The Effect of Different Re-mating Time after Parturition on the Haematology of Doe Rabbits

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ABSTRACT

The field experiments for this research were carried out at the rabbitary of the Teaching and Research Farm, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus, Ayetoro. Laboratory investigations were carried out at the Animal Nutrition and Physiology Laboratory, of the University. One hundred and eight New Zealand White × Chinchilla Does were subjected to three postpartum re-mating time-periods in two seasons. Blood samples were collected at 2, 10 and 20 days post coitum for haematological assay. All haematological indices examined were not significantly (P>0.05) affected by postpartum re-mating time-period. Seasonal variation in haematological values were equally not significantly (P>0.05) different. The results of this research has demonstrated that concurrent pregnancy and lactation occasioned by early rebreeding in the Doe rabbit does not place a stress on the Does' internal physiology at least in the short term.

Keywords: *Doe rabbit, re-mating time postpartum, haematology, season*

INTRODUCTION

The reproductive potential of the domestic rabbit is legendary. Being an induced ovulator, the doe rabbit can be successfully re-bred immediately after parturition. This biological potential has been exploited in the commercial rabbit enterprise of Europe. Extensive research work has been carried out on the reproductive performance and production implications of subjecting the Doe rabbit to different postpartum re-mating interval. However, little work seems to have been done in certain areas bothering on the regulation of the internal physiology of the Doe rabbit. The physiological states of pregnancy and lactation are believed to place some strain on the physiology of all mammalian species, how much more when pregnancy and lactation run simultaneously.

According to FAO (1957), it is believed that in pregnancy, extra energy is needed for the growth of the foetus and placenta and the development of associated maternal tissues and later for the increased physical activity of motherhood. Iyeghe–Erakpotobor *et al.* (2002) reported that the postpartum period is a particularly difficult one for the animal because of competition for nutrients by various physiological processes such as lactation, uterine involution, and maintenance of body condition and re-initiation of ovarian activity. Iyeghe–Erakpotobor *et al.* (2002) report that complex neuro-hormonal reproductive interactions and an equally complex nutrient partitioning controls reproduction. Esonu *et al.* (2001) reported that the physiological response of the animal to its internal and external environment is reflected in the haematology.

In rats, most pregnant dam blood values were not appreciably different from values of non-pregnant dams until near term (LaBorde *et al.,* 1999). According to these authors, near term values of some analytes (red blood cells, haemoglobin, haematocrit, mean corpuscular haemoglobin concentration, glucose, total bilirublin, sodium, and chloride) decreased but returned to near normal values soon after delivery. In humans, Rastogi (1976) reported that WBC values were higher in pregnancy. Kriesten, Murawaski and Schmidtmann (1987) report that haemoglobin values decreased from non-pregnant to lactating Doe rabbits. Awojobi *et al*. (2004) reported that hematological values were not affected by pregnancy and lactation in the doe rabbit. However, Kim J., Yun, Cha, Kim K., Koh and Chung (2002) observe that RBC counts and haemoglobin concentrations on gestation day 20-28 were lower than those of non-pregnant rabbits.

Haematocrit values in pregnant rabbits also decreased slightly in the third trimester. Mean corpuscular volume in pregnant rabbits increased gradually during the course of gestation than in non-pregnant rabbits. Kim *et al*. (2002) report a difference in mean corpuscular haemoglobin concentration between pregnant and non-pregnant rabbits. They observed that platelet count on gestation day 24-28 were lower than that of normal non-pregnant rabbits, total white blood cell and lymphocyte counts on gestation day 24 were lower than those of normal pregnant rabbit, and no differences were observed in the numbers of neutrophils, eosinophils, basophils and monocytes between pregnant and non-pregnant rabbits. This study therefore examined the effect of different re-mating time after parturition on the haematology of Doe rabbits. Depending on the re-mating time, Does are either pregnant, lactating or concurrently pregnant and lactating

