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EFFECT OF FORAGE TYPE AND LEVEL, PALM OIL SUPPLEMENTATION AND SEX ON PERFORMANCE OF WEANER RABBITS

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ABSTRACT

Ninety six crossbred rabbits aged 5-7 weeks were used to evaluate the effect of forage type, forage level, palm oil supplementation and sex on performance of weaner rabbits in a 2x2x2x2 factorial arrangement in a completely randomized design.Factors considered were forage type (groundnut, lablab), forage level (20, 40), palm oil supplementation (without, with), and sex (male, female). The rabbits were offered 100 g/rabbit/day feed and clean waterfor 98 days.There was no (P>0.05) difference in weight gain, daily feed cost, feed conversion and feed cost/kg gain between rabbits fed groundnut and lablab forage however, feeding lablab forage gave saving/kg gain of ₦42.00. Rabbits fed 40% forage had significantly (P<0.05) higher feed intake and lower weight gain than those on 20% forage. There were non-significant differences (P>0.05) in daily feed cost, feed cost/kg gain of rabbits fed 20% and 40% forage levels.However, rabbits fed 20% forage gave saving/kg gain of ₦96.68 over 40% forage meal. Palm oil supplementation and sex had significant (P<0.05) interaction on performance of the rabbits.Female rabbits fed diets without palm oil had significantly (P<0.05) lower weight gain and feed intake than females fed diets with palm oil and males fed diets with or without palm oil. However, diets without palm oil gave saving/kg gain of ₦23.10 over palm oil while feeding female rabbits gave saving/kg gain of ₦49.59 over males. Significant (P<0.05) interaction between forage level and type was observed in weight gain with rabbits fed 20% lablab forage meal being better than 20% groundnut forage meal, however rabbits fed 40% groundnut forage meal and 40% lablab forage meal were not different. Female rabbits fed 20 and 40% forage meal had significantly (P<0.05) higher weight gain than males fed 20% forage meal. There was significantly (P<0.05) higher total weight gain of rabbits fed 20% forage with palm oil, than 40% forage with palm oil.It was concluded that rabbits fed 20% forage gave better performance than 40% and palm oil improved weight gain.

Key words: Rabbits, lablab, groundnut, forage, sex, palm oil, performance.

INTRODUCTION

Domestic rabbits (*Oryctolaguscuniculus*) are pseudo-ruminant animals with high reproductive potentials, fast growth rate (Hassan *et al*., 2012). They can utilize low grain and high roughage diets and breed all year-round (Irlbeck, 2001).In spite of the various attributes of rabbits over other livestock, the cost of production is high due to the ever increasing cost of concentrate feeds and low weight gains in the humid and sub-humid tropics. In view of this, the need to develop alternative feed resources that are cheap, readily available and with great potentials in supporting livestock growth becomes imperative (Omoikhoje *et al*., 2006).

Forages, especially legumes, with their high protein content, have the potential of meeting the need for cheaper feed sources for rabbits (Iyeghe-Erakpotobor, 2007).However, feeding forage alone will not support adequate growth performancehence supplementation with other sources of energy is required to increase energy content of forage diets. A potential energy source is fats such as palm oil. The main advantage of using oil in rabbit feed is its high calorie density. This create opportunities for using forages whose energy content might be a limitation (Blas *et al.*,2008).Sanni *et al.*(2005) reported that a 50:75 concentrate and *Stylosanthes*combination gave better return on investment than other combinations. This study was conducted to evaluate the effect of forage type, forage level, sex and palm oil supplementation on performance of weaner rabbits.

MATERIALS AND METHOD

Study site:

The study was conducted at theRabbitry of the National Animal Production Research Institute, Shika Zaria, Nigeria. Shika is located within the northern Guinea Savannah zone, latitude 11° 12'42" N of the equator and longitude 7°33'14" E with an altitude of 691m above sea level (Ovimaps, 2012); average annual rainfall of 1100mm, which starts from April to September. The mean maximum temperature varies from 19°C to 38°C depending on season.

