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EFFECT OF REPLACEMENT OF CONCENTRATE WITH LABLAB FORAGE MEAL WITH OR WITHOUT PALM OIL ON PERFORMANCE AND CARCASS CHARACTERISTICS OF RABBITS

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ABSTRACT

Fourteen weeks feeding trial was conducted to evaluate the performance of growing rabbits fed lablab forage meal (LFM) with or without palm oil (PO). Forty grower crossbred rabbits were randomly allocated to five combinations of concentrate, LFM and PO. The combinations were; Control (0% LFM), 20%LFM, 40%LFM, 20%LFM+PO and 40%LFM+PO in a completely randomized design. Feed intake and weight gain were measured on daily and weekly basis respectively. Data collected were subjected to statistical analysis. The results showed that total weight gain was significantly higher ($P<0.05$) for rabbits fed 20%LFM+PO compared to the rabbits fed the control and 40%LFM+PO diets. Total feed cost was relatively higher for rabbits on 20%LFM and 20%LFM+PO when compared to 40%LFM. The weight of the gastro-intestinal tract increased ($P<0.05$) with increase in the inclusion level of lablab forage meal. Inclusion of palm oil reduced the weight of the GIT of rabbits on 20%LFM+PO and 40%LFM+PO ($P>0.05$) when compared to those on 20%LFM and 40%LFM which had no palm oil. It is concluded that the performance of growing rabbits could be improved by inclusion of lablab forage meal with palm oil supplementation at 20% lablab forage meal.

Keywords: lablab, forage, palm oil, rabbits.

INTRODUCTION

Poor economic condition in many tropical countries and associated increase in the shortage of animal protein has turned attention to rabbit production as a ready solution. This is in view of rabbit's fast growth rate and short generation interval (Iyeghe-Erakpotobor *et al.*, 2006). Rabbits are herbivorous non-ruminant animals with functional caecum which has the capacity to extract nutrients in fibrous feedstuffs and convert them into high biological value proteins (de Toledo *et al.*, 2008). In spite of the various attributes of rabbits over other livestock, the cost of production is very high due to the ever increasing cost of concentrate feeds. 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). Consequently, researchers are diverting attention to the rabbit's natural habit of high forage intake (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 *et al.*, 2007). Rabbits can be maintained on green leaves alone, but for best growth to be achieved, the forage has to be supplemented with concentrate (Omole *et al.*, 2007). Hence, studies are being conducted to find out which forages can be used along with concentrates to give the best carcass yield with favourable returns to the farmer. Lablab is a

nutritionally valuable legume resource which can be utilized by rabbits (Omole *et al.*, 2007). It contains an average of 17% protein, 46% neutral detergent fibre and an average dry matter digestibility of 83% (Murphy *et al.*, 1999). Lablab forage can be fed as sole feed for rabbits (Omole *et al*., 2007) or together with concentrate feed (Iyeghe-Erakpotobor and Muhammad, 2007; Mudunuru *et al.*, 2008).

Dietary fat (e.g. palm oil) aids the animal to withstand heat stress by reducing heat increment, increases the energy of density of diets, facilitates supply and absorption of fat soluble vitamins, improves consistency, reduces dustiness, improve diet palatability and improves digestibility (Iyeghe and Ekpenyong, 1990; Tawfeek *et al.*, 1993). This creates opportunities for using forages whose energy content might be a limitation (Blas *et al.*, 2008). This experiment was therefore conducted to evaluate the effect of utilization of lablab forage meal with or without palm oil by growing rabbits on growth performance and carcass characteristics.

MATERIALS AND METHODS

Site of study

The experiment was conducted in the Rabbitry of the National Animal Production Research Institute (NAPRI), Shika, Zaria, Nigeria. Shika is located in the Northern Guinea Savanna ecological zone. The area lies between latitude 10°11' N and longitude 7°8' E, with an altitude of 650 meters above sea level. The area receives an annual rainfall of 1100 mm, which is spread from April to October. The mean minimum and maximum temperatures range between 12 and 28°C in the dry cold (harmattan) season while, in the dry hot season, a temperature range of 20 - 36°C is recorded. Relative humidity during the rainy season is about 75% and 21% during the dry season (Iyeghe-Erakpotobor *et al.*, 2006).