MATERIALS AND METHOD

The field experiments for this research were carried out at the rabbitary of the Teaching and Research Farm, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus, Ayetoro. Laboratory investigations were carried out at the Animal Nutrition and Physiology Laboratory, of the University. Ayetoro is located in latitude 7^{O} 15'N and longitude 3^{O} 3'E in a deciduous/derived savannah zone of Ogun State. Climate is sub-humid tropical with an annual rainfall of 1,909.3mm. Rainy season is between early April and late October. Rainfall pattern is bimodial with two peaks in June and September. Maximum temperature varies between $29^{O}C$ during the peak of the wet season and $34^{O}C$ at the onset of the wet season. Mean annual relative humidity is 81% (Onakomaiya, Oyesiku and Jegede, 1992). A total of one hundred and eight New Zealand White × Chinchila Does were used for this experiment. The Does (54 each in the dry and rainy season) were allocated to three experimental re-mating time-periods: Intensive (IN; 1-9 days), Semi-intensive (SI; 10-20 days), Extensive (EX; 21-28 days) postpartum. These Does are in their second parturitions along these experimental groupings at the time of experimentation. Feeding and watering was *ad libitum.* Does were fed a concentrate ration containing 23.8% CP, 10.8% CF, 6.5% EE and 2666 kcalDE/kg diet. Does were individually housed in flat-decked wooden hutches measuring 90 × 60× 45cm. Does were subjected to natural lighting and ventilation throughout the experiment.

Blood sample was collected from the Does at 48 hours, 10days and 20 days after mating. 5 mls of blood was collected from the jugular vein of the rabbits using needle and syringe. The blood sample was discharged into sterile bottle containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant. This sample was immediately used for haematological assessment. The haematological analysis carried out are packed cell volume (PCV), haemoglobin (Hb), red blood cell count (RBC) and total white blood cell count (WBC) . The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemglobin concentration (MCHC) were also calculated. The packed cell volume was measured by the microhaematocrit method (Mitruka and Rawnsley, 1977). Haemoglobin concentration was determined by the cyanomethhaemoglobin method (Mitruka and Rawnsley, 1977). The RBC and WBC were determined as described by Jain (1986). MCV, MCH and MCHC were calculated as described by Mitruka and Rawnsley (1977). All data were analysed using the GLM procedure of SAS (1999) for a randomized complete block design, with re-mating interval and season as factors of variation. Significant means were separated using the Duncan's multiple range test of the same statistical software. Only the results of haematological assays for Does that successfully rebred along experimental groupings were subjected to statistical analysis.

RESULTS AND DISCUSSION

Table 1 shows the main effects of postpartum re-mating interval and season on the PCV of doe rabbits 2, 10 and 20 days post coitum. Neither the re-mating interval nor season significantly (P>0.05) influenced PCV values at 2, 10 and 20 days after mating. Nonetheless, PCV value increased as postpartum re-mating interval increased at days 2 and 20 post coitum. At 10 days post coitum, PCV values were highest in Does under semi-intensive mating system and lowest in Does under extensive mating system. PCV values increased from day 2 to 20 in Does under intensive and extensive mating systems, while it increased from day 2 to 10 to decrease at day 20 in Does under semi-intensive mating system. PCV values were higher in the rainy season than the dry season at day 2 after mating and vice versa at days 10 and 20 after mating.

Table 2 shows the effect of experimental postpartum re-mating interval and season on RBC values of Doe rabbits. As observed for PCV, RBC values increased with increased postpartum re-mating interval at days 2 and 20 after mating. Again, the highest and the lowest values of RBC at 10 days after mating were observed in Does under semi-intensive and extensive mating systems respectively. However, no significant (P>0.05) effect of postpartum re-mating interval was observed on RBC values. RBC values were higher in the rainy season than dry season and the value obtained at 10days after mating was significantly (P<0.05) different. The effects of experimental postpartum re-mating interval and season on Hb concentration of Doe rabbits is shown on table 3. At 2 days post coitum, Hb concentration increased as postpartum re-mating interval increased. At 10 days after mating, Hb increased from intensive to semi-intensive re-mating, and fell at the extensive re-mating. Hb concentration decreased as postpartum remating interval increased for measurements taken at day 20 post coitum.

All measurements were however not significantly (P>0.05) different. For Does under the intensive and semi-intensive mating systems, Hb concentration increased as gestation age increased. For Does under extensive mating system, Hb decreased from day 2 to 10 after mating, to increase slightly at day 20 after mating. However, values were not significantly (P>0.05) different. The Hb concentration was not significantly (P>0.05) influenced by season. WBC count was not significantly (P>0.05) affected by postpartum re-mating interval (Table 4). WBC count increased from day 2 to 10 post coitum (p.c) to decrease at day 20 p.c. across all the three re-mating intervals. WBC count increased with increase in gestational age in Does under the semi-intensive and extensive mating systems. For Does under the intensive mating system values decrease from 2 to 10 days p.c. and rose sharply at 20 days p.c. WBC values was significantly (P<0.05) higher in the rainy season than dry season at 2 days after mating. Values were however not significantly (P>0.05) different in the two seasons at days 10 and 20 after mating.

