ISSN 0189-0514
J. Anim. Prod. Res. (2017) 29(1):193-199

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email: japr@napri.gov.ng
Website: http://journals.napri.gov.ng

PROTEIN PARTITIONING OF PREGNANT AND LACTATING RABBIT DOES FED COMBINATION OF CONCENTRATES AND LABLAB HAY

[1]Latu, M. Y., [2]Olutunmogun, A. K., [2]Barje, P. P. and [2]Iyeghe-Erakpotobor, G. T.
[1]Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State, Nigeria, [2]National Animal Production Research Institute, Ahmadu Bello University, Shika – Zaria, Kaduna State, Nigeria
Corresponding author: olutunmogunkayode@yahoo.com

ABSTRACT

Twenty eight crossbred rabbit does were fed levels of concentrate and lablab hay combinations during pregnancy and at lactation in a completely randomized design to examine the partitioning of protein by breeding does. During pregnancy, 150 g/day/doe concentrate and lablab hay combinations (20:130g, 40:110g, 80:70g and 100:50g) of feed was offered while 350 g/day/doe concentrate and lablab hay combinations (47:303g, 94:256g, 188:166g and 276:74g) was also offered during lactation. Data collected for live weight (LW), dry matter (DM), digestible crude protein (DCP) intake and litter weight were used to estimate metabolic weight, protein requirement for maintenance, fetal growth and lactation of rabbit does. Results obtained showed pregnant rabbit does fed the combinations had significant ($P<0.05$) differences in the parameters considered apart for LW, DM intake $DCP_{maintenance}$ and $DCP_{requirement}$. During the lactating phase, most parameters considered showed no significant ($P>0.05$) difference although DM intake (147.96 to 202.04g/day) and balanced DCP (-3.29 to -2.19g/day) which had significant ($P<0.05$) difference. At the stages of pregnancy, the 4^{th} week had significant ($P<0.05$) difference over the 2^{nd} week in most parameters apart for LW, $DCP_{maintenance}$ (7.52 to 7.57g/day) and $DCP_{requirement}$ (2.04 to 2.05g/$LW^{0.75}$/d) that had no significant ($P>0.05$) differences. The diet combinations were adequate to meet protein requirement of pregnant rabbit does but not adequate for lactating does as observed in the balance DCP for the lactating does. Hence there is the need for the investigation of suitable combinations of concentrate and forage for lactating rabbit does to avoid any adverse effects in subsequent reproductive circles.

Key words: Rabbit, Pregnancy, Lactation, Protein Partitioning, Concentrate, Lablab hay.

INTRODUCTION

Rabbits unlike other animal species like poultry, beef and swine can be produced on a wide range of feedstuff materials like forages, cereal by-products and soybeans cheese waste which is in less competition with man (Iyeghe-Erakpotobor *et al.*, 2006a). Despite this merit, rabbit feeding still pose a great challenge in any type of rearing system adopted (Xiccato and Trocino, 2010) and in conditions where there is great intensification of breeding on does; the reproductive rhythm becomes widespread along side pregnancy and lactation. This therefore leads to does needing high nutrient feed balance with increase voluntary intake to meet up the physiological needs of milk production and fetal development. Feed partitioning between energy and protein feedstuff materials in rabbit is important as it showed that rabbits can utilize 50g of concentrates partitioned with forage or legume residues combinations without adverse effect on growth (Iyeghe-Erakpotobor *et al.*, 2006a) and consequently, rabbits performs better when fed mixture of forage and concentrates (Ojewole *et al.*, 1999). Therefore, this study focuses at protein

partitioning of pregnant and lactating breeding rabbit does offered levels of concentrate and lablab hay to ascertain if it meets their nutritional and reproductive requirement.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Rabbit Research Unit of the National Animal Production Research Institute, (NAPRI), Ahmadu Bello University, Shika, Zaria, Nigeria. Shika is geographically located in the Northern Guinea Savannah between latitude 11º 12' 42" N and longitude 7º 33'14" E at an altitude of 640m above sea level (Ovimaps, 2014). The climate is characterized by well defined dry and wet season which are divided into cold-dry season (November-February), the hot-dry season (March-May) and the wet season (June-October). Detailed description of Shika climate has been given elsewhere by Kabir *et al.* (2006).