Animals and housing

Forty 8-week old crossbred rabbits, progenies from mating between New Zealand White X California breeds, of average weight 0.68-0.82kg, were used for this study. They were individually housed in metal cages with dimensions of 60 x 50 x 50 cm, placed in a completely walled house with open windows covered with poultry wire mesh and mosquito netting. The house was well-ventilated. As the weather was cold at the onset of the experiment, the windows were covered with polythene sheets to protect the rabbits from strong winds and cold draft. The polythene sheets were later removed when the weather became relatively warm. The cages were thoroughly washed and disinfected before the rabbits were placed in them. The feeders and drinkers were made of earthen pots with curved mouths and flat bottoms, so as to reduce wastage of feed and water. The feeders and drinkers were also washed before the onset of the experiment and regularly throughout the period of study.

Preparation and processing of diets

The concentrate diet (Table 1) was compounded and supplied by the feed mill of NAPRI, while the lablab forage was obtained from the forage production unit of NAPRI. It was harvested, chopped, milled and bagged for the study. Palm oil was purchased from Shika market.

Experimental procedure

All the rabbits were weighed at the start of the study before being randomly allocated to the five lablab forage meal (LFM) treatments. The treatments were control (0%LFM), 20%LFM,

40%LFM, 20%LFM+PO and 40%LFM+PO. The proportions of concentrate, lablab forage meal and palm oil (Table 2) in the rations were weighed, thoroughly and carefully mixed, before being kept in metal bins covered with lids for the period the feed lasted.

Table 1: Composition of the concentrate diet

Ingredient	Proportion (%)
Maize	39.24
Maize offal	15.00
Groundnut cake	42.26
Bone meal	3.00
Salt	0.25
Vitamin/mineral premix	0.25
Nutrient Composition:	
Dry matter	92.90
Crude protein (%)	16.00
Crude fibre (%)	20.75
Ether extract (%)	4.22
Ash (%)	5.6
Nitrogen free extract (%)	53.43

Table 2: Percentage composition of the concentrate, forage and palm oil in the experimental diets

	Proportion in diets (%)				
Ingredient	Control	20%LFM	40%LFM	20%LFM+PO	40%LFM+PO
Concentrate	100	80	60	79	59
Lablab forage meal	-	20	40	20	40
Palm oil	-	-	-	1	1

LFM – Lablab forage meal PO – Palm oil

Proximate analysis

The proximate analysis of the test ingredients and experimental diets were carried out using AOAC (1990) procedure.

Data Analysis

Data were subjected to analysis of variance using general linear model procedure and pair-wise difference method was used to separate significantly different means (SAS, 1987).

RESULTS AND DISCUSSION

Proximate composition of the experimental diets

Table 3 shows the proximate composition of the experimental diets and the lablab forage meal. Lablab forage meal used for this experiment had a dry matter of 95.51%, which was close to the 96.42 reported by Iyeghe-Erakpotobor and Muhammad (2007) and much higher than the 23.4% reported by Omole *et al.* (2007) for fresh lablab. Its crude protein value of 8.56% was lower than the 13.43%, 16.70% and 18.18% reported by Iyeghe-Erakpotobor and Muhammad (2007), Mudunuru *et al.* (2008) and Omole *et al.* (2007) respectively. Its ether extract value (1.28%) compared favourably with 1.23% obtained by Omole *et al.* (2007). Its nitrogen free extract content (34.84%) was lower than 56.29% reported by Omole *et al.* (2007) but higher than 19.47% reported by Iyeghe-Erakpotobor and Muhammad (2007). The crude protein and other nutrients in legume forages are affected by their stage of maturity (George and Bell, 2001). Lablab forage used in this study was obtained after seed harvest; hence, this may be more matured than those used by these other authors in their studies and this could be responsible for the variations observed.

Table 3: Proximate composition (%) of experimental diets and lablab forage used in the study

			Lablab forage meal level (%)			
Parameter	LFM	Control	20	40	20+PO	40+PO
Dry matter	95.51	92.90	93.40	93.66	92.28	93.70
Crude protein	8.56	16.00	19.38	15.59	16.81	14.47
Crude fibre	39.06	20.75	20.87	25.51	20.87	21.14
Ether extract	1.28	4.22	2.37	3.09	3.33	3.09
Ash	16.26	5.6	6.85	5.25	6.92	12.21
Nitrogen free extract	34.84	53.43	50.53	50.56	52.07	49.09

