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A STUDY OF SOME NON-GENETIC FACTORS AFFECTING POSTPARTUM REPRODUCTIVE PERFORMANCE IN FRIESIAN COWS

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The effect of parity, type of calving, season of the year, feed and milk production on postpartum reproductive physiology was studied in 348 Friesian cows. Cows were checked regularly for oestrus activity, and rectal palpation was performed weekly, starting one week after calving. The time from calving to complete uterine involution, first ovulation, first oestrus and conception was recorded along with the number of services per conception and the incidence of ovulatory anoestrus and cystic follicles. Longer intervals, a higher number of services per conception and a greater incidence of cystic follicles were found among cows that calved abnormally. Longer intervals occurred in cows which calved during autumn and summer than those calving in spring or winter. The intervals were shorter in cows fed green feed and they had a shorter service period and lower number of services per conception. The uterine involution period increased with parity.

Higher milk yields in the first 35 days postpartum were associated with higher incidence of ovulatory anoestrus and cystic follicles; it had no effect on the interval to first ovulation or the number of services per conception.

Key words: Dairy cattle, reproduction, calving

Several trials have been conducted to study the introduction of exotic dairy breeds, especially Friesians, for upgrading local cattle breeds or maintaining pure herds. Basic information on the postpartum reproductive processes and the factors affecting them in such exotic breeds is needed for the planning and management for maximum herd production and fertility. Calving interval is influenced by the time taken for the postpartum resumption of ovarian and oestrus activity and the condition of the reproductive tract in preparation for a new pregnancy. The purpose of the present work was to study the factors which affect the postpartum reproductive performance and its relationship with the productive status in an adapted Friesian herd raised under semiarid conditions.

Materials and Methods

This investigation was carried out on a purebred Friesian herd owned by the Animal Production Research Institute of the Egyptian Ministry of Agriculture and bred at Sakha experimental farm in the northern part of the Nile Delta.

A total of 348 cows calving over a full calendar year were used. They were kept under the normal feeding and management conditions applied on the farm. Cows grazed berseem clover (*Trifolium alexandrinum*) during winter and spring from 0800 to 1400 h and then were fed on concentrates and rice straw to complete their requirements according to their average milk yield. During summer and autumn, concentrates, rice straw and berseem hay

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were offered according to average daily milk yield. All cows were kept loose in open yards and were machine milked twice daily.They were checked for oestrus, using a teaser bull twice daily at 0800 and 1500h. Starting from day 45 postpartum, cows were inseminated when seen in oestrus using locally produced frozen semen.

Rectal palpations were performed weekly, starting 7 - 10 days after calving until insemination. The following information was recorded: the interval from parturition to: complete uterine involution, time of first ovulation, time of first detected oestrus, cystic structures and time of conception.

Cows which retained plactental membranes longer than 24 h were considered abnormal. 24 hours later manual removal of the placenta from such cows was accomplished and 3 - 4 boluses of UT Fort (Therapogen-Werk, Munchen, W.Germany) were placed in utero.

The total number of cows were allocated to two groups: 300 clinically normal cows and 48 clinically abnormal cows, which showed difficulties at calving such as retained fetal membranes, metritis and pyometra. The normal calving cows were classified into four seasonal categories based on the time of calving and into two categories according to the feeding season, green or dry. To study the effect of the level of milk production on postpartum reproductive processes, the cows were divided into three groups according to the average daily milk yield during the first 35 days postpartum: Group A, less than 15 kg/d (low); Group B, 15-20 kg/d (medium); Group C, more than 20 kg/d (high). The data obtained were subjected to standard analysis of variance (Steel and Torrie 1960). Differences in the incidence of cystic follicles, silent heat and number of services per conception beween different categories were tested using Fisher's exact test according to Zar (1974) .