Experimental Animals and Management

A total of 28 crossbred does (New Zealand White X California and California X Chinchilla breeds) of about eight months of age were randomly allocated to four dietary treatments. The diets contain concentrate and lablab hay combinations fed to pregnant does (20:130g, 40:110g, 80:70g and 100:50g) and lactating does (47:303g, 94:256g, 188:162g and 276:74g). The lablab hay was obtained after harvesting the seed, dried at room temperature and chopped before feeding while the concentrate diet was formulated and contained crude protein of 22% and metabolizable energy of 2600ME/Kg (Table 1). Estimations of digestible crude protein during pregnancy and lactation was carried out and reference data were used in the calculation of digestible crude protein requirement ($DCP_{requirement}$) and digestible crude protein required for fetal (DCP_f) and digestible crude protein required for maintenance (DCP_m) according to Parigi Bini and Xiccato (1998). Does were housed individually in metal cages housed in a building with large open windows. Pregnant does were offered a total of 150g feed/day/doe and lactating does were offered 350g feed/day/doe. Water was given *ad libitum*. Flat bottom earthen feeders with rims were used for feeding the rabbits to reduce wastage. The experiment lasted for four months.

Table 1: Composition of concentrate diets fed to pregnant and lactating rabbit does

Ingredients	Composition (%)
Maize	39.24
Ground-nut	42.26
Maize offal	15.00
Bone meal	3.00
Salt	0.25
Vitamin/mineral premix	0.25
Total	**100.00**

Data collection and statistical analysis

Data were collected and analyzed for live weight, dry matter, digestible crude proteins (intake, requirement, maintenance, fetal growth, balance and metabolic weight) on pregnancy and lactation and interactions with the dietary treatments using the General Linear Model Procedure

of SAS (1987). Pair wise difference was used to separate significant means. Interaction effects between level of dietary treatment and stage of pregnancy were dropped. Below shows the mathematical models used for the study:

Pregnancy:

$$\mathbf{Y_{ijk} = \mu + T_i + S_j + (T_i * S_{j)} + e_{ijk}}$$

Where;

Y_{ijk} = observation on the i^{th} treatment in the j^{th} stage of pregnancy in the k^{th} random error,

μ = overall mean,

T_i = fixed effect of treatment

S_j =fixed effect of stage of pregnancy (i= 2^{nd} week and ii= 4^{th} week),

e_{ijk} = random error

Lactation:

$$\mathbf{Y_{ij} = \mu + T_i + e_{ij}}$$

Where;

Y_{ij}= observation on the i^{th} treatment of the j^{th} random error,

μ = overall mean,

T_i = fixed effect of dietary treatment,

e_{ij} = random error

RESULTS AND DISCUSSION

Table 2 shows protein partitioning of rabbit does offered levels of concentrate and lablab hay combinations. Digestible crude protein intake (DCP), digestible crude protein requirement (DCP_{req}), digestible crude protein required for fetal growth (DCP_{fg}) and balance of digestible crude protein (Balance DCP) significantly ($P<0.05$) increased as concentrate level increased in the combination. However, no significant ($P>0.05$) differences were observed for live weight (LW), dry matter intake (DM), digestible crude protein required for maintenance (DCP_m) and digestible crude protein requirement per metabolic weight per day ($DCP_{req}/LW^{0.75}/d$).

Irrespective of the level of significance amongst some of the parameters, there was increment as level of concentrate and lablab combination increased apart from live weight and DM intake. Similar DM intake reduced in-spite of the differences in concentrate and lablab hay combinations; this suggested that animals eat to meet their requirement. It also shows the potentials of lablab forage as a means to meeting the feed gap of animals in terms of nutrients supply compared to the concentrate. The performance of pregnant rabbit does fed concentrate and lablab hay at different partitioning levels improved and is in line with earlier work of Ojewole *et al.* (1999) who reported a better performance of growing rabbits fed mixture of concentrates and forages compared to the sole feeding of concentrates or forages. Also, increase in concentrate level and reduction in lablab hay aided better performance on weight which agrees with Partridge *et al.* (1989) who noted a depression in growth rate of rabbits fed high levels of grass meal. The values obtained for DCP intake, DCP required and maintenance are higher than those reported by Nwagu and Iyeghe-Erakpotobor (2012) for growing rabbits fed levels of soybean cheese waste diet which was used as concentrate and lablab hay. The higher the

digestion efficiency the more the nutrients in the feed will be made available to the animal for all metabolic activities leading to better performance. Lablab a well digested forage and in combination with concentrate has shown potentials in provision of nutrients for good production Nwagu and Iyeghe-Erakpotobor (2012).

