production , held at Ilorin, March 19<sup>th</sup>-21<sup>st</sup> Pp 84-86.
- Aduku, A.O. and Olukosi, J.O 1990. Rabbit Management in the Tropics, production, processing Utilization, Marketing, Economics, Practical Training Research and Future prospect. Pp 1, 33-50
- Akinmutimi, A. H., 2004. Evaluation of Sword Bean (*Canavalia gladiata*) as an Alternative Feed Resource for Broiler Chicken. Ph.D Thesis College of Animal Science and Health, Michael Okpara University of Agriculture, Umudike.
- Akinmutimi, A. H. 2006. Utilization of raw sword bean (*Canavalia gladiata*) in grower rabbits diets; Effect on haematological parameters and blood chemistry, proceedings of the 11<sup>th</sup> Annual Conference of Animal Science Association of Nigeria Held at Ibadan 18<sup>th</sup>-21<sup>st</sup> September, 2006. Pp 108-110.
- Akinmutimi, A.H., Abasiokong S. F. and Izundu, R. O. 2002. Effect of processing on Metabolizable Energy and Protein Content of Sword Bean (*Canavalia gladiata*) using Muscovy duck (*Carina moshata*). *Journal of Animal Science*. 5(1):51-56.
- Akinmutimi, A.H. and A. Akufo. 2006. Effect of Graded Levels of Dietary Inclusion of Siam Weed (*Chromolaena odorata*) Leaf Meal in Grower Rabbits diet in a Tropical Environment. *Journal of Animal and Veterinary Advances*. 5 ( 8 ) : 7 0 7 - 7 1 1 . <http://www.medwellonline.net>
- Akinmutimi, A.H., and Ezea J. 2006. Effect of Graded Levels of Toasted Lima Bean (*Phaseolus lunatus*) Meal in Weaner Rabbit Diets. *Pakistan Journal of Nutrition* 5(4): 368-372.
- Ani, O.A and Adiegwu, I.I 2005. The feeding value of velvet bean (*mucuna pruiennnts*) to weaner Rabbits. Proceedings of the 30th Annual conference of the Nigerian Society for Animal Production held at University of Nigeria, Nsukka. 20<sup>th</sup>-24<sup>th</sup> March, 2005. Pp 186-189.
- Biobaku, W.O. and Dosumu, E.O. 2005. Growth Response of Rabbits fed

- Graded Levels of processed and undulled Sunflower Seed. Nigeria Journal of Animal Production.30 (2): 179-184.
- Brunner, J. H. 1984.** Direct spectrophotometric Determination of Saponin, Analytical chemistry 34: 13,14-1326.
- D, Mello, J.P. and Devendra, F. 1995.** Topical Legumes in animal Nutrition: United Kingdom. Pp 96-133.
- Duncan 1955.** Multiple Range and Multiple Tests, Biometrics 11: 1 42
- Ezea, J. 2004.** Effects of Graded levels of toasted Lima Bean (*phaeolus huatus*) Meal in weaner Rabbit Diets. B. Agric Thesis College of Animal Science and Health, Michael Okpara University of Agriculture Umudike.
- F.A.O. 1992.** Food and Agriculture Organisation of United Nation Rome. The State of Food and Agriculture. Pp 42
- Lucas, G.M. and Markakas P. 1975.** Phytic Acid and other Phosphorus Compounds of Bean (*Phaseolus vulgaris*) *J. Agric Ed Chem.*, 23: 13 15.
- Maga, J.A. 1982.** Phytate, its Chemistry Occurrence Food Interaction Nutritional Significance and Method of Analysis *Journal. Science Food and Agriculture*, pp 30-31.
- Odimba, N.E 2006.** Influence of Forage Legumes (*Centrosema pubscens*, *Calopogonium phasloides*) on the Semen Characteristics and Testicular Dimensions of Rabbits. B.Agric Thesis, College of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike Pp 33.
- Ogbonna, I. U., Oredien, A. O. and Adesehinwa A. O. K. 2000.** Effect of replacing Groundnut Cake with raw Soybean Residue in diet on performance and nutrient Digestibility of Cockerel chick. A preliminary Study. Nigeria poultry Science Journal 1 :23-31.
- Ojewola G.S., Ukachukwu, S. N. and Abasiokong, S. F. 1999.** Performance of Growing Rabbits Feed Sole concentrate forage Diets and
- Onwudike, O. C., 1995.** Use of Legume Tree Crops *Gliricida sepium* and *Leucaena leucocephala* as Green Feeds for Growing Rabbits. *Animal Feed Science and Technology* 51, pp 153-163.
- Onyimonyi, A.E and Ene, J.C 2003.** Performance of growing rabbits fed Panicum maximum with graded Levels of a Concentrate Diet . proceeding 8<sup>th</sup> Annual conference of Animal Science Association of Nigeria (ASAN), federal University of Technology Minna, Nigeria, September 15-18, Pp73-75.
- Rao, D.R Chavan, C.B 1979.** Nutritive value of Rabbits Meat. Pp. 53-55 Rabbits. Corvallis
- Sonniya, E. B. William, A. R. and Oni, S. A. 1986.** A Biological and Economic Appraisal of Broiler production up to 16 weeks. *Journal of Animal Science Research* 6 (2):115-125.
- Steel, R.G and torrie, J.H. 1980.** Principle and procedure of statistics. Biometric Approach 2<sup>nd</sup> edition Mc Graw- Hill Book co. Inc. New York
- Taiwo, A. A., Adejuyigbe, A. D., Talabi, E. O. Ekwumankama, G. and Adebowale, E. A. 2003.** Effects of raw and Cooked Mucuna Seed Meal based 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, Nigeria September 15th-18th Pp 83-85.