Experimental animals and housing:
Ninety-six crossbred weaner rabbits, aged 5-7 weeks, average weight of 700 grams were used in this study. The rabbits were housed individually in metal cages, measuring 40 x 60 x 50 cm arranged in a well-ventilated house with large windows. Each cage was equipped with flat bottom earthen feeders and drinkers to prevent feed wastage.

Experimental diets and procedure:
The rabbits were randomly allocated to four factors in a 2×2×2×2 factorial arrangement in a completely randomized design (CRD). The factors considered were: Forage type (groundnut (*Arachis hypogea*) and lablab (*Lablab purpureus*)); level of inclusion of forage meal (20 and 40%); palm oil supplementation (with, without); and sex effect (male and female). At the onset of the study, the rabbits were treated with anti-stress (Vitalyte; Phoenix pharmaceuticals U.S.A), antibiotic (Tetracin; Vetinida Pharmaceutical Limited India), coccidiostat (Amprolium; Lonye Technology Limited Guangzhou, China) and Ivomec(Savorite Pharmaceutical Limited Baroda (Guj), India against external and internal parasites during the one week adjustment period.

Groundnut and lablab forages were obtained after maturity and harvest of the seeds, from the Forage Production Unit of the National Animal Production Research Institute (NAPRI). The basal diet (concentrate)was compounded with maize 39.5%, Maize offal 15%, Groundnut cake 42.00%, Bone meal 3%, salt 0.25% and Biomix premix 0.25%. The forages (lablab and groundnut) were air-dried for 7 days, chopped and milled. For the 20 and 40% forage meal diets without palm oil, the forage meals were incorporated into the basal diet in the proportion of 80% concentrate:20% forage meal or 60% concentrate:40% forage meal. For the 20 and40% forage meal with palm oil diets, the forage meal was incorporated into the basal diet in the proportion of 79% concentrate:20% forage meal:1% palm oil or 59% concentrate:40% forage meal:1% palm oil. The proximate composition of the diets is shown in Table 1. The rabbits were served 100g/rabbit/day of feed daily and clean water *ad libitum*in earthen flat bottom pots. Feed left over was weighed daily and used to determine feed intake. The rabbits were weighed

weekly and feed costs (daily feed cost and feed cost per kilogram gain) were calculated based on the market prices of the ingredients used. Saving per kg gain (saving/kg gain) was calculated as the difference between the feed cost/kg gain of the groups.

Table 1: Proximate Composition (%) of Experimental Diets fed to the rabbits

Forage type	Groundnut		Lablab		Groundnut		Lablab	
Forage level	20	40	20	40	20	40	20	40
Palm oil	-	-	-	-	+	+	+	+
Dry matter	92.22	90.91	91.54	91.55	91.22	91.59	91.91	91.96
Ash (%)	6.37	6.41	6.85	5.25	5.69	7.10	6.92	9.21
Ether extract (%)	16.68	15.45	15.53	15.83	18.17	16.68	16.55	16.59
Crude Fibre (%)	15.76	16.86	16.09	17.28	18.82	16.16	17.26	17.25
NFE	44.22	45.72	42.15	44.83	40.82	44.48	43.58	40.95
Crude Protein (%)	16.97	15.56	19.38	16.81	16.50	15.58	15.69	16.00

DM: Dry matter, EE: Ether extract, CF: Crude fibre, NFE: Nitrogen free extract, palm oil: - without, + with.

Statistical Analysis:

Data collected were subjected to analysis of variance test using the General Linear Model procedure and significant differences in means were separated using Pairwise Difference Procedure of SAS (2001).

RESULTS

The performance of rabbits fed the types and levels of forage meal is shown in Table 2. There was non-statistical (P>0.05) difference in daily weight gain, feed to gain ratio, feed cost and feed cost/kg gain between rabbits fed groundnut and lablab forage meal. Rabbits fed diets with lablab forage however gave saving/kg gain of ₦42.00 over groundnut forage meal. Daily weight gain of rabbits fed 20% forage was significantly (P<0.05) higher than those fed 40% forage meal while feed intake, and feed to gain ratio of rabbits fed 40% forage meal were significantly (P<0.05) higher than those fed 20% forage meal. Although daily feed cost, feed to gain ratio and feed cost/kg gain were not statistically (P>0.05) different,for the forage levels; rabbits fed 20% forage gave saving/kg gain of ₦96.68 over those fed 40% forage meal level.