Results and Discussion

1. *Effect of type of calving:* The average values and standard errors of the different reproductive parameters studied, classified by the type of calving, are given in Table 1. The intervals from calving to com-

Table 1:
Effect of type of calving on various reproductive traits

Trait	Normal calving $\bar{x}$	Normal calving SE	Abnormal calving $\bar{x}$	Abnormal calving SE	Significance level (P)
Interval (days) from calving to :					
uterine involution	26.8	± 0.47	28.9	± 1.32	< 0.05
first ovulation	28.6	± 0.52	38.2	± 0.98	< 0.01
first oestrus	43.1	± 1.31	65.4	± 1.67	< 0.01
conception	87.8	± 2.24	124.2	± 5.71	< 0.01
Number of services/ conception	1.85		2.98		< 0.01
Ovulatory anoestrus (%)	46.0		47.9		N.S.
Cystic follicles (%)	6.3		18.8		< 0.01

plete uterine involution, first detected oestrus and conception were significantly shorter ($P < 0.05$, $P < 0.01$ and $P < 0.01$ respectively) in the cows which calved normally than the corresponding values for the cows which had difficulties at or just after calving. It seems that the causes of the calving abnormality had a long lasting effect throughout the postpartum period, and that the effect was cumulative so that the difference between the two groups increased from about two days for the interval to complete uterine involution, to 10 and 36 days in the interval to first ovulation and conception respectively. This may reflect an irregular hormone balance in the abnormally calved cows, controlling the postpartum ovarian activity, which was indicated by the high incidence of cystic follicles (18.8%). ($P < 0.01$). Wiltbank et al (1953) suggested that cystic follicles may occur due to the high levels of oestrogen present during late pregnancy. Their occurrence may be due to other factors such as lower levels of gonadotrophins. A further possible effect of calving abnormality on the processes subsequent to ovulation and insemination was indicated by the higher number of services per conception, as compared to normal calving cows ($P < 0.01$). The delayed uterine involution and postpartum ovarian activity in this study are similar to that reported by Morrow et al (1966).

The overall values obtained here for normal calving cows, are in close agreement with those reported by other authors (Morrow et al 1966; Casida and Wisnicky 1950). Longer intervals were, however, reported by Buch et al (1955), Menge et al (1962) and Wickersham and Schultz (1963).

First ovulation occurred by day 42 in about 94% of the normally calved cows. Other workers (Kudlac 1971; El-Keraby and Schilling 1976; Lamming 1978 and Bulman and Wood 1980) reported similar results.

The interval from calving to first detected oestrus for the normal cows (43.1 ± 1.31 days) is close to that reported by Wickersham and Schultz (1963). On the other hand, Trimberger (1954) and Fosgate et al (1962) reported longer intervals (50.2 and 51.2 days, respectively), while Buch et al (1955), Morrow et al (1966) and El Keraby and Schilling (1976) gave shorter intervals of 33.0, 15.0 and 37.0 days respectively.

About 85% of the normal cows conceived by day 108 post calving. The average value for the period between calving and conception recorded in this study (87.8 ± 2.24 days) is close to that obtained by Plasse et al (1965), Serousov and Orlovskii (1970) and Bulman and Wood (1980).

The incidence of ovulatory anoestrus in the normally calving cows is similar to that reported by Zemjanis (1961). A higher value of 56.6 % was obtained by Morrow et al (1966), while much lower results, however, have been reported by Stewart (1962), Hall et al (1959), Mylrea (1962), and Esslement (1974). Aboul-Ela (1980) concluded that differences between values reported in different studies may have been caused by differences in the methods, frequency and timing of oestrus detection.

