EFFECT OF MIXED FEEDING OF FORAGES AND GRADED DIETARY ENERGY LEVELS ON THE PERFORMANCE OF WEANER RABBITS

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ABSTRACT
Thirty six New Zealand White X Dutch rabbits of crosses were used for the experiment to assess the effect of mixed feeding of forages and graded dietary metabolisable energy levels at 1500kcal/kg, and 2000kcal/kg and 2500kcal/kg, respectively. Forages used were *Calapogonium mucunoides, Panicum maximum* and *Tridax procumbens* in a 3 x 3 factorial in a Completely Randomized Design (CRD) with nine treatments, replicated into two with two animals per replicate. The experiment lasted two months. There was no significant ($P>0.05$) difference in feed intake among the treatments except for *Tridax procumbens* with energy level of 2500kcal/kg. Feed conversion ratio decreased significantly ($P<0.05$) with increased in energy level of concentrate. The feed conversion ratio was significantly ($P<0.05$) higher in rabbits fed *Tridax procumbens* and concentrate with 1500kcal/kg energy level and lowest in treatment of *Calapogonium mucunoides* and concentrate with 2500kcal/kg energy. The weight gain of rabbits fed with *Calapogonium mucunoides* and concentrate of 2500kcal/kg respectively, was significantly ($P<0.05$) higher than the others. For blood parameters, packed cell volume and serum potassium showed slight variation whereas the serum quality of calcium, phosphorus, magnesium and haemoglobin varied significantly.

Key words: Rabbits, *Calapogonium* ¸ *Panicum* , *Tridax* , Energy, *C*oncentrate .

INTRODUCTION
Rabbit is identified as an economic livestock for small scale rural farmers or dwellers. According to Abdulmalik (1994) rabbit is capable of producing about 4.7kg of meat, enough to solely meet with animal protein requirement of a medium family size. Rabbit production also has enormous potential in alleviating the problems of animal protein supply in a developing economy (Biobaku and Dosumu, 2003). The most advantageous attributes of the rabbit is that it has high reproductive potential and fast growth rate (Ojewola *et al.*, 2006). This is due to its short period length, early maturity, high prolificacy and ability to rebreed shortly after parturition (Odubote and Akinokun, 1991).

Omole *et al.*, (2005) reported that the white meat of rabbit is nutritious, easily digestible and extremely low in cholesterol and sodium levels. Damron (2006) showed that cooked piece of rabbit meat is high in protein (56%), low in fat (9%), low in cholesterol, sodium and calories (8%) and contains 28% phosphorus, 13% iron, 16% zinc, 14% riboflavin,, 6% thiamin, 35% B_{12} and 48% niacin. There is a direct relationship between nutrition and the outstanding reproductive qualities of the rabbit as observed by Egbunike and Ladokun (1998). Herbert *et al*., (2005) reported that nutrition affects the secretory functions of the accessory sex gland, that is, the products that make up the seminal plasma. Nutrition plays a vital role in enhancing the reproducing capacity of an animal and the overall increase of animal products such as meat, milk and egg. Forage legume feeding has been advocated and is being adopted by small to medium scale livestock farmers in the tropics to boost nutritional regimes of their animals (Preston and Leng, 1989; Herbert *et al.*, 2005).

Ayoade *et al.*, (1985) observed that rabbit can thrive and survive on a wide range of fresh or preserved grasses, shrubs and leaves that are not consumed by humans. Evers (2000) reported that leguminous forages are high in protein and crude fibre. They have high digestibility, contain five times the calcium, 30% to 50%

phosphorus and twice the magnesium of grasses. *Calapogonium.mucunoides* is a creeping and twinning, hairy forming, trifoliate and prostrate that is drought resistant and relatively palatable (Olorode, 1984). *Panicum maximum* is palatable and nutritious during the early stage of growth (Olubanjo, 1977). *Tridax procumbens* is leafy and succulent green.

According to Spore (2007) and Soyebo (2006), rabbit production has the potential to improve on the diet and income of many poor households due to its high growth and fecundity rate, low investment and labour cost. Despite these good qualities of rabbit, there are still indications that the appreciation level of rabbit by Nigerians is low. This study investigated the performance of weaner rabbits fed mixed feeding of forages and graded dietary energy levels.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the rabbitry unit, Michael Okpara University of Agriculture Umudike, Abia State. Umudike is located on latitude $05^{0}29'$ N and longitude $07^{0}33'$E in South Eastern Nigeria.

Experimental animals and management

Thirty six weaner rabbits (New Zealand White x Dutch breed) with average weight of 682.64g were randomly selected and assigned to treatments in a 3 x 3 factorial arrangement in a Completely Randomized Design (CRD). The treatments were replicated into two, each with two rabbits per replicate. Rabbits were housed two per cage in a long three tier wire cage supported at the base with wooden planks. The cages were placed inside a well ventilated rabbitry with concrete floor and asbestos roofing sheets. The cages were washed and disinfected before the animals were introduced.