Table 2: Effect of Forage level and Forage type on performance of weaner rabbits (LSmean±SE)

Parameter	Forage level (%)		P. value	Forage type		P. value
	20	40		Groundnut	Lablab	
Feed intake (g/day)	61.30±1.21^{b}	65.28±1.17^{a}	0.02	63.40±1.16	63.18±1.23	0.90
Weight gain (g/day)	9.68±0.23^{a}	8.97±0.22^{b}	0.03	9.11±0.22	9.54±0.23	0.17

Feed cost (₦/day)	5.98±0.27	6.43±0.26	0.22	6.09±0.26	6.33±0.27	0.53
Feed to gain ratio	7.31±0.29[b]	8.11±0.28[a]	0.05	8.09±0.27	7.33±0.29	0.06
Feed cost/kg gain (₦)	724.10±45.8	820.78±44.1	0.13	793.44±43.7	751.44±46.3	0.51
Saving/kg gain (₦)	96.68	-		-	42.00	

[abc] Means with different superscripts within the same row are significantly(P<0.05) different. SE= standard error

The effect of palm oil supplementation and sex on performance of rabbits is shown in Table 3. There were non-significant differences (P>0.05) in weight gain, feed intake, feed cost or feed cost/kg gain of rabbits fed diets supplemented with or without palm oil. However, rabbits fed diets without palm oil supplementation had saving/kg gain of ₦23.10 compared with those supplemented with palm oil. Similar performance was obtained for male and female rabbits, though feeding female rabbits gave saving/kg gain of ₦49.59 than male rabbits.

The interaction between forage level and palm oil supplementation on performance of rabbits is shown in Table 4. The result show significant interaction effects on performance of rabbit. There was significant (P<0.05) difference in total weight gain of rabbits fed 20% forage with palm oil, than those fed 40% forage with palm oil. However, total weight gain of rabbits fed 20 and 40% forage without palm oil was not significantly different. Similarly, average daily gain was significantly higher, in rabbits fed 20% forage with palm oil than those fed 20% forage without palm oil and those fed 40% forage with or without palm oil. Daily and total feed intakes were significantly higher in rabbits fed 40% forage with palm oil, and those fed 20% forage without palm oil; which was however, not significantly different from those fed 20% forage with palm oil and 40% forage without palm oil. Feed to gain ratio was significantly higher in rabbits fed 40% forage with palm oil, and lowest in those fed 20% forage with palm oil; which were not significantly different from those fed 20 and 40% without palm oil. There were no significant interaction between forage level and palm oil supplementation on daily feed cost, total feed cost and feed cost per kilogram gain, rabbits fed 20% forage with palm oil and 40% forage without palm oil had savings per kilogram gain of ₦37.00 and ₦83.24 respectively.

Table 3: Effect of palm oil supplementation and sex on performance of weaner rabbits (LSmean±SE)

Parameter	Palm oil supplementation		P. value	Sex		P. value
	Without	With		Male	Female	
Feed intake (g/day)	61.85±1.22	64.73±1.16	0.09	64.05±1.20	62.53±1.18	0.37
Weight gain (g/day)	9.08±0.23	9.58±0.22	0.11	9.43±0.23	9.23±0.22	0.53
Feed cost (₦/day)	5.95±0.27	6.47±0.26	0.54	6.47±0.26	5.95±0.26	0.16
Feed to gain ratio	7.72±0.29	7.70±0.28	0.95	7.67±0.29	7.75±0.28	0.84
Feed cost/kg gain (₦)	760.88±46.2	784.00±43.7	0.16	796.23±45.4	748.64±44.6	0.46
Saving/kg gain (₦)	23.12	-		-	49.59	

SE= standard error

Table 4. Interaction effects of forage level and Palm oil on performance of rabbits (LSmean ± SE)

