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Effect of flushing on reproductive performance of rabbits.

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Abstract

Twenty eight (28) multiparous crossbred does were placed on four diets consisting of 16, 18, 20 and 24% CP for two weeks before mating and one week after mating to evaluate the effect of flushing on the reproductive performance of rabbits. The does were placed on 16% CP diet during pregnancy and 18% CP diet during lactation.

Results obtained showed similar (P>0.05) weight changes and feed intake for all the groups though does fed the 16% CP diet lost weight. Does flushed with 18, 20 and 24% CP had slightly larger litter size at birth while 18% and 20% CP flushed does had slightly larger litter size alive at birth than 16 and 24% CP does. Litter size at 21 days postpartum was significantly (P<0.05) higher for does flushed with 20 and 24% CP than those flushed with 16 and 18% CP. Litter weights were significantly (P<0.05) higher for 20% and 24% CP flushed than 16 and 18% CP flushed does at 7-, 14- and 21-day postpartum. Stillbirths increased with increase in protein level up to 20% CP level before decreasing slightly at 24% CP. Kit mortality rates at 0-7, 7-14 and 14-21 days postpartum were similar (P>0.05) but numerically lower for 20 and 24% CP flushed does. Total kit mortality rate (0-21 days postpartum) was significantly (P<0.05) higher for does flushed with 16 and 18% CP diets. It is concluded from this study, that flushing multiparous does with 20 and 24% CP diets gave better reproductive performance than with 16 and 18% CP diets. Feeding 16% CP diet to does during pregnancy does not appear to meet their protein requirement for gestation.

Key Words: Rabbit, flushing, protein, doe, litter, performance.
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Introduction

Litter size is one of the most important factors affecting productivity of rabbit does. The more kits the doe kindles and weans the greater the profitability of the enterprise (Afifi and Emera, 1987). Nutrition is an important factor affecting litter size of does. Higher energy intakes have been reported to increase ovulation when given for a short period (Anderson and Melampey, 1971). Feeding sheep high protein supplements 6-10 days before oestrous has also been reported to enhance ovulation rates (Oldham and Lindsay 1984, Teleni *et al.* 1984). Smith (1988) however, reported minimal effects of specific protein on ovulation rates similar to conventional flushing diets of short duration. Sanchez *et al.* (1985)

noticed slightly higher litter size in rabbits as protein levels increased from 17.5 to 20.5%. This increase was however, associated with greater number of stillbirths. Source and level of protein, was also reported to have little effect on the ovulation rate of pigs (Aherne and Kirkwood, 1985).

Reproductive responses to changes in nutritional status are reported to fall within two categories which are: acute responses that occur within a few days, such as increased ovulation rate associated with 'flushing' and chronic responses that occur after several days or weeks, such as delayed puberty and anoestrus (Britt *et al.*, 1988). Acute responses occur so quickly that there are usually no sufficient changes in body composition and are more likely mediated through direct gonadal effects, while chronic responses are often associated with major shifts in body composition and are mediated through the higher centres (Smith and Somade, 1994). Coop (1966a,b) also divided flushing response into the effect of live weight per se (static effect) and the effect of increased nutrient intake immediately prior to mating (dynamic effect). The dynamic effect of flushing is thought to increase secretion of pituitary gonadotropins (Coop, 1966a), which may result from a decrease in concentration of steroids that inhibit the pituitary (Thomas *et al.*, 1987).

The type of feed offered and composition of feed may be more important than the quantity (Smith, 1984) in dynamic flushing effect response of animals. The protein:energy ratio of the pre-mating diet has been reported to be more critical to obtain a reproductive response (Croker *et al.*, 1985). There is however, very little work done on the quality of the feed for flushing in the tropics and the effect of this on rabbit productivity. This study was conducted therefore, to investigate the effect of flushing using different protein levels on reproductive performance of rabbit does.

Materials and Methods

28 crossbred multiparous does between 12 and 18 months old were randomly placed on four protein diets consisting of 16, 18, 20 and 24% CP (Table 1) in a completely randomised design. The does were obtained from matings between New Zealand White, California and Chinchilla rabbits. The does were housed individually in metal cages of dimensions 60 x 120 x 50cm. The cages were placed in a completely walled house with poultry wire mesh covered windows.

The does were placed on 16% CP diet for two weeks prior to flushing. Does were flushed for two weeks before mating and one week after mating with the various diets. 120g-concentrate meal was fed in the morning at 08.00 hours in flat-bottomed clay pots during flushing. After flushing, all does were fed *ad libitum* and placed on the 16% CP diet during pregnancy and 18% CP diet during lactation. Grass hay (20g) was fed in the evening to all does at 15.00 hours. Water was supplied daily.

Does were mated to intact bucks at mating. All does were supplied flat-bottomed nesting clay pots on the 25th day of pregnancy. Does were weighed at onset of flushing, mating, end of flushing and at kindling. Doe feed intake was monitored up to end of flushing. Litter sizes and weights were monitored at birth and at weekly intervals up to 21 days postpartum. Kit mortality rates were also monitored at weekly intervals. 22% CP treatment group was removed from the study because they did not kindle.