PO – Palm oil

Growth performance of rabbits

The final weights of the rabbits were not significantly different ($P>0.05$) (Table 4). However, total weight gain and average daily gain were significantly ($P<0.05$) different, with rabbits fed 20%LFM+PO (1.00kg and 11.90g) and 20%LFM (0.93kg and 11.11g) having the highest gains. Growing rabbits fed the control and 40%LFM+PO diets recorded lower ($P<0.05$) total weight gain and daily weight gain compared to the 20%LFM+PO fed group. These values were greater than the 0.603kg recorded by Omole *et al*. (2007) when they fed rabbits sole lablab forage meal and compared well with the 0.849kg–1.35kg obtained by Omole and Onuwudike (1983) when they fed growing rabbits with cassava peel meal supplemented with palm oil. The difference in performance might be due to the higher energy content of the diets of rabbits on 20%LFM and 20%LFM+PO. The higher energy content of these diets was as a result of the higher proportion of concentrate in these diets, as well as the addition of palm oil in treatment group 20%LFM+PO. Better performance of rabbits fed diets supplemented with palm oil when compared to diets with no palm oil was observed by Iyeghe and Ekpenyong (1990). The decreased total weight gain observed in growing rabbits fed the control diet, even though the diet was high in energy was likely due to the side effects

of sole concentrate feeding. Leng (2008) had explained that concentrate diets high in starch and/or protein are often incompletely digested in the rabbit small intestine due to long transit time and this may cause enteritis and the proliferation of *Clostridia* and *Escharia coli*. Total feed intake was significantly higher (P<0.05) for growing rabbits fed the lablab forage meal based diets compared to the control. Rabbits fed LFM based diets consumed more feed, which could be likely due to the lower energy content of the diet, coupled with higher crude fibre content when compared to the control diet. Rabbits have been reported to adjust their feed intake according to the energy content of the feed offered (Lebas *et al.*, 1997).

Table 4: Performance of rabbits fed concentrate and lablab forage meal with or without palm oil

Parameter	0%LFM	20%LFM	40%LFM	20%LFM+PO	40%LFM+PO	SEM
Initial weight (kg)	0.65	0.79	0.68	0.7	0.82	0.09
Final weight (kg)	1.48	1.73	1.55	1.74	1.66	0.11
Total weight gain (kg)	0.83^{b}	0.93^{ab}	0.84^{b}	1.00^{a}	0.82^{b}	0.05
Average daily gain (g/day)	8.48^{b}	11.11^{ab}	10.05^{b}	11.90^{a}	9.78^{b}	0.55
Total feed intake (g)	4320.87^{b}	5820.00^{a}	5708.13^{a}	5728.75^{a}	6262.86^{a}	369.62
Total feed cost (₦)	422.28^{ab}	494.81^{a}	392.18^{b}	483.59^{a}	437.15^{ab}	28.61
Daily feed cost (₦)	4.31^{ab}	4.95^{a}	4.00^{b}	4.93^{b}	4.46^{ab}	0.29
Feed conversion ratio	5.21^{b}	6.32^{ab}	6.98^{ab}	5.83^{b}	7.62^{a}	0.47
Feed cost/kg gain (₦)	533.91^{a}	470.80^{ab}	482.70^{ab}	463.31^{b}	482.64^{ab}	31.24

Means with different superscripts along rows are significantly different (P>0.05), SEM-Standard Error of Mean

Total feed cost was highest for 20%LFM (₦494.81), which is significantly (P<0.05) higher than 40%LFM (₦392.18). Feed cost per kg gain was lowest (P<0.05) for growing rabbits fed 20%LFM+PO (₦463.31) compared to 0% LFM (₦ 533.91). Hence, feed cost was saved in feeding 20% LFM + PO as it was efficiently converted to live weight gain as observed in its FCR (5.83).

Average daily feed intake

There was a general increase in average daily intake during the course of the experiment (Fig. 1). However, there was a slight drop in average daily intake during weeks 7 and 11, which might be due to high ambient temperature observed during these weeks, though the weather was generally cool, being the harmattan season. Average daily intake did not differ significantly for all the experimental diets except during week 10. The highest daily feed intake (82.86g) was observed during week 10 for rabbits on 40%LFM+PO, while the lowest feed intake (41.70 g) was observed for rabbits on 20%LFM during week 1.