Forage levels (%)	20		40		P value
Palm oil (PO) supplementation	Without PO	With PO	Without PO	With PO	
Total weight gain (g)	865.24±33.03^{ab}	945.57±30.13^{a}	835.96±30.72^{ab}	828.25±30.19^{b}	0.16
Average daily gain(g)	9.19±0.34^{b}	10.18±0.31^{a}	8.97±0.31^{b}	8.98±0.31^{b}	0.05
Daily feed intake (g)	59.52±1.79^{b}	63.08±1.63^{ab}	64.18±1.67^{ab}	66.38±1.64^{a}	0.05
Total feed intake (g)	5833±175.57^{b}	6182±160.14^{ab}	6289±163.25^{ab}	6505±160.44^{a}	0.05
Feed to gain ratio	7.49±0.43^{ab}	7.14±0.39^{b}	7.96±0.40^{ab}	8.25±0.39^{a}	0.05
Daily feed cost (₦)	5.74±0.40	6.22±0.36	6.16±0.37	6.72±0.36	0.94
Total feed cost(₦)	562.99±38.77	609.79±35.36	603.47±36.05	658.73±35.43	0.96
Feed cost/Kg gain (₦)	742.60±67.66	705.60±61.72	779.16±62.91	862.40±61.83	0.52
Savings/Kg gain(₦)	-	37.00	83.24	-	

^{abc} Means with different superscripts within the same row are significantly(P<0.05) different. SE= standard error

The interaction between forage level and forage type on the performance of rabbits is shown in Table 5. Significant (P<0.05) interaction between forage level and type were observed in total weight gain and average daily gain of rabbits fed 20% lablab forage meal than those fed 20% groundnut forage meal, however, rabbits fed 40% groundnut forage meal and those fed 40% lablab forage meal were not different. Rabbits fed 40% groundnut forage meal had significantly higher total feed intake, daily feed intake and feed to gain ratio compared to rabbits fed 20% groundnut forage meal which had the least total feed intake, daily feed intake and feed to gain ratio. Rabbits fed 20 and 40% lablab forage meal were not significantly (P>0.05) different from those fed 20 and 40% groundnut forage meal. There was no significant (P>0.05) interaction between forage level and forage type on daily feed cost, total feed cost and feed cost per kilogram gain, however rabbits fed 20% groundnut forage and 20% lablab forage meal had savings per kilogram gain of ₦95.25 and ₦98.10 respectively.

The interaction between forage level and sex on performance of rabbits is shown in Table 6. Female rabbits fed both 20% and 40% forage meal had significantly (P<0.05) higher total weight gain and average daily gain than male rabbits fed 20% forage meal while male rabbits fed 40% forage meal were not significantly different from the others. The highest daily and total feed intake were recorded in male rabbits fed 40% forage meal than female rabbits fed 20 and 40% forage and male rabbits fed 20% forage meal. Feed to gain ratio of male rabbits fed 40% forage meal was higher than male rabbits fed 20% forage meal while female rabbits fed 20 and 40% forage meal had similar feed to gain ratio. There was no significant (P>0.05) interaction between sex and forage level on daily feed cost, total feed cost and feed cost per kilogram gain. Saving per kilogram gain was ₦172.73 and ₦20.62 for male rabbits fed 20% forage meal and female rabbits fed 20% forage meal respectively.

Table 5: Interaction between Forage level and Forage types on performance of rabbits (LSmean ± SE)

Forage type	Groundnut		Lablab		P
Forage level	20	40	20	40	value
Total weight gain (g)	883.5±30.13^{ab}	811.3.13±30.13^{b}	927.3±33.03^{a}	852.5±30.82^{ab}	0.05
Average daily gain (g)	9.52±0.31^{ab}	8.70±0.31^{b}	9.84±0.34^{a}	9.25±0.31^{ab}	0.05
Feed intake (g)	60.20±1.63^{b}	66.60±1.63^{a}	62.40±1.79^{ab}	64.00±1.67^{ab}	0.05
Total feed intake (g)	5900±160.14^{b}	6527±160.15^{a}	6116±175.57^{ab}	6268±163.81^{ab}	0.05
Feed to gain ratio	7.54±0.39^{b}	8.64±0.39^{a}	7.09±0.43^{b}	7.57±0.40^{ab}	0.05
Daily feed cost (₦)	5.99±0.36	6.20±0.36	5.98±0.40	6.68±0.37	0.52
Total feed cost (₦)	586.66±35.36	607.86±35.36	586.13±38.77	654.35±36.17	0.64
Feed cost/Kg gain (₦)	745.81±61.72	841.06±61.71	702.39±67.66	800.49±63.13	0.97
Savings/Kg gain(₦)	95.25	-	98.10	-	