Data collected were subjected to analysis of variance test using general linear model procedure, and orthogonal pair-wise difference

Table 1. Composition of diets fed to does

Ingredients	Treatment (% CP) 16	18	20	24
Maize	58.72	48.00	45.73	32.76
Groundnut cake	22.98	33.70	35.77	48.74
Maize offal	15.00	15.00	15.00	15.00
Bone meal	3.00	2.80	3.00	3.00
Salt	0.25	0.30	0.25	0.25
Vit./mineral premix	0.25	0.30	0.25	0.25
Calculated content:				
Energy (Kcal ME/kg)	2813.60	2638.90	2687.74	2567.19
Crude protein (%)	16	18	20	24
Crude fibre (%)	5.57	3.07	4.17	4.31
Ash (%)	3.87	5.34	2.68	3.23
Feed cost (₦/kg)	12.97	16.89	17.34	21.77

method (SAS, 1987) was used to determine differences between means.

Results and Discussion

There was non-significant (P>0.05) effect of flushing on doe weight and feed intake (Table 2). Similar doe weights at mating, end of flushing and kindling obtained in this study are at variance with the result of Raharjo *et al.* (1986) who reported significant mean doe weight at kindling when does were fed 16 and 21% CP. This could however likely be because does in this study were fed the different diets only during flushing after which they were all placed on the same diet. Sanchez *et al.* (1985) however, reported no difference in doe weights at kindling when fed 17.5, 19 and 20.5% CP diets. The trend however, indicate that does on 16% CP diet during flushing lost weight while there was a slight though non-significant increase in weight gain with increase in protein level up to 20% CP before mating and up to 24% CP after mating. The 20% CP group only maintained their weight after mating. This result agrees with Smith *et al.* (1990) who reported no effect of dietary protein on ewe live weight.

Feed intake (Table 2) was higher after mating than before mating and there was an initial increase in feed intake of does up to 20% CP after mating. Similar result was obtained for multiparous and nulliparous does flushed with 18, 20, 22 and 24% CP diets (Iyeghe-Erakpotobor *et al.*, 2002ab).

Litter size at birth, kits alive at birth, 7 and 14 days postpartum (Table 3) was similar for all the treatments. Aganga *et al.* (1991) reported similar non-significant differences in litter size when does were fed 15 and 20% CP diets. The trend showed an increase with increase in protein level

up to 20% CP and then a decrease at 24% CP. Does flushed with 20 and 24% CP diets however, had significantly ($P<0.05$) more kits at 21 days postpartum. This indicates better mothering ability in these does as up to 21 days of age the kits depend solely on the dams' milk (Ferraz, *et al.* 1991). Litter size at 21 days postpartum is an indication of milk production (Hamilton *et al.*, 1997). Lower litter sizes at 21-d postpartum were observed in this study compared with litter sizes of 2.57 to 3.50 for multiparous and 4.33 to 5.00 for nulliparous does when flushed with 18, 20, 22 and 24% CP diets (Iyeghe-Erakpotobor, 2001). This could probably be as a result of the 16% CP fed during pregnancy compared with 18% CP diet that was used in those studies. Changes in maternal nutritional status have been reported to affect both the endometrial secretory protein profile and composition of allantoic fluids from which the developing foetus derives its nutrients (Ashworth, 1991). It is possible that this effect could manifest in lower survivability of kits during lactation.

Litter weights at 7-, 14- and 21-d postpartum were significantly ($P<0.05$) affected by flushing (Table 4). Litter weights at birth and kits alive at birth were low and increased with protein level up to 20% CP. The low birth weights observed in this study could also be as a result of feeding

Table 2. Effect of flushing on doe weight, feed intake and weight gain of multiparous does.

	Crude protein (%)				
Parameter	**16**	**18**	**20**	**24**	**SEM**
Initial weight (kg)	2.89	2.65	2.69	3.04	0.16
Weight at mating (kg)	2.79	2.70	2.84	3.07	0.15
Weight at end flushing (kg)	2.76	2.71	2.84	3.12	0.13
Weight at kindling (kg)	2.74	2.66	2.79	2.90	0.12
Feed intake before mating (g)	537.14	532.50	623.75	507.00	88.65
Feed intake at end flushing (g)	660.71	697.50	695.50	558.00	102.94
Weight gain before mating (g)	-100.00	50.00	150.00	30.00	88.04
Weight gain at end flushing (g)	-28.57	25.00	0.00	50.00	61.54

Table 3. Effect of flushing on litter size of multiparous does.

	Crude protein (%)				
Litter size	**16**	**18**	**20**	**24**	**SEM**
Birth	2.71	4.83	5.00	4.00	0.81
Alive at birth	2.00	3.17	4.00	2.60	0.90
7-d Postpartum	1.14	1.33	3.00	1.40	0.82
14-d Postpartum	0.71	0.67	3.00	1.40	0.76
21-d Postpartum	0.43^{b}	0.50^{b}	3.00^{a}	1.40^{a}	0.74

^{a,b} Means bearing different superscripts along rows are statistically different ($P<0.05$).

Table 4. Effect of flushing on litter weights (Grams) of multiparous does.