2. *Effect of the feeding season:* It seems from the data presented in Table 2 that cows which calved during the green feeding season had better reproductive performance than those calving during the dry feeding season, in terms of shorter intervals from calving to complete uterine involution (23.9 vs. 29.3 days), first ovulation (25.6 vs. 31.0 days), first detected oestrus (38.8 vs. 46.1 days) and conception (74.8 vs. 96.3 days),

Table 2:
Effect of feeding season on various reproductive traits

Trait	Green feeding season		Dry feeding season		Significance level
	$\bar{x}$	SE	$\bar{x}$	SE	(P)
Intervals (days) from calving to :					
uterine involution	23.9	± 0.64	29.3	± 0.62	< 0.01
first ovulation	25.6	± 0.84	31.0	± 0.66	< 0.01
first oestrus	38.8	± 1.75	46.1	± 1.83	< 0.01
conception	74.8	± 2.52	96.3	± 3.12	< 0.01
Number of services/ conception	1.71		2.00		< 0.01
Ovulatory anoestrus (%)	55.2		45.6		< 0.05
Cystic follicles (%)	5.87		6.71		NS

and the lower number of services per conception (1.71 vs. 2.00). The differences between the two groups in all these parameters were statistically significant ($P < 0.01$). A possible cause of these differences is the difference in the vitamin content in the diet between the two feeding seasons. The effect of specific nutrients on the reproductive processes has been reviewed elsewhere (Lamming 1969).

No significant difference was found between the two groups in the incidence of cystic follicles (Table 2). The incidence of ovulatory anoestrus increased significantly ($P < 0.05$) during the green feeding period.

3. *Effect of the season of calving:* There was a marked and significant variation among different seasons of calving in all parameters studied (Table 3), with the exception of the incidence of cystic follicles which was similar and did not exceed 6.8% in any of the calving seasons. Such a value is lower than those reported in other studies (Casida & Chapman 1951; Menge et al 1962 and El-Keraby and Schilling 1976). In general cows which calved during summer and autumn had longer intervals to complete uterine involution, first ovulation, first oestrus and conception than those which calved in spring or winter (Table 3). The differences among seasons were more pronounced after the first ovulation and first oestrus. Autumn calving cows had the highest percentage of ovulatory anoestrus (74.6%) which is almost thrice that which occurred during spring and summer. This, along with the highest number of services per conception, resulted in the longest interval from parturition to conception. This lowest reproductive performance for autumn calving cows may be due to cumulative effect of dry feeding during summer and autumn and/or the adverse climatic conditions during late pregnancy. Hale (1975) postulated that a period of time is required between the cause and effect on fertility. Other authors

Table 3:
Effect of season of calving on various reproductive traits

Trait	Summer		Autumn		Winter		Spring		Significance level (P)
	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	
Intervals (days) from calving to :									
uterine involution	30.1	± 0.94	28.9	± 0.79	24.8	± 0.73	22.7	± 1.10	< 0.01
first ovulation	30.7	± 0.96	31.1	± 0.88	26.6	± 1.18	24.5	± 1.19	< 0.01
first oestrus	39.6	± 2.08	49.8	± 2.55	42.2	± 2.48	33.4	± 2.07	< 0.01
conception	87.4	± 2.87	102.3	± 4.55	72.1	± 2.92	76.5	± 4.29	< 0.01
Number of services/ conception	1.67		2.20		1.69		1.71		< 0.01
Ovulatory anoestrus (%)	24.1		74.6		60.6		28.0		< 0.01
Cystic follicles (%)	6.3		5.9		6.8		6.6		NS

have suggested that the seasonal variation in reproductive activities could be due to photoperiod (Thibault et al 1966) or to seasonal differences in nutrition and/or housing (De Kruik 1975)but the reason has not yet been resolved. From the economic point of view, autumn calving would not be recommended under conditions similar to those of the present study. More attention should be given to the detection of oestrus during the postpartum period, particularly in autumn calving cows, using more than one method of detection and with checking being done more frequently to improve detection efficiency (Aboul-Ela 1980).

