Nigerian Veterinary Journal 2009 Vol 30(1): 17 - 25

SOME FACTORS AFFECTING POST-PARTUM RESUMPTION OF OVARIAN CYCLICITY IN DAIRY CATTLE

BELLO[1*], A.A., RWUAAN[1], J.S. and VOH (Jr.)[2], A.A.

[1]Department of Surgery and Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria
[2]Artificial Insemination Unit, Animal Reproduction Research Programme, National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria, Nigeria

***Correspondence: E-mail: zyyor@yahoo.com; 08036153483**

SUMMARY

The effect of some factors on postpartum resumption of ovarian cyclicity in dairy cows was studied at the Dairy Research Programme of National Animal Production Research Institute (NAPRI), Shika, Nigeria, with a view to using the results to improve reproductive and dairy performance of dairy cattle. The parameters studied were average daily milk yield (AVDMYLD), lactation length (LACTLENG), postpartum interval (PPI) to resumption of ovarian cyclicity, dam management, breed of dam, season of birth, season of birth by breed of dam and parity. A total of 262 reproductive records of Bunaji and Friesian x Bunaji crossbreds between the years 2000 and 2003 were studied. The statistical analysis of the data was with the General Linear Model (GLM) and Mean Procedures. There was a significant effect (P<0.05) of breed of dam on average milk yield and lactation length, with the Friesian crossbreds giving more milk yield (5.09kg) than the Bunaji (2.49kg) and longer lactation length (258.67 days) than the Bunaji (115.67 days). Dam management equally had a significant effect (P<0.05) on postpartum interval to resumption of ovarian cyclicity with non-suckled cows resuming ovarian cyclicity earlier (93.45 days) than suckled cows (182.67 days). Season of birth, season of birth by breed of dam and parity had no effect on average daily milk yield, lactation length and postpartum interval to resumption of ovarian cyclicity. It was concluded that bucket-fed management system and crossbreeding of Bunaji (White Fulani) with Friesian to obtain F_1 crossbred dairy animals, a programme embarked upon by the Research Institute, is beneficial and recommended to dairy farmers for adoption.

KEY WORDS: Factor, Post-Partum, Resumption, Ovarian cyclicity, Dairy Cattle

INTRODUCTION

Animal production is a familiar practice to mankind and is as old as man himself. Despite all these, one may be right to say that man has not fully mastered the "subject". Issues are even more compounded when influences of environmental factors and time are involved. This probably explains why up to now man is still researching, and will continue to research into animal production. More so, the alarming growing world population especially in the mid 20th century and onwards, which has now reached 6.4 billion in 2004 and 6.6 billion in 2006 (Asford, 2004; Haub, 2006), compels man to continue with investigations into how to improve and find other better ways and methods of animal production to meet up with man's energy and protein requirements and needs.

The genetic potential for milk of most indigenous cattle in the tropics is less than for breeds supporting the infrastructure of dairying in temperate countries (Morales *et al.*, 1989). Therefore, the fastest way to improve the dairy potential of tropical cattle is to introduce inheritance from *Bos taurus* dairy breeds (Syrstad, 1988).

Although germplasms of European origin have high milk potential, fitness is relatively less in tropical environments because of insufficient and costly feed supplies, disease and parasite challenges and narrow margins between input cost and output incomes (Mc Dowell, 1985, Malau-Aduli *et al.*, 1996). On the other hand, natural selection over hundreds of generations has equipped and provided indigenous tropical cattle with a high level of heat tolerance and some resistance to many tropical diseases. Crossbreeding has therefore been exploited as an efficient tool of blending the adaptability of tropical cattle with the high milk potentials of the exotic breeds for increased milk production.

A crossbreeding programme involving the Bunaji (also known as "White Fulani") and other indigenous breeds and Friesian started in the early nineteen hundreds in the country. This continued and in 1964 in Shika, Northern Nigeria, Bunaji and Friesian crossbreeding commenced with the objective of improving the milk yield of the indigenous breed (Bunaji) (Olayiwole *et al.*, 1978; and Buvanendran *et al.*, 1981).