	Crude protein (%)				
Litter weight	**16**	**18**	**20**	**24**	**SEM**
Birth weight	135.71	179.17	231.25	190.00	33.34
Alive birth weight	100.00	120.83	181.25	162.50	34.75
7-d postpartum	281.25^{b}	243.75^{b}	737.50^{a}	400.0^{ab}	94.71
14-d postpartum	416.67^{b}	262.50^{b}	1075.00^{a}	683.33^{ab}	108.76
21-d postpartum	462.50^{bc}	366.67^{c}	1250.00^{a}	850.00^{ab}	100.50

$^{a,b,c:}$ Means bearing different superscript along rows are statistically different (P<0.05).

Table 5. Effect of flushing on weight gain (Grams) of kits

	Crude protein (%)				
Weight gain	**16**	**18**	**20**	**24**	**SEM**
LWG 7-d PP	168.75	160.71	462.50	283.33	75.76
LWG 14-d PP	175.00	132.29	337.50	283.33	65.50
LWG 21-d PP	79.17	133.33	175.00	166.67	53.27
Total LWG 0-21 d PP	339.58^{c}	393.00^{bc}	975.00^{a}	733.33^{ab}	85.46
KWG 0-21 d PP	198.48	249.56	163.57	400.00	88.03

$^{a,b,c:}$ Means bearing different superscript along rows are statistically different (P<0.05).

PP Postpartum, LWG Litter weight gain, KWG Kit weight gain .

16% CP diet during pregnancy. Partridge and Allan (1982) reported that giving a diet low in protein to does during pregnancy resulted in reduced pup birth weights. Does flushed with 20% CP diet had kits with significantly higher litter weight at 7-, 14- and 21-day postpartum than those flushed with 16 and 18% CP diets. Litter weights were similar for does flushed with 20 and 24% CP diets. This indicates a higher milk production by does flushed with 20 and 24% CP diets. Lukefahr *et al.* (1990) reported a high correlation of 0.85 between cumulative milk production on d 1 to 21 and litter weaning weight. It seems there is a long-term effect of the short duration protein intake during flushing by does on milk production.

Litter weight gain (Table 5) at 7, 14, 21 and 0-21 days postpartum increased with increase in protein level up to 20 % CP. Total litter weight gain was significantly (P<0.05) higher for kits born to does flushed with 20% CP than for the 16 and 18% CP flushed groups. Total litter weight gain was however similar (P>0.05) for the 24 and 18% CP flushed groups. Sanchez *et al.*, (1985) reported that does fed 19% CP had heavier litters at birth, 21 days, 28 days and had greater 1- to 21-day litter weight gains than 17.5 and 20.5% CP. Since gain in litter weight is reported to be a good indicator of milk yield in the rabbit (Partridge & Allan, 1982), it could therefore, be inferred that does flushed with 20 and 24% CP diets produced more milk than those

Table 6. Effect of flushing on mortality rate (%) of kits

	Crude protein (%)				
Mortality	**16**	**18**	**20**	**24**	**SEM**
Stillbirth	27.38	30.83	35.00	26.67	15.44
0-7 days Postpartum	53.57	48.41	4.17	20.00	18.36
7-14 days Postpartum	10.71	19.44	0.00	-0.00	8.71
14-21 days Postpartum	19.05	5.55	0.00	0.00	10.81
0-21 days Postpartum	69.05[a]	72.62[a]	4.17[b]	20.0[b]	14.94

[a,b] Means bearing different superscript along rows are statistically different (P<0.05).

flushed with 16 and 18% CP diets. Kit weight gain 0-21 days postpartum increased with protein level except for 20% CP which was lower than the other groups. This is likely so as a result of the higher litter size in this group. Hamilton *et al.* (1997) reported that the 21-d litter weight measure of milk production also reflects 21-d litter size.

Table 6 shows the effect of flushing on stillbirth and kit mortality. There was an increase in stillbirth with increase in protein level up to 20% CP. Higher stillbirth with 10% than 22% protein was reported by Omole (1982). Pre- and peri-ovulatory as well as early pregnancy nutrition has significant effects on embryo survival (Smith and Somade, 1994). Omole (1982) further reported that a high incidence of stillbirths as a result of low protein diet is an indicator of adverse consequences of insufficient protein during gestation on foetal livability. Mortality rates were higher in the period 0-7 days postpartum for all the treatments. Similar high mortality in the first week of birth has been reported in literature (Partridge *et al.*, 1981; Goonerwardene and Pararajasingam, 1983; Iyeghe-Erakpotobor *et al.*, 2002b). Does flushed with 16 and 18% CP had significantly higher total kit mortality (0-21 days postpartum) rates than 20 and 24% CP groups. This result agrees with Omole (1982) who reported higher kit mortality with 10 and 14% protein than 18 to 26% protein.

Conclusion.

It could be concluded from this study, that flushing does with 20 and 24% CP diets produced larger litter size at 21 days postpartum, heavier litters at 7- to 21-day postpartum and had lower kit mortality rates than with 16 and 18% CP diets. Feeding 16% CP diet to does during pregnancy does not appear to meet their protein requirement for gestation.

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