^{ab}Means with different superscripts within the same row are significantly($P<0.05$) different. SE= standard error

Table 6: Interaction between Forage level and Sex on performance of rabbits (LSmean ±SE)

	Sex				
	Male		Female		P value
Forage Level (%)	20	40	20	40	
Total weight gain(g)	746.31±31.79^{b}	816.39±30.80^{a}	864.50±31.42^{a}	847.82±30.13^{a}	0.05
ADG (g)	8.05±0.32^{b}	8.80±0.31^{a}	9.32±0.32^{a}	9.14±0.31^{a}	0.05
Daily feed intake (g)	60.99±1.72^{b}	67.11±1.67^{a}	61.61±1.70^{b}	63.44±1.63^{b}	0.05
Total feed intake (g)	5977±168.98^{b}	6577±163.68^{a}	6038±167.00^{b}	6218±160.14^{b}	0.05
Feed to gain ratio	6.68±0.41^{c}	8.66±0.40^{a}	7.95±0.41^{ab}	7.56±0.39^{bc}	0.04
Daily feed cost (₦)	6.31±0.38	6.63±0.37	5.66±0.38	6.25±0.36	0.72
Total feed cost (₦)	618.51±37.31	650.10±36.14	554.28±36.87	612.10±35.36	0.72
Feed cost/Kg gain (₦)	709.87±65.12	882.60±63.08	738.33±64.36	758.95±61.72	0.41
Savings/Kg gain (₦)	172.73	-	20.62	-	

^{abc}Means with different superscripts within the same row are significantly ($P<0.05$) different. ADG –average daily gain. SE= standard error

Table 7: Interaction between Palm oil and Sex on performance of rabbits (LSmean ± SE)

Sex	Male		Female		P
Palm oil supplementation	Without PO	With PO	Without PO	With PO	value
Total weight gain (g)	892.82±32.29^{ab}	869.88±30.24^{ab}	808.37±31.42^{b}	903.94±30.13^{a}	0.05
Average daily gain (g)	9.68±0.33^{ab}	9.43±0.31^{ab}	8.76±0.32^{b}	9.80±0.31^{a}	0.05
Daily feed intake (g)	65.00±1.75^{a}	63.11±1.64^{ab}	58.70±1.70^{b}	66.36±1.63^{a}	0.005

Effect of forage type and level, palm oil supplementation and sex

Total feed intake (g)	6370±171.62[a]	6184±160.71[ab]	5753±167.00[b]	6503±160.14[a]	0.005
Feed to gain ratio	7.79±0.42	7.55±0.39	7.66±0.41	7.84±0.39	0.56
Daily feed cost (₦)	6.26±0.39[ab]	6.68±0.36[a]	5.64±0.38[b]	6.26±0.36[ab]	0.05
Total feed cost (₦)	613.94±37.89[ab]	654.67±35.48[a]	552.53±36.87[b]	613.85±35.36[ab]	0.05
Feed cost/Kg gain(₦)	781.58±66.14	810.89±61.93	740.17±64.36	757.11±61.72	0.94
Savings/Kg (₦)	29.31	-	16.94	-	-

[ab]Means with different superscripts within the same row are significantly($P<0.05$) different. ADG – average daily gain. SE= standard error