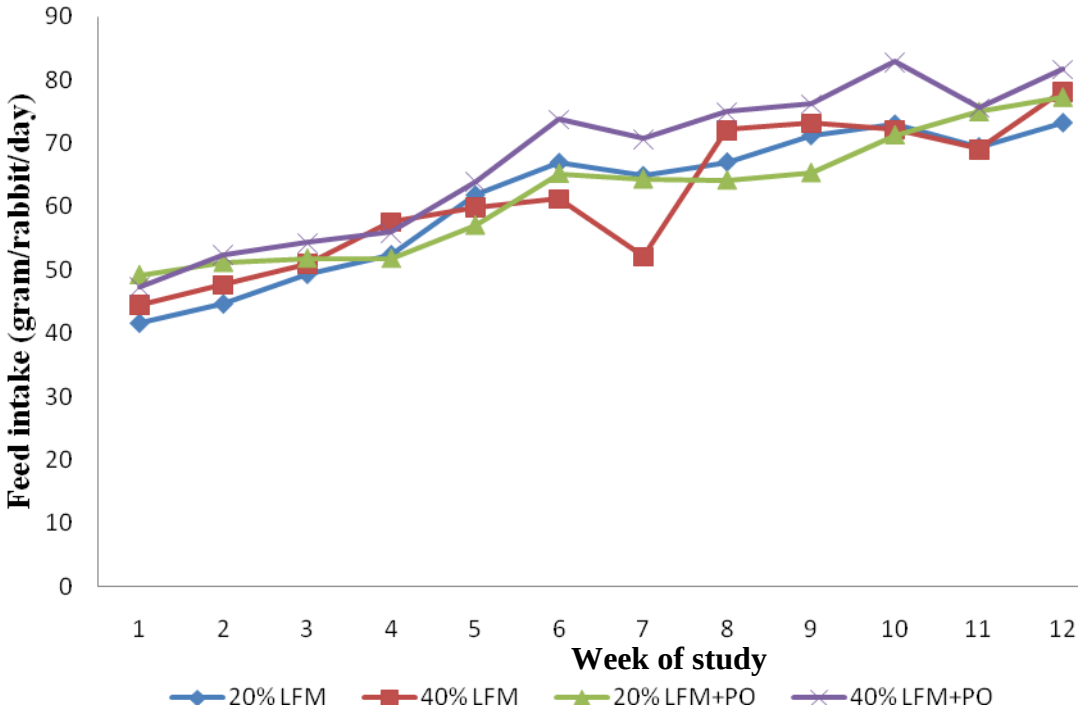


Figure 1: Average daily feed intake of growing rabbits fed concentrate and lablab forage meal

Cumulative weight gain

Cumulative weight gain (Fig. 2) showed the growth rate of the rabbits for the different treatments. Rabbits fed 20%LFM+PO had the highest cumulative weight gain (i.e. growth rate) while those fed 40%LFM+PO had the lowest.