With the above observations and in response to it, dairy establishments have evolved over time as part of the efforts made by man. In dairy farms calf and milk productions are directly related as both are desirable aims of the farms. Their effects influence the reproductive ability of the dam among other factors as reported by Oyedipe *et al.* (1982), Harman *et al.* (1996), Malau-Aduli *et al.* (1996), Mejia *et al.* (1998) and Rhodes *et al.* (2003). While considering these genetic factors, management factors such as calf rearing methods, nutrition, health, etc, exert their own effects as reported by Diskin *et al.* (2001) affecting post-partum interval (PPI) negatively by prolonging the interval. Environmental factors such as season, temperature, location, etc, equally have their effects on the performance of dairy animals (Badinga *et al.*, 1985). As scientific findings are being reported from different parts of the world for specific or general applications, taking into cognizance peculiarities, it is beneficial to have a scientific basis for the dairy farms in Nigeria.

Considering the dairy animal breeds found in Northern Nigeria, the Bunaji and its Friesiancross are being used to study the effect of average daily milk yield, lactation length and post-partum interval to resumption of ovarian cyclicity in dairy animals. The choice of these factors was because it has been observed that there is little information of their effects on the breeds' reproductive performance locally. It is desired that the findings will serve as a means of assessing the productive ability of the breeds and provide information needed for improving the dairy cattle production in Nigeria and Northern Nigeria in particular.

MATERIALS AND METHODS

The study area

The study was carried out at the Dairy Research Programme of the National Animal Production Research Institute (NAPRI), Shika, Zaria. Details of the establishment of the original herd in 1928 have been described previously by Olayiwole *et al.* (1973) and Buvanendran *et al.* (1981). The crossbreeding programme involving the Bunaji and the Friesian at Shika commenced in 1964. The dairy performance of the crosses during the initial stages of the programme up to 1978 and for the period 1967 to 1989 have been reported by Buvanendran *et al.* (1981) and Malau Aduli *et al.* (1996) respectively. Shika, in the Guinea Savannah zone, is located at latitude 11°N and longitude 12°E at an altitude of 640m above sea level with an average annual rainfall of 1100mm most of which falls in the months of June to October. Daily temperatures range from 14°C 30°C with relative humidity of 21% during the "harmattan". The average temperature and humidity during the wet season are 25°C and 72% respectively. The "harmattan" is a period of dry, cool weather that marks the onset of dry season which starts from mid-October to January, while the dry season extends from February to mid-May. The dry season is very hot and the daily temperatures range from 21°C to 36°C with mean relative humidity of 21% (Buvanendran *et al.*, 1981; Oyedipe *et al.*, 1982

and Malau-Aduli *et al.*, 1996).

Management of the animals

In the rainy season (mid May to mid-October) the animals were grazed on paddocks sown with pasture without any concentrate supplementation. During the dry season (mid October to mid May) however, in addition to hay or silage, the animals were supplemented with a concentrate mixture of underlinted cotton seed cake, maize, maize or wheat offal, salt and bone meal. Water and mineral salt licks were provided *ad libitum*.

Lactating cows were offered a dairy concentrate ration at 2% body weight (for the first 5 litres) and 1kg additional concentrate for every additional litre of milk produced.

Calves were separated from their dams four days after birth and bucket-fed until three months of age when they were weaned (Malau Aduli *et al*, 1996).

The cows were hand-milked twice daily, morning and evening. Animal health management practices comprised annual vaccination against anthrax, blackquarter, haemorhagic septicemia, Contagious Bovine Pleuropneumonia (CBPP) and rinderpest. Animals were strategically dewormed four times annually. For ticks and other ectoparasitic control, the animals were sprayed once weekly and forth nightly in the rainy and dry seasons, respectively with appropriate acaricides which were alternated to forestall resistance. Individual clinical cases were attended to appropriately as they arose by an experienced resident veterinarian. Season of calving was classified as dry (November to May) and rainy (June to October).