Interaction between palm oil and sex on performance of rabbits is shown in Table 7. The result showed that female rabbits fed diets without palm oil had significantly lower total weight gain, average daily gain, feed intake, total feed intake than females fed diets with palm oil and malesfed diets with or without palm oil. Although, there were no ($P>0.05$) differences in total weight gain, average daily gain, total feed intake, daily feed intake in female rabbits fed diets with palm oil, and males fed diets with or without palm oil, the females fed palm oil diets had slightly higher values than those on the other diets followed by males fed diets with and without palm oil.There was no significant interaction between sex and palm oil on feed to gain ratio and feed cost per kilogram gain. Daily feed cost and total feed cost were significantly ($P<0.05$) lower in female rabbits fed diets without palm oil, and higher in male fed diets with palm oil. Male and female rabbits without palm oil had savings per kilogram gain of ₦29.31 and ₦16.94 respectively.

DISCUSSION

The increase in feed intake of rabbits fed 40% forage over 20% forage could be attributed to increased fibre content of the diets or to possible reduction in metabolizable energy content of the diets and hence the rabbits had to increase intake to meet the energy deficit. The observed increase in feed intake and feed to gain ratio with increased level of forage inclusion at 40% is in line with the report of Taiwo *et al*. (1999) who stated that rabbits tend to eat more of a diet containing high crude fibre content. However, Asuquo (1997) and Nworgu *et al*. (1999) observed reduction in feed intake andassociated it to high crude fibre content in forage based diets.The inclusion of cassava leaves and stem hay up to 20% in rabbit diets did not affect their general performance (Scapinello *et al*., 2000). Higher weight gain of rabbits fed 20% forage than those fed 40% forage could be attributed to better utilization of the feed by the rabbits. The rate of gain in this study agrees with the daily growth rate of 5-10g reported by Iyeghe-Erakpotobor *et al*. (2001) during the grower phase but were lower than growth rate of 28.9g/day for rabbits fed alfalfa with molasses blocks or 10 to 12g/day on fresh lablab with molasses or sugar cane reported by Linga and Lukefahr (2000).Tangendjaja *et al*. (1990) reported replacement of concentrate with40% *Leucaena leucocephala*as ideal because it supported growth without adverse effect.

Similar feed intake of rabbits fed the two forage types could be attributed to the palatability and acceptance of these two forages by rabbits. Similar weight gain, feed conversion ratio and feed cost/kg gain of rabbits fed both forages supports the report of Iyeghe-Erakpotobor (2012a) that forage type did not affect final weight, feed intake, and weight gain or feed cost per kg of rabbits.Iyeghe-Erakpotobor *et al*. (2002) also reported similar weight gain when rabbits were

fed groundnut haulms, lablab and mucuna forages. However, Aderinola *et al*. (2008) reported higher feed intake, daily weight gain and feed efficiency of rabbits fed *Centrosema pubescens* than *Calapogonium mucunoides.* Total weight gain of rabbits fed lablab (889.95g) and groundnut (847.56g) forage in this study are higher than the gains of 715.51, 603.46 and 605.10 g reported by Omole *et al*. (2007), for rabbits fed with *Stylosanthe sguianensis*, *Lablab purpureus* and sun flower forage meals respectively.

The non-significant effect of forage level and forage type on daily feed costand feed cost/kg gain observed in this study agrees with the findings of Iyeghe-Erakpotobor (2012a) who fed groundnut and lablab forage sole or mixed to rabbits and observed similar feed cost and feed cost/kg gain for the forages fed. Saving/kg gain of ₦96.68 on 20% forage meal over 40% forage level and ₦42.00 on lablab over groundnut forage indicates the potential of making more profit in a production system by feeding 20% forage than 40% or lablab than groundnut forage. The fact that these values might appear small in this study precludes the consideration of scale of production and its magnifying effect on total profit obtainable on the long run.