Table 2: Protein Partitioning of Pregnant Rabbit Does Offered levels of concentrate and lablab hay combinations

	Concentrate and Lablab hay combinations (g)					
Parameters	**20:130**	**40:110**	**80:70**	**100:50**	**SEM**	**P-value**
Live weight (g)	2580	2530	2640	2610	40.0	0.774
DM intake (g/d)	135.02	131.19	130.64	121.53	4.09	0.362
DCP intake (g/d)	20.83^{b}	21.98^{b}	26.32^{a}	25.44^{a}	0.57	0.006
$DCP_{requirement}$ (g/d)	16.27^{b}	16.64^{b}	18.71^{a}	18.29^{a}	0.41	0.008
DCP_{m} (g/d)	7.52	7.41	7.65	7.60	0.13	0.787
DCP_{fg} (g/d)	8.75^{b}	9.23^{b}	11.06^{a}	10.69^{a}	0.37	0.006
Balance of DCP (g/d)	4.57^{b}	5.34^{b}	7.62^{a}	7.15^{a}	0.51	0.010
DCPrequirement ($g/LW^{0.75}/d$)	2.03	2.01	2.07	2.06	0.02	0.793

$^{ab=}$ Means within rows with different superscripts are significant ($p<0.05$) different. DM= Dry matter, DCP_{req} = Digestible crude protein requirement, (DCP_{m}) = Digestible crude protein for maintenance, DCP_{fg} = Digestible crude protein for fetal growth, Balance DCP = Balance of digestible crude protein, $DCPreq/LW^{0.75}/d$ = digestible crude protein requirement per metabolic weight per day.

The protein partitioning of concentrate and lablab hay combinations fed to pregnant rabbit does in the second and fourth week of pregnancy is shown in Table 3. Dry matter intake (DM intake), digestible crude protein (DCP intake), digestible crude protein required (DCP_{req}), digestible crude protein for fetal growth (DCP_{fg}) and balance of digestible crude protein were significantly ($P<0.05$) higher in the 4^{th} week than 2^{nd} week of pregnancy.

Iyeghe-Erakpotobor *et al*. (2006b) reported an increase in crude protein digestibility which the authors suggest a higher protein requirement as pregnancy progresses from first to fourth week of pregnancy. This might be because of the low requirement of the conceptus in early pregnancy than high nutrient requirement in late pregnancy. During the initial two thirds of pregnancy, body protein retention is higher than that of the conceptus while in the last third trimester of pregnancy, a portion of body protein is mobilized to support the high growth rate of the conceptus (Fraga, 1998). However, no significant ($P>0.05$) difference was obtained in live weight, digestible crude protein requirement for maintenance and digestible crude protein requirement per metabolic weight per day between the 2^{nd} and 4^{th} weeks of pregnancy.

The reduced dry matter intake in the second week of pregnancy when compared with increase in the dry matter intake in the fourth week of pregnancy could be attributed to increased nutrient requirement of the fetuses as pregnancy progresses. This finding is in consonant with earlier report of Iyeghe-Erakpotobor *et al.* (2009) who reported a progressive increment in dry matter intake as pregnancy stages progresses. Also, the authors argued that the progress of pregnancy

leads to higher digestibility and utilization of nutrients which compensates for the growth of the fetus and organ formations. However, differences in feed intake observed by various researchers could be linked to differences in feed types, feed ingredients used, litter size, as well as the stage of maturity of forages used in feeding the rabbit does. Rabbit does moderate their nutrient intake to cater for their fetuses and for mammary glands development required during lactation (Iyeghe-Erakpotobor *et al*., 2006b).