Variables studied

The dependant variables studied were average daily milk yield (AVDMYD) lactation length (LACTLENG), post-partum interval (PPI), while dam management, Breed of dam, Season of birth of calf, Season of birth of calf by Breed of dam and parity as independent variables. Postpartum interval (PPI) to oestrus was calculated as number of days between calving date and first observable standing oestrus.

Statistical analysis

Incomplete records were excluded so that the data eventually utilized consisted of 214 reproductive and lactation records. The data were analysed using the General Linear Model (GLM) procedure of the Statistical Analysis Systems (SAS, 1987) and Mean procedure. Fixed effects in the model included two levels of dam management, two seasons of birth of the calf, two levels of breed of dam and eight levels of parity. Total number of observations was 262.
The following statistical model was used:

$$Y_{ikjlm} = \mu + M_i + S_j + B_k + P_l + S_j / B_i + e_{ijklm}$$

where

Y_{ijklm}, average daily milk yield, lactation length and postpartum interval; μ, overall mean; M_i, effect of the ith management; S_j, effect of the jth season of birth of calf; B_k, effect of the kth breed of dam; P_l, effect of the lth parity; S_j/B_i, effect of the jth season of birth interaction with breed of dam; and e_{ijklm}, a random error associated with each observation.

RESULTS

The results of the study are summarized in Tables I to III. Table I shows the effects of season of birth, breed of dam and method of dam management on average daily milk yield, lactation length and postpartum interval to resumption of ovarian cyclicity as determined by the mean procedure. Tables II to III on the other hand summarized the effects of the same factors on average daily milk, lactation length and postpartum interval to resumption of ovarian cyclicity as determined by the GLM procedure.

The results show that the breed of the dam had a significant effect on average daily milk yield and lactation length with the crossbreds giving more milk (5.09kg/day) than the Bunaji (2.49kg/day) and longer lactation length (258.67 days) than the Bunaji (115.67 days), respectively (Table III). Furthermore, postpartum interval to resumption of ovarian cyclicity was affected by whether or not the dam were suckled, with non-suckled cows resuming ovarian cyclicity earlier (93.45 days) than suckled cows (182.67 days) (Table III).

The results revealed that season of birth, parity and season of birth by breed had no effect on average daily milk yield, lactation length and postpartum interval to resumption of ovarian cyclicity.

TABLE I: Means ± SE of the effect of season of birth, breed of dam and method of dam management on milk yield, l actation length and postpartum interval to resumption of ovarian cyclicity

Dependent variables	Independent variables			
	N	Mean ± SE	N	Mean ± SE
	SEASON			
	Dry		Rainy	
AVDMYLD	51	2.83 ± 0.33	37	2.88 ± 0.41
LACTLENG	62	152.95 ± 18.87	42	101.86 ± 16.24
PPI	112	144.83 ± 13.05	91	110.21 ± 8.44
	BREED OF DAM			
	Bunaji		Fresian x Bunaji	
AVDMYLD	28	1.29 ± 0.35	60	3.59 ± 0.29
LACTLENG	41	52.15 ± 13.32	63	184.49 ± 17.08
PPI	131	138.56 ± 11.82	72	112.49 ± 8.29
	MANAGEMENT OF DAM			
	Non-suckled cows		Suckled cows	
AVDMYLD	87	2.83 ± 0.26	114	5.10 ± 0.0
LACTLENG	103	130.89 ± 13.25	114	279.00 ± 0.0
PPI	118	91.24 ± 5.80	85	182.17 ± 16.27

TABLE II: Least Square analysis of variance for factors affecting dairy performanc (Summary)

Source	DF	Mean Square AVDMYLD	LACTLENG	PPI
MANAGEMENT OF DAM (Suckling)	1	13.46	48089.93	342290.00*
BREED OF DAM	1	112.14*	427054.46*	1083.77
SOFBIRTH	1	0.23	39673.81	19960.87
PARITY	7	3.50	19103.46	12118.91
SOFBIRTH X BREED	1	0.99	32637.02	82.46