4: *Effect of parity:* Complete uterine involution took place earlier in the primiparous as compared to the multi-parous cows (24.5 vs 27.8 days). The differences between the two groups were significant ($P < 0.01$). This result is in agreement with that mentioned by Buch et al (1955). Parity did not affect any of the other postpartum intervals which is in line with the findings of Morrow et al (1966) who indicted that parity had no significant effect on the period to first ovulation, first oetrus and conceptiom . However, others have reported differences due to parity in the interval to first postpartum oestrus (Buch et al 1955; Badaway et al 1973). The incidence of ovulatory anoestrus was lower, although not significant, in the primiparous cows (Table 4). This result in is contrast to that of Bulman and Wood (1980) who reported that the incidence of "silent heat" was highest in the primiparous cows and decreased with the advance in lactation number.

5. *Effect of the level of milk production:* The average values of the various reproductive criteria studied, classified by the level of milk production during the first 35 days postpartum are shown in Table 5. Cows in the three groups had almost similar intervals from calving to complete uterine involution and first ovulation. There was a tendency for a prolonged

Table 4:
Effect of parity of various reproductive traits

Trait	Primiparous $\bar{x}$	SE	Pluriparous $\bar{x}$	SE	Significance level (P)
Intervals (days) from calving to :					
uterine involution	24.5	± 0.78	27.8	± 0.48	< 0.01
first ovulation	27.7	± 0.87	29.1	± 0.69	NS
first oestrus	43.1	± 2.27	43.1	± 1.60	NS
conception	88.6	± 3.88	87.5	± 2.83	NS
Number of services/ conception	1.91		1.87		NS
Ovulatory anoestrus (%)	42.1		47.7		NS
Cystic follicles (%)	5.0		7.0		NS

Table 5:
Effect of level of milk production on various reproductive traits

Trait	Average daily milk yield in the 35 days post partum: Low (less than 15/kg) $\bar{x}$	SE	Medium (15-20 kg) $\bar{x}$	SE	High (more than 20 kg) $\bar{x}$	SE	Significance level (P)
Intervals (days) from calving to:							
uterine involution	24.9	± 0.7	25.3	± 0.64	26.9	± 1.13	NS
first ovulation	26.5	± 0.99	25.8	± 0.67	27.1	± 1.52	NS
first oestrus	42.9	± 2.67	42.6	± 1.93	51.7	± 4.06	NS
No. of services/ conception	1.74		2.04		1.91		< 0.05
Ovulatory anoestrus (%)	39.9		41.6		56.6		< 0.05
Cystic follicles (%)	2.1		9.5		12.5		< 0.05

interval to first detected oestrus in the high yielding cows as compared to the medium and low producers. The difference, however, was not statistically significant. This trend may have occurred as a result of the significant ($P < 0.05$) increase in the incidence of ovulatory anoestrus in the high yielding cows (Table 5). This finding supports the earlier results of Morrow et al (1966) and El-Keraby and Schilling (1976) who found a positive correlation between the level of milk production and the occurrence of "silent heat".

Insignificant positive correlation coefficiencts of 0.13, 0.1 and 0.06 were found between milk yield in the first 35 days postpartum and the intervals from calving to complete uterine involution, first ovulation and first detected oestrus, respectively. Findings in the literature concerning the relationship between milk yield and the intervals from calving to first ovulation, first oestrus and open days are at variance, as some workers found significant association between high milk yield and the prologation of these periods (Olds and Seath 1953; Marion and Gier 1968; Whitmore et al 1974; Spalding et al 1975 and Stevenson & Britt 1979), while others did not (Boyd et al 1954; El-Keraby and Schilling 1976 and Bulman and Wood 1980). Such conflict may have resulted from differences in the genetic potential and the level of production of animals used in different studies. An interesting result obtained here is the significantly ($P < 0.05$) higher incidence of cystic follicles in the high yielding cows (12.5%) as compared to the medium (9.5%) and low producers (2.1%). A similar trend was reported by Johnson et al (1966) and El-Keraby and Schilling (1976). The reason for such an effect cannot be specified and it needs further detailed studies on the effect of high milk yield on the level of circulating gonadotrophic hormones and/or the ovarian response to these hormones.

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