Table 5 shows the effect of postpartum re-mating interval and season on MCV. MCV values increased with increasing days after mating, to decrease at 20 days after mating across all three mating systems. The trend was the same at days 2 and 20 after mating with the MCV values increasing from intensive to semi-intensive mating system to decrease at extensive mating system. At 10days after mating, there was a decrease in the MCV value from intensive to semi-intensive mating system followed by an increase at the extensive mating. Postpartum re-mating interval did not significantly (P>0.05) affect MCV values. Similarly MCV values did not show any significant (P>0.05) seasonal variation, though values were higher during the dry season than rainy season. Table 6 shows the MCH values of doe rabbits as affected by post partum re-mating interval and season. MCH values increased as gestational age increased across all three mating systems. Values were however not significantly (P>0.05) different. At 2 days after mating, MCH increased from intensive to semi-intensive re-mating with a fall at extensive re-mating. At 10 days after mating MCH increased as postpartum re-mating interval increased while it decreased as postpartum re-mating interval increased at 20 days after mating. MCH values at 2 and 10 days post coitum were significantly (P<0.05) higher in the dry than rainy season. Values are however comparable (P>0.05) at 20 days after mating.

Table 7 shows the effect of postpartum remating interval and season on MCHC of Doe rabbits. MCHC values in the Doe rabbits were not significantly (P>0.05) affected by postpartum remating interval at days 2, 10 and 20 after mating. MCHC value during the dry season was significantly (P<0.05) higher than that of the rainy season, at day 2 after mating. Values at days 10 and 20 after mating however did not show any significant (P>0.05) seasonal variation. There is wide variation in haematological values in the domestic rabbit. These borders on the influence of age, sex, breed and strain of rabbit, environmental factors, nutrition of the animal among others (Mitruka and Rawnsley, 1977; Kozma *et al*., 1974). Awojobi, Opiah and Sotuminu (2004) report that haematological values were not different in non-pregnant, pregnant and lactating Doe rabbits. Similarly, LaBorde *et al*. (1999) observe that pregnant dam blood values were not appreciably different from that of non-pregnant rats. In the domestic rabbit, there is dirth of information on the effect of concurrent pregnancy and lactation on the haematology of the domestic rabbit. The result of this research has however demonstrated that haematology in the domestic rabbit was not significantly affected by postpartum remating interval, for samples taken at 2, 10 and 20 days post coitum. Except for the RBC, all haematological values across all the three mating systems fell within the normal range reported for the domestic rabbit in literature. The lower RBC values across all mating systems at 20 days of gestation agreed with the report of lower RBC value on gestation days 20 – 28 by Kim *et al*. (2002). However, the findings of this research did not show a similar trend for haemoglobin as reported by these same authors. Kim *et al.* (2002) report that mean corpuscular volume in pregnant rabbits increased during the course of gestation. However, such observation was not recorded in this experiment. Some near term values of RBC, Hb, haematocrit and MCHC have also been reported to decrease but returned to near normal values soon after delivery by LaBorde *et al*. (1999). Near term values were however not taken in this experiment. Some slight differences in mean corpuscular values in relation to remating interval and season are not of any practical value in the interpretation of anaemias since all the values still fell within the normal ranges.

CONCLUSION

The results of this research has demonstrated the existence of natural adaptation to different postpartum re-mating time with no deleterious effect on the haematology of the Doe rabbit at least in the short run. Seasonal variations in haematology have also been shown to be along narrow limits. Invariably, the Doe rabbit has natural endowment to cope with concurrent pregnancy and lactation with little or no stress from the standpoint of haematology. According to Hudson, Schaal, Bilko and Altabacker (1996), during the reproductive season, wild rabbits mate immediately after kindling and the nursing of kits last 25 days. Future research effort should look at the effect of long time exposure to early re-mating since commercial Doe rabbits are bred at all seasons all year round.

Table 1: Effects of experimental postpartum remating interval and on packed cell volume (PCV) of doe rabbits

Parameters	GA	Re-mating Interval Inte 1-9 days	 SInte 10-20 days	 Exte 21-28 days	SEM	Season Dry	 Rain	SEM
PCV (%)	2	38.42	38.86	40.86	1.42	37.85	40.54	1.11
PCV (%)	10	41.07	42.07	41.00	0.63	41.38	41.33	0.50
PCV (%)	20	41.25	41.40	41.71	0.37	41.75	41.25	0.39

Means on the same row are not significantly different (P > 0.05). SEM: Standard error of means.