***Significant effect (P<0.05)**

TABLE III: Least Square Mean (LSM) ± SE of some factors affecting dairy traits

FACTORS	AVDMYLD (kg)		LACTLENG (days)		PPI (days)	
Overall Mean	2.85 ± 0.25		132.32 ± 13.20		129.31 ± 8.21	
	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE
Dam management						
Non-suckled cows	(87)	1.88 ± 0.39	(103)	74.54 ± 19.19	(118)	93.45 ± 14.36[a]
Suckled cows	(114)	5.70 ± 2.25	(114)	299.80 ± 115.24	(85)	182.67 ± 16.91[b]
Breed of dam						
Bunaji	(28)	2.49 ± 1.20[a]	(41)	115.67 ± 60.99[a]	(131)	135.89 ± 15.57
Friesian X Bunaji	(63)	258.67 ± 60.57[b]	(72)	140.63 ± 16.51	(60)	5.09 ± 1.19[b]
Season of birth of calf						
Dry season	(51)	3.73 ± 1.15	(62)	208.57 ± 59.33	(112)	148.56 ± 14.56
Rainy season	(37)	3.85 ± 1.23	(42)	165.78 ± 62.11	(91)	127.26 ± 16.61
Season of birth of calf by breed of dam						
D S x B J	(17)	2.55 ± 1.20	(26)	117.73 ± 61.05	(74)	146.16 ± 17.14
D S x FRX	(34)	4.91 ± 1.21	(36)	299.41 ± 61.62	(38)	151.96 ± 19.79
R S x B J	(11)	2.43 ± 1.35	(15)	113.61 ± 66.45	(57)	125.22 ± 19.42
R S x FRX	(26)	5.27 ± 1.24	(27)	217.94 ± 63.08	(34)	129.31 ± 22.23
Parity						
1.	(22)	4.43 ± 1.14	(29)	235.82 ± 58.21	(64)	149.98 ± 14.19
2.	(17)	4.24 ± 1.24	(21)	230.88 ± 62.43	(51)	120.38 ± 16.21
3.	(16)	4.02 ± 1.23	(18)	212.24 ± 62.84	(35)	115.09 ± 18.50
4.	(10)	4.65 ± 1.32	(12)	226.37 ± 65.53	(21)	147.93 ± 23.96
5.	(11)	4.90 ± 1.31	(11)	276.10 ± 66.83	(13)	190.07 ± 30.53
6.	(6)	3.66 ± 1.42	(6)	169.10 ± 73.16	(11)	114.97 ± 33.04
7.	(4)	2.75 ± 1.57	(5)	138.47 ± 76.28	(7)	131.01 ± 41.91
8.	(1)	1.69 ± 2.45	(1)	8.39 ± 126.23	(2)	133.85 ± 76.90

Significant effect (P<0.05)
ab

DISCUSSION

The results of the study revealed that average daily milk yield was affected by the breed of dam. Buvanendran *et al.* (1981), Malau-Aduli *et al.* (1996) and Bello (2004) have reported similar results for the same herd previously. Also, similar findings on Bunaji and other tropical breeds of cattle crossbred with Friesian and other temperate breeds have been reported by Foster (1960), Knudsen and Sohael (1970), Olayiwole *et al.* (1973), Meyn and Wilkins (1974), David-West (1978), Buvanendran (1979), Al-Rawi and Said (1980), Shah *et al.* (1982), Sohael (1984), Mbap and Ngere (1989; 1991), Risikat (1994) and Mejia *et al.* (1998) and all the results show better performance by the crossbreds. This is the basis for the recommendation of crossbreeding as a short to medium-term approach to improving milk production.