Experimental diets

Three concentrates were used as feed supplements at different metabolisable energy levels of 1500kca/kgl, 2000kcal/kg and 2500kcal/kg at 50g/day. Table 1 showed the composition of supplementary concentrate that was fed to experimental rabbits. The basal ration was made up of forages thus: *Panicum maximum, Calapogonium mucunoides* and *Tridax procumbens*. Each forage type was fed *ad lib.* per day per animal.The composition of supplementary concentrate that was fed to the experimental rabbits is show in Table 1.

Table 1: Composition of supplementary concentrates fed to the experimental rabbits

Ingredient	Diet 1	Diet 2	Diet 3
Maize	1.00	7.35	34.70
Soyabean meal	1.00	7.00	10.00
Palm kernel cake	2.00	20.00	16.00
Fish meal	1.00	3.00	5.00
Wheat offal	74.00	56.00	30.00
Bone meal	7.00	3.00	1.30
Oyster shell	6.00	2.65	1.30
Salt	3.00	0.50	0.50
Vitamin premix	5.00	0.50	0.50
Total	100.00	100.00	100.00
Metabolisable Energy (kcal/kg)	1500	2000	2500
Crude protein (%)	12.58	13.17	12.13

Experimental design

A 3 x 3 factorial in completely randomized design (CRD) was used. The thirty six weaner rabbits were randomly allocated into three groups of twelve rabbits each. Each group was assigned to basal forage feed

and further divided into three sub-groups. The sub-group was randomly assigned to level of dietary concentrate supplementation.

Parameters measured

The following parameters were measured:

- daily live weight gain
- daily feed intake
- feed conversion ratio
- haemoglobin
- packed cell volume
- percentage dressed weight
- percentage weight of offal
- plasma and serum contents for sodium, potassium, magnesium and calcium

Data collection

Growth study

The rabbits were weighed individually prior to the commencement of the experiment and subsequently on weekly basis. Feeds were supplied once a day with concentrate weighed and served first, then followed by the forage. Every morning, the remnants of both concentrate and forages were recovered and weighed before cleaning individual cages. Feed intake was calculated from the difference in weight of feed introduced and that of the remnant. The average daily weight gain and feed intake were calculated and recorded at the end of the week.

Carcass yield

At the end of sixty days, two rabbits were randomly selected from each treatment, that is one rabbit per replicate for carcass and haematological analyses. Prior to slaughtering, the animals were fasted, stunned and bled afterwards. This was followed by de-hairing as well as evisceration. The head, intestine, stomach and visceral organs were removed before weighing the carcass and the different weights were recorded as dressed weight. These were then computed in percentages.

Haematological study

Sahli's method year (acid hermatin) was used to determine haemoglobin values. The brown pigment colour formed was compared with the standard after which the values were read with Sahli's haemotometer. Packed cell volume (PVC) was determined using the micro- haemotocrit method after centrifugation. Haematocrit reader was used to read off values. Blood serum was used to determine minerals. Complexiметric titration using ethylene diamine tetra acetic acid (EDTA) was used to determine calcium and magnesium while flame photometry was used to determine sodium and potassium.

Analysis of data

Data analysis was done using ANOVA (Steel and Torrie, 1980) and significant means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISSCUSSION

Table 2 showed the values for daily feed intake and other performance parameters. Values for feed intake was highest for rabbits feed with *Panicum maximum* than *Calapogonium mucunoides* and *Tridax procumbens*. Those rabbits fed concentrate with energy level of 1500kcal/kg consumed more feed than rabbits fed concentrate with energy level 2000kcal/kg and 2500kcal/kg. This is in agreement with earlier report of Lebas *et al*., (1986) and Cheeke (1984). This may probably be due to the factor that *Panicum maximum* had lower nutrient density, thus encouraging rabbits to eat more to satisfy their energy needs. Feed intake increased significantly ($P<0.05$) with decreased energy irrespective of the forage fed. Values obtained were reduced significantly ($P<0.05$) when the energy level of 2500kcal/kg was fed with *Tridax procumbens.* This further indicates that this feeding combination did not improve but rather reduced feed intake. Apart from feeding combined *Panicum maximum* with energy level concentrate of 1500kcal/kg and *Tridax procumbens* with energy level concentrate of 2500kcal/kg, there was no significant ($P>0.05$) difference in feeding with other concentrates. All mixed feeding of *Panicum maximum* and *Calapogonium*

mucunoides with the respective energy level concentrates gave better result in weight gain than *Tridax procumbens* with concentrates mixtures.