GA = *Gestation Age; Int = Intensive; SInte = Semi-intensive; Exte = Extensive; SEM = Standard error of means*

Table 2: Effects of experimental postpartum remating interval and season on red blood cell (RBC) count of doe rabbits

Parameters	GA	Re-mating Interval Inte 1-9 days	 SInte 10-20 days	 Exte 21-28 days	SEM	Season Dry	 Rain	SEM
RBC ($x10^6/mm^3$)	2	4.19	4.36	4.69	0.27	4.08	4.66	0.21
RBC ($x10^6/mm^3$)	10	4.23	4.31	4.03	0.10	3.65^b	4.94^a	0.08
RBC ($x10^6/mm^3$)	20	3.81	3.85	3.87	0.69	3.74	3.92	0.73

[ab] Means on the same row with different superscript are significantly different (P <0.05).

GA = *Gestation Age; Int = Intensive; SInte = Semi-intensive; Exte = Extensive; SEM = Standard error of means*

Table 3: Effects of experimental postpartum remating interval and season on haemoglobin (Hb) level of doe rabbits

		Re-mating Interval						
Parameters	**GA**	**Inte**	**SInte**	**Exte**	**SEM**	**Season**		**SEM**
		1-9 days	**10-20 days**	**21-28 days**		**Dry**	**Rain**	
Hb (g/dl)	2	11.81	12.36	12.65	0.28	12.25	12.12	0.22
Hb (g/dl)	10	12.27	12.46	12.10	0.12	12.28	12.24	0.09
Hb (g/dl)	20	12.63	12.50	12.25	0.30	12.30	12.56	0.32

SEM: Standard error of means

Table 4: Effects of experimental postpartum remating interval and season on white blood cell (WBC) count of doe rabbits

		Re-mating Interval						
Parameters	**GA**	**Inte**	**SInte**	**Exte**	**SEM**	**Season**		**SEM**
		1-9 days	**10-20 days**	**21-28 days**		**Dry**	**Rain**	
WBC (X10^3/mm^3)	2	5.09	5.14	5.09	0.32	4.49^{b}	5.61^{a}	0.22
WBC (X10/^{3}mm^3)	10	5.06	5.33	5.31	0.26	5.47	4.90	0.21
WBC (X10^3/mm^3)	20	5.30	5.84	5.49	0.82	5.44	5.59	0.87

^{ab} Means on the same row with different superscript are significantly different ($P < 0.05$). SEM: Standard error of means

Table 5: Effects of experimental postpartum remating interval and season on mean corpuscular volume (MCV) of doe rabbits

		Re-mating Interval						
Parameters	**GA**	**Inte**	**SInte**	**Exte**	**SEM**	**Season**		**SEM**
		1-9 days	**10-20 days**	**21-28 days**		**Dry**	**Rain**	
MCV (cm)	2	93.83	96.20	88.32	7.64	99.00	87.88	5.96
MCV (cm)	10	99.46	99.02	102.05	3.57	111.94	83.41	2.87
MCV (cm)	20	108.35	108.94	108.41	5.41	113.32	105.13	5.05

Table 6. Effects of experimental postpartum remating interval and season on mean corpuscular haemoglobin (MCH) of doe rabbits

		Re-mating Interval						
Parameters	**GA**	**Inte**	**SInte**	**Exte**	**SEM**	**Season**		**SEM**
		1-9 days	**10-20 days**	**21-28 days**		**Dry**	**Rain**	
MCH (mg)	2	28.78	29.31	27.33	2.07	31.55^{a}	25.51^{b}	1.61
MCH (mg)	10	29.70	30.02	30.24	0.73	33.68^{a}	24.68^{b}	0.59
MCH (mg)	20	33.18	32.52	31.68	0.92	33.00	32.09	0.78

^{ab} Means on the same row with different superscript are significantly different ($P < 0.05$). SEM: Standard error of means

Table 7: Effects of experimental postpartum remating interval and season on mean corpuscular haemoglobin concentration (MCHC) of doe rabbits

		Re-mating Interval						
Parameters	**GA**	**Inte**	**SInte**	**Exte**	**SEM**	**Season**		**SEM**
		1-9 days	**10-20 days**	**21-28 days**		**Dry**	**Rain**	
MCHC (%)	2	30.91	31.91	31.33	0.80	32.57^{a}	30.01^{b}	0.63
MCHC (%)	10	29.89	29.63	29.72	0.41	29.71	29.79	0.33
MCHC (%)	20	30.65	30.10	29.30	1.15	29.50	30.53	0.97

^{ab} Means on the same row with different superscript are significantly different ($P < 0.05$). SEM: Standard error of means

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