The results of the current study show that lactation length was affected by breed of the dam. Similar results had been reported by Buvanendran *et al.* (1980), Malau-Aduli *et al.* (1996) and Bello (2004) of the same herd in the past. Hayatmagarkar *et al.*, (1990) have also reported similar observations in Friesian crossbred under rural production management elsewhere. The LSM lactation length of 258.67 $\pm$ 60.57 days obtained in this report was higher than 244 days (Buvanendran *et al.*, 1981), 247 days (Dettmers and Laseinde-Olotu, 1978) and 250 days (Malau-Aduli *et al.*, 1996) reported for the crosses but lower than 271 days obtained by Sohael (1984). In all cases, the mean lactation length of 258 days of the current report was higher than that for the pure Bunaji in the reports of Buvanendran, Dettmers and Malau-Aduli, an indication that crossbreeding Bunaji with Friesian had a beneficial effect on lactation length since on the average longer lactation length means more milk yield.

The results show that breed had no effect on postpartum interval (PPI) to resumption of ovarian cyclicity.

The results revealed that postpartum interval to resumption of ovarian cyclicity was significantly ($P<0.05$) affected by whether the dam was sucked or not, with the non-suckled cows resuming ovarian cyclicity earlier than cows that were suckled by their calves. Eduvie (1985) and Diskin *et al.* (2001) have reported similar findings even when restricted suckling was a factor in some cases. Under traditional agropastoral management, Voh, Jr. and Otchere (1989) have reported similar observations. This was expected as reports all showed negative effect of suckling on postpartum interval by prolonging PPI while calf isolation or separation from the dam shortens PPI.

The results of this study appear to suggest that it is possible to obtain a calf per cow per year from the Friesian crossbred with the non-suckled dams. Furthermore, the results also indicate that dam management system had no effect on average daily milk yield and lactation length.

The results of the current study show that season of birth had no effect on average daily milk yield, lactation length and postpartum interval to resumption of ovarian cyclicity. The result is similar to the reports by Oyedipe *et al.* (1982) on the effect of season on age at first calving, but differ from the reports of season on calving interval to be shorter in dry season (Eduvie, 1985), reports of season on conception or calving to be most important in March, April, May and June (Voh, Jr. and Otchere, 1989) and reports of season on lactation length, total lactation yield, estimated 305 day yield days dry (all to be significant), age at first calving and calving interval to be non-significant (Malau Aduli *et al.*, 1996).

The result further show that season of birth of calves by breed of dam also had no effect on average daily milk yield, lactation length and postpartum interval to resumption of ovarian cyclicity.

Across parities, results of the current study revealed that there was a trend of increasing average daily milk yield with increasing parity and peaks at the fifth parity (4.90kg), thereafter; it declined as the parity increased. Adeneye and Adebanjo (1978), Licitra *et al.* (1990), Risikat (1994) and Malau-Aduli *et al.* (1996) all reported that milk yields of cows increased with parity with highest milk production during the fourth (Adeneye and Malau) and fifth (Risikat) lactations respectively. The present study confirms those findings. The most likely reason for this observation is that when most heifers calve for the first time, they are still growing; their physiological and anatomical structures for milk secretion are not yet fully developed. With an increase in age, there is a corresponding linear relationship with yield until a certain stage, beyond which an inverse relationship takes over (Morales *et al.*, 1989 and Malau Aduli *et al.*, 1996).

CONCLUSION

In conclusion, the result indicates that calf separation from the dam and cross breeding of Friesian and Bunaji are beneficial. This is because the non-suckled cows had shorter intervals for postpartum ovarian cycling than suckled cows, and the F_1 crosses produced twice as much milk as the Bunaji.

ACKNOWLEDGEMENT

I want to acknowledge the Director of National Animal Production Research Institute (NAPRI), The Programme Leader, Dairy Research Programme, NAPRI, Dr. P.I. Rekwot Head of Artificial Insemination Unit, NAPRI, Dr. S.A.S. Olurunju and Prof. L.O. Eduvie for permission to carry out the work in the establishment and their valuable contributions.

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