Similarities in weight gains by both sexes observed in this study supports the finding of Ekpo *et al*. (2008) who did not observe any difference between the sexes in growth performance of rabbits fed unpeeled, peeled cassava tuber and cassava peel meals. Iyeghe-Erakpotobor (2010) reported similar feed intake, feed cost and feed cost/kg gain for male and female rabbits offered sole or mixed forage meal.Laxmi *et al*. (2009) also obtained non-significant effect of sex on body weights of rabbits at ages 4, 8, and 16 weeks. Similarly, Nakkitset *et al*. (2007) observed no effect of sex on growth performance or feed intake when ruzi grass, head lettuce residue, Mimosa pigra and water spinach were fed to rabbits. The current results are different from that reported by Lazzaroni and Biagini (2002) which show a higher feed intake by females than male rabbits. Iyeghe-Erakpotobor (2012a) also observed non-significant difference in both sexes in weight gain but higher feed intake in males than females on groundnut and lablab forages.Lower feed cost/kg gain and higher saving/kg gain obtained for female rabbits is an indication that there is a tendency of reducing cost of production when raising female rabbits than male rabbits. Generally in a production system more females are kept than males therefore more money would be saved in these enterprises by feeding the female rabbits with these forages.

The non-significant difference in the main effects of palm oil supplementation on performance of rabbits could indicate that the percentage of palm oil incorporated into the diets was not sufficient to show a significant effect. However, significant interaction between sex and palm oil supplementation observed as significant improvement in total weight gain, average daily gain, feed intake and feed to gain ratio of rabbits, especially in female rabbits fed palm oil supplemented diets could indicate some level of sexual dimorphism in utilization of feed by rabbits.This observation is in line with the report of Iyeghe and Ekpenyong (1990) that palm oil supplementation in rabbit diet improved growth performance by increasing weight gain; feed conversion, fat and crude fibre digestion. The significant difference ($P<0.05$) in feed: gain ratio across the treatments is in agreement withthe reports of Omole and Onwudike (1983) and Nuhu (2010) that showed significant difference ($P<0.05$) in feed: gain ratio of weaner rabbits fed cassava peel supplemented with palm oil, and when soya bean meal was replaced with moringa leaf meal in the diets of weaner rabbits respectively. Although there were no significant ($P>0.05$) effect of forages-palm oil interaction on daily feed cost, total feed cost and feed cost per kg gain, interaction between 40% forage and palm oil seems to have resulted in a higher

cost. Lower feed cost/kg gain and hence higher saving/kg gain obtained for rabbits fed diets without palm oil indicates that addition of palm oil to the diets increased feed cost and cost of production. It is likely however that the inclusion of palm oil would yield benefits in other aspects rather than feed cost. Addition of oils in diets is reported to enhance absorption of vitamin A, have sparing action on vitamin D and protein, improve immune response, and increase caloric density of diets (Iyeghe-Erakpotobor *et al*., 2000).

Alawa and Amadi (1991) had earlier reported that ability of rabbits to utilize highly fibrous diets may depend on the level of replacement, nature of the fibre source, age of rabbit and the length of adaptation period of their digestive system to the fibre source. Thus the higher feed intake observed in rabbits fed 40% groundnut meal might be as a result of increase in the fibre content of the diet with increased level of forages. However, this is contraryto the report of Nworgu (1999) which showed a reduction in feed intake by rabbits on increased forage meal in the diet. Rabbits fed 20% lablab had the highest weight gain compared to rabbits fed 40% groundnut haulms which were the lowest in the group, this finding agrees with the report of Ngodigha *et al*. (1994) who observed that up to 50% of groundnut haulms can support weight gain of growing rabbits. Also Iyeghe-Erakpotobor (2012b), observed that weight gain of rabbits were unaffected by the level of groundnut forage and rabbits can be fed up to 45% groundnut forage meal. Fotso *et al*. (2000) reported that up to 42% of cassava leaf meal can be fed to growing rabbit with positive result. Similarly, Rohilla and Bujarbaruah (2000) revealed that rabbits can tolerate up to 40% of broom grass (*Thysanolaena maxima*) in their diets without adverse effect on growth performance.

In conclusion, feeding rabbits 20% forage meal is recommended than 40% forage meal. Lablab forage meal appear to be a better forage for rabbit production however groundnut forage is more readily available in the market than lablab which has to be produced by the farmer.Addition of palm oil in forage improved the performance of rabbits in terms of weight gain, feed intake and feed to gain ratio and it was cheaper to feed female than male rabbits.

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