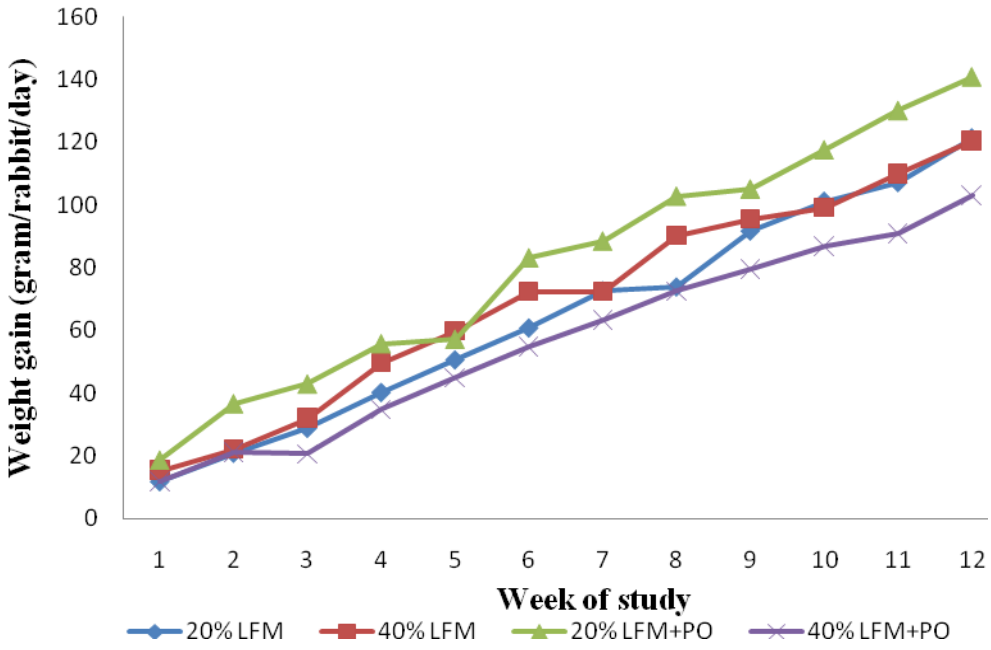


Figure2: Cumulative weight gain of rabbits fed concentrate and lablab forage meal

LFM- lablab forage meal

Carcass characteristics

The results showed on Table 5 indicated the carcass characteristics of rabbits across the different treatment groups. While weights of the skin, heart, liver and hot carcass were not significantly different (P>0.05), the head, kidney, gastro-intestinal tract (GIT) and lungs differed significantly (P<0.05). The weight of the GIT increased with increase in the inclusion level of lablab forage meal in the diet. An exception to this trend was observed with 20%LFM+PO diet, which had the lowest GIT weight (13.47%). This increasing trend was observed by Biya *et al*. (2008) who fed rabbits concentrates with varying inclusion levels of vegetable cuttings and reported that much roughage in the diet tends to over develop the digestive tract, thereby lowering feed efficiency. Inclusion of palm oil reduced (P<0.05) GIT weight of rabbits on 20%LFM+PO and 40%LFM+PO when compared to 20%LFM and 40%LFM respectively. This indicated the potential of palm oil to increase energy content of a forage-based diet and therefore reduce the need of the rabbits to consume more feed in order to meet their energy requirement. Inclusion of lablab forage meal with or without palm oil reduced the fat level of the carcass. However, 40%LFM+PO had higher carcass fat level when compared to 40%LFM. This was in agreement with the findings of Retore *et al.* (2008) that, increase in dietary fat increased the fat content of rabbit meat. Panja (1996) also observed increased carcass fat level when palm oil was included in isonitrogenous diets of broilers. The dressing percentage of the rabbits in this study was not significantly different (P>0.05) for the different treatments groups.

Table 5: Carcass characteristics of rabbits fed concentrate and lablab forage meal with or without palm oil

Parameter	0%LFM	20%LFM	40%LFM	20%LFM+PO	40%LFM+PO	SEM
Live weight (kg)	1.87	1.87	1.77	1.85	1.65	0.12
Fat level	1.00	1.67	1.33	1.67	1.67	0.30
Dressing percentage (%)	52.70	52.33	53.84	54.13	53.51	2.13
Organ weight (% LW)						
Skin	8.89	10.34	10.38	10.82	10.07	0.77
Head	8.01 ^{a}	11.35 ^{b}	11.23 ^{b}	10.82 ^{b}	9.11^{ab}	0.87
Heart	0.55	0.39	0.47	0.45	0.40	0.10
Kidney	1.11^{ab}	0.89^{ab}	0.94^{ab}	1.26 ^{a}	0.60 ^{b}	0.19
Liver	1.76	2.34	2.64	3.07	2.49	0.50
Gastrointestinal tract	16.20^{ab}	16.39^{ab}	19.84^{a}	13.47^{b}	17.21^{ab}	1.28
Lungs	1.18^{a}	1.07^{ab}	1.24^{a}	1.08^{ab}	0.71^{a}	0.13

a, b, c Means with different superscripts along rows are significantly different (P<0.05).
SEM-Standard Error of Mean.
Fat level, 1-1.33= abdominal fatty pad present; 1.67=no fat pad present.

CONCLUSION AND RECOMMENDATION

From the results of this study, the performance of growing rabbits could be improved by inclusion of lablab forage meal with or without palm oil in concentrate-based diet. The best inclusion level was 20% lablab forage meal with palm oil.

REFERENCES

Biya A. J., A. Kannan, M. Morgan, M. Murugan and K.S. Anil (2008) Effect of different feeding systems on the carcass characteristic of New Zealand white rabbits. A M.V.Sc. thesis submitted to Kerala Agricultural University, Thrissur, India.