Table 2: Interaction effect on the performance of growing rabbits as influenced by mixed feeding of forage and concentrate

Forage Concentrate (Kcal/	*Panicum maximum*			*Calopogonium mucunoides*			*Tridax procumbens*		
	1500	**2000**	**2500**	**1500**	**2000**	**2500**	**1500**	**2000**	**2500**
Daily feed intake (g/rabbit)	73.31^{a}	66.25^{b}	67.50^{b}	57.75^{b}	50.50^{b}	52.15^{b}	53.25^{b}	49.75^{b}	40.00^{c}
Feed conversion ration	4.73^{b}	3.12^{f}	2.72^{g}	3.30^{e}	2.58^{h}	2.31^{l}	5.92^{a}	4.14^{c}	3.64^{d}
% dressed weight	75.81^{a}	71.27^{e}	75.07^{b}	72.33^{d}	76.19^{a}	76.26^{a}	71.64^{e}	67.12^{f}	73.11^{c}
% weight of offal	21.00^{f}	23.34^{d}	20.89^{f}	23.19^{d}	23.30^{e}	19.95^{g}	25.23^{b}	28.80^{a}	24.39^{c}
Haemoglobin (g/dl)	7.7^{g}	7.9^{f}	7.5^{h}	7.4^{h}	8.5^{d}	9.5^{b}	9.1^{c}	8.1^{e}	10.7^{a}
Packed cell volume (%)	25.0^{b}	27.0^{a}	30.0^{a}	30.5^{a}	29.0^{a}	24.0^{b}	27.5^{a}	29.5^{a}	27.0^{a}
Serum potassium (MEq/L)	3.39^{c}	3.59^{c}	3.47^{b}	2.59^{d}	3.53^{a}	3.57^{a}	3.36^{c}	3.31^{c}	3.26^{c}
Serum phosphorus (MEq/L)	3.50^{b}	3.45^{b}	3.85^{a}	2.87^{c}	2.60^{g}	2.92^{c}	2.70^{f}	2.70^{f}	3.40^{b}
Serum magnesium (MEq/L)	0.69^{e}	0.73^{d}	0.73^{d}	0.73^{d}	0.84^{a}	0.77^{c}	0.84^{a}	0.84^{a}	0.84^{a}
Serum calcium (MEq/L)	4.28^{g}	4.37^{f}	4.39^{f}	4.55^{e}	4.70^{d}	4.78^{b}	4.75^{c}	4.75^{c}	5.25^{a}

$^{a\ to\ h}$ Means with different superscriptsin the same row are significant (P<0.05)

Fed conversion ratio decreased significantly (P<0.05) with increase in energy level. This agreed with the views of Cheeke and Patton (1980) that when diets containing high energy grains such as maize are fed to rabbits, starch may pass undigested through the small intestine. The ration was highest (P<0.05) with mixed feeding of *Tridax procunbens* and concentrate with energy level of 1500kcal/kg and significantly lowest with mixed feeding of *Calapogonium mucunoides* and concentrate of 2500kcal/kg energy level. The highest dressed carcass weight was observed in the feeding of *Calapogonium mucunoides* and concentrate of 1500kcal/kg and 2500kcal/kg mixtures. Sell and Owing (1981) observed that high concentration of energy in the diet of rabbit increase the caloric density of diet and could also increase organ and carcass yield or affect fatty acid composition of tissue and organ of the body. Eshiett *et al.,* (1979) reported slight increase in carcass yield and reduction in kidney and liver weights with energy increase in energy composition of rabbits diets. The haematological properties of rabbits showed an interaction except serum sodium which did not show any interaction (P>0.05) effect with mixed feeding (Table 2). The highest values for haematocrit and serum potassium were observed feeding *Panicum maximum* with 1500kca/kg energy concentrate and *Calapogonium mucunoides* with concentrate of 2500kcal/kg energy level, respectively. The haemoglobin, serum calcium, phosphorus and magnesium showed clear variations with mixed feeding. *Tridax procumbens* according to Ali *et al.,* (2001) is to extensively used as anticoagulant and possesses wound healing function.

CONCLUSION

Feeding with *Panicum maximum* and energy level concentrate of 1500kcal/kg gave better result in feed intake and percent dressed weight. *Calapogonium mucunoides* combined with energy levels of 2000kcal/kg and 2500kcal/kg also did better in percent dressed weight. High feed conversion ratio was recorded for *Tridax procumbens* combined with energy level concentrate of 1500kcal/kg while high percent weight of offal was recorded for *Tridax procumbens* and concentrate combination of 2000kcal/kg. However, almost all the feed combinations responded positively in packed cell volume. It is therefore recommended that forages like *Panicum maximum* with energy level concentrate of 1500kcal/kg and *Calapogonium mucunoides* with energy level of 2000kcal/kg and 2500kcal/kg should be adopted for rabbit feeding.

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