Table 3: Effect of Stage of Pregnancy on Protein partitioning of Pregnant Rabbit Does offered levels of concentrates and lablab hay combinations

	Stage of Pregnancy (Weeks)			
Parameter	**2**	**4**	**SEM**	**P-value**
Live weight (g)	2580	2600	40.0	0.7579
DM intake (g/d)	117.78^{b}	141.42^{a}	4.09	0.0002
DCP intake (g/d)	21.49^{b}	25.79^{a}	0.57	0.0011
Total DCP requirement (g/d)	16.55^{b}	18.40^{a}	0.41	0.0021
DCP_m (g/d)	7.52	7.57	0.13	0.7606
DCP_{fg} (g/d)	9.03^{b}	10.83^{a}	0.37	0.0011
Balance of DCP (g/d)	4.95^{b}	7.39^{a}	0.51	0.0013
DCP req (g/$LW^{0.75}$/d)	2.04	2.05	0.02	0.7555

$^{ab=}$ Means within rows with different superscripts are significant ($p<0.05$) different. DM= Dry matter, DCP_{req} = Digestible crude protein required, (DCP_m) = Digestible crude protein for maintenance, DCP_{fg} = Digestible crude protein for fetal growth, DCPreq/$LW^{0.75}$/d = digestible crude protein requirement per metabolic weight per day

Table 4: Protein Partitioning of Lactating Does offered different combinations of concentrate and lablab hay

	Concentrate and Lablab hay combinations (g)					
Parameters	**47:303**	**94:256**	**188:166**	**276:74**	**SEM**	**P-value**
Live weight (g)	2380	2330	2580	2400	80.0	0.701
Litter weight at 21 days (g)	1166.67	1050.00	1075.00	717.26	90.38	0.426
TMP (kg)	3.39	3.23	3.27	3.27	5.90	0.380
Daily MP (g)	161.51	153.79	155.44	104.56	11.51	0.381
DM intake (g/d)	202.04^{a}	185.93^{a}	154.98^{b}	147.96^{b}	9.69	0.001
DCP intake (g/d)	21.07	20.45	19.04	17.76	1.16	0.380
Total DCP required (g/d)	23.32	22.64	22.12	21.04	1.88	0.374
DCP_m (g/d)	7.31	7.10	7.65	7.54	0.28	0.497
DCP_{milk} (g/d)	16.01	15.54	14.47	13.49	1.88	0.374
Balance DCP (g/d)	-2.25^{bc}	-2.19^{c}	-3.08^{ab}	-3.29^{a}	0.42	0.052

$^{abc=}$ Means within rows with different superscripts are significant ($p<0.05$) different. DM= Dry matter, TMP = Total milk production, DCP_{req} = Digestible crude protein required, DCP_m = Digestible crude protein for maintenance, DCP_{fg} = Digestible crude protein for fetal growth, Balanced DCP = Balance of digestible crude protein, LW = Liter weight at 3 weeks

Table 4 shows the protein partitioning of lactating rabbit does offered concentrate and lablab combinations. There was significant ($P<0.05$) difference in dry matter intake and balance of digestible crude protein with other parameters between the combinations having no significant ($P>0.05$) difference. For the production of milk, maintenance of body and for other physiological balances, there is the harvest and mobilization of protein from the body reserves (Toschi *et al.*, 2005). This statement seems to explain the findings of this result as there was mobilization of body nutrients which led to a negative balance in digestible crude protein in the body of the does with the 276:74 combinations having a higher negative result of -3.29 which may adversely affect the body performance and health status the lactating does. This result on lactation is the reversed of what was observed during the pregnancy stage where the balanced of digestible crude protein was positive implying that the rabbit does have sufficient and can store excess for lactation requirements. However, continuous feeding of these combinations during lactation might have adverse effect on subsequent reproductive ability of the does.

CONCLUSION

The study shows that the diet combinations were adequate to meet protein requirement of pregnant rabbit does but not adequate for lactating does as observed in the balance DCP. Hence there is the need for the investigation of suitable combinations diets for lactating rabbit does to avoid any adverse effect breeding rabbit does.

ACKNOWLEDGEMENT

The authors wish to state their gratitude to the Director, National Animal Production Research Institute, Shika-Zaria for releasing the facilities used for the study. The contributions of staffs of Rabbitry and Central Labouratory Unit are well acknowledged.

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