Blas E., Ródenas L., Martínez E., Pascual J.J., Cervera C. (2008) effect of dietary fat quality on the performance and health of fattening rabbits. Proceedings of 9th World Rabbit Congress – June 10-13, 2008 – Verona – Italy. 151p

De Toledo G.S.P., da Silva L.P., de Quadros A.R.B., Retore M., Araújo I.G., Brum H.S.,Ferreira P., Melchior R. (2008) Productive performance of rabbits fed with diets containing ramie (*Boehmeria nivea*) hay in substitution to alfalfa (*Medicago sativa*) hay. 9th World Rabbit Congress – June 10-13, 2008, Verona, Italy Pp827-830.

George, M. R. and Bell, M. E. (2001). Using Stage of Maturity to Predict the Quality of Annual Range Forage. Range Land Management Series Publication 8019, Division of Agriculture and Natural Resources, University of California.

Iyeghe, G.T. and Ekpenyong, T.E. (1990) Effect of palm oil on growth performance and nutrientdigestibility by grower rabbits. Tropical Animal. Production Investigators, 1:46-52.

Iyeghe-Erakpotobor G.T., and Muhammad, I.R. (2007) Performance of rabbit breeding does fedconcentrate and lablab combinations during pregnancy and lactation. Journal of Animal and Veterinary Advances 6(3); Pp 358-363

Iyeghe-Erakpotobor G. T., AliyuR. and UguruJ. (2006) Evaluation of concentrate, grass andlegume combinations on performance and nutrient digestibility of grower rabbits under tropical conditions African Journal of Biotechnology Vol. 4 (20), pp. 2004-2008.http://www.academicjournals.org/AJB

Lebas F, Coudert P, Rochambeau H de and Thébault R G (1997). Nutrition and Feeding, In: The Rabbit - Husbandry, Healthand Production. FAO Animal Production and Health Series No. 21. Retrievedfrom http://www.fao.org/docrep/t1690E/t1690E00

Leng, R.A. (2008) Digestion in the rabbit. In: MEKARN Workshop.

http://www.mekarnworkshop.com

Mudunuru U.1, Lukefahr S.D.1, Nelson S.D., Flores D.O. (2008) Performance ofgrowing rabbits fed lablab purpureus forage with molasses mini-blocks and restricted commercial pellets. 9th World Rabbit Congress, June 10-13, 2008, Verona – Italy Pp 753 – 758.

Murphy A.M., Colucci P.E., Padilla M.R. (1999) Analysis of the growth and nutritional characteristics of *Lablab purpureus*. *Livestock Research for Rural Development (11) 3.* htttp://www.cipav.org.co/lrrd/lrrd11/2/colu112.htm.

Omoikhoje S.O., Bamgbose, A.M., Aruna, M.B. and Animashahun, R.A. (2006) Response ofweaner rabbits to concentrate supplemented with varying levels of *Syndrella nodiflora* forage. Pakistan Journal of Nutrition 6: 577-679.

Omole, A.J., Adejuyigbe, A., Ajayi, F.T. and Fapohunda J.B., (2007) Nutritive value of*Stylosanthes guianensis* and *Lablab purpureus* as sole feed for growing rabbits. African Journal of Biotechnology, 6 (18); 2171-2173, 19 September 2007.Available online at http://www.academicjournals.org/AJB

Omole, T.A. and Onwudike,O.O. (1983) Effect of palm oil on the use of cassava peel meal by rabbits. Tropical Animal Production, 8(1): 27-32.

Panja, P. (1996) Effect of supplementation of palm oil in isonitrogenous diets of broilers. Available online at www.tijisat.tu.ac.th/issues/1996/no1/1996_V1No1_7.PDF

Retore M., da Silva L.P., de Toledo G.S.P., Araújo I.G., Aramburú Jr J.S., Araújo C.C.B. (2008) Fibre quality to growing rabbits. 9th World Rabbit Congress, June 10-13, 2008 – Verona – Italy. Pp 787

SAS. (1987). SAS/STAT. Guide for Personal Computers. Version 6. Ed. SAS INSTITUTE Inc. NC. Pp. 697-978.

Tawfeek, M.I, Eggaafary,M.N., Abd Elrahim, M.I. and Soad, S. Ahmed (1993). Influence of dietary citric acid and acidulated palm oil soap stock supplementation on growth response, nutrient utilization, blood metabolites, carcass traits and reproductive efficiency of NZW rabbits. 198p