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POSTPARTUM OVARIAN ACTIVITY IN FRIESIAN COWS UNDER EGYPTIAN CONDITIONS

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ABSTRACT

This investigation aimed at studing the cyclic and acyclic patterns of ovarian function in Friesian cattle. Twenty-one pregnant Friesian cows were taken randomly from a herd located at sakha experimental station, Animal Production Research Institute, Ministry of agriculture, Egypt. Cows were experimented 15-20 days before the expected calving day till two months after fertile insemination. Blood samples were withdrawn twice weekly at 3 - 4 days intervals. Plasma was used for assaying progesterone levels imploying radioimmunoassay. Heat detection was performed twice daily in all cows preconception.

Results revealed that the overall mean of postpartum anestrus period was 80.4 days. During this period plasma progesterone was recorded at basal level (<0.5 ng/ml), postpartum anestrus period was prolonged in the highly milk producing cows compared to low producers (91.88 versus 61.23 days). The difference between low and high lactating cows in this respect was statistically insignificant. Overall average length of postpartum to first ovulation interval was 116.3 days. Postpartum to the first ovulatory estrus interval averaged 127.0 days, while days open averaged 186.1 days. Milk production had a significant ($p<0.01$) effect on postpartum to first ovulation and to first estrus intervals. Number of ovulations and inseminations /conception was 3.9 and 2.35, respectively with insignificant effect of milk production on both traits.

The percentage of quiet ovulation was 41.7%. This percentage was 71.4% , 42.1% and 27.3% in the first, second and third postpartum ovulation, respectively. Forty one percent of the short low peak progesterone cycles was 9.79 days in length with an average progesterone peak of 2.2 ng/ml. Overall average length of regular normal progesterone cycles was 22.36 days with average progesterone peak of 6.37 ng/ml.

Keywords: Friesian cows, ovarian function, estrous cycle, ovulation, and progesterone.

INTRODUCTION

As a matter of fact, in Egypt, milk production of local cows is low. This may be due to the genetic and environmental factors. (Sabrah *et al*.. 2001) also could be attributed to late puberty. Age at first calving and the calving interval were increased due to long period of postpartum anestrus, long service period and an increase in number of services. This reproductive disorder under the subtropical conditions may be due to the high ambient temperature and extended time of day length (Cavestany *et al*.. 1985. Ray *et al*.. 1992. Farian *et al*.. 1994. and Hassanin *et al*.. 1996 a, b), improper nutrition (Butler and Smith, 1989) and hormonal imbalance (Perry *et al*., 1988 and Harrison *et al*., 1990). El-Keraby and Aboul-Ela (1982) noticed that cows calved in summer and autumn had significantly longer interval to first

postpartum ovulation than those calved during winter and spring (30.9 and 25.6 days respectively).

The objective of this work is to study the postpartum ovarian activity of Friesian cows under Egyptian conditions by monitoring ovarian cyclicity and acyclicity through heat detection and blood plasma progesterone profile. This study also included effects of parity, year, seasons and levels of milk production on some reproductive traits.

MATERIALS AND METHODS

Twenty-one pregnant Friesian cows were taken randomly from the herd located at Sakha Experimental Station, Animal Production Research Institute, Ministry of Agriculture, Egypt. This study commenced 15-20 days pre-expected day of parturition and terminated at about two months of next gestation. In the hot season (May to October) cows were fed according to their live body weight and reproductive status (pregnant or milking). During hot season the ration consisted of wheat or rice straw and concentrate (each kg of concentration mixture contained 380 g. Undecorticorted cotton seed meal, 220g. yellow maize, 300g wheat bran, 30 g. molasses, 20g. limestone, and 10g. common salt.

The ration was offered twice daily at 8.30 and 15.30 O'clock. In temperate season (November to March) animals were left to graze on Egyptian clover (*Trifolium alexandrinum*) ad libitum with rice straw. Drinking water was available all time of the day. Mobile milking machine was used to milk the cows individually in their barn.

At the 15 th day postpartum, cows were checked for estrus signs two times daily at 8.0 and 17.0 O'clock, using a vasectomized bull . Standing behavior was the reliable sign of estrus, in addition to the other estrus signs such as mounting behavior, vulvar swelling discharge, restlessness and raising the tail. Cows showing heat signs during the first 40 days postpartum were not served according to the routine work in the station. Cows were inseminated artificially using frozen semen. Animals that did not return to estrus 60 days after insemination were palpated for pregnancy diagnosis. Blood samples were withdrawn twice weekly at 3 to 4 days intervals. Bleeding started nearly 15 days before calving, and a sample was taken on calving day or the next day of calving and continued until next pregnancy. Blood (5ml) was drained in a tube containing Na_2 , Sodium EDTA, and was Centrifuged in a cooling Centrifuge. Plasma was collected and stored at – 20 °C till analyzed for progesterone. Progesterone was measured by a direct radioimmunoassay procedures adapted for cattle (Abraham, 1981).

Throughout the first 90 days postpartum, the experimental cows were divided into two classes according to their level of milk production. The high producing cows (> 950 kg milk) and low producers (< 950 kg milk), Animals were subdivided according to parity into two groups, primiparous and pluriporous cows. Data were statistically analyzed according to the linear model procedure described in SAS 1988). Differences between means were checked according to Duncan.

Methods were used for monitoring reproductive patterns in this study. plasma progesterone profile and estrus activity. Postpartum anestrus. The period from calving up to the resumption of ovarian activity or to the first rise of plasma progesterone level was also recorded.

RESULTS AND DISCUSSION

1-Postpartum anestrus

Table (1) showed the length of postpartum anestrus it could be noticed that the overall mean length of postpartum period was 80.40 days« ranged from 38-234 days » (Table 1). The length of this period was shorter than that reported in Zebu cattle by Mukaso *et al*. (1991) who found that this period averaged 304.1 with a range of 31-1084 days. However, it was almost equal to that reported by Custer *et al*. (1990) who reported anestrus period averaged 60 and 90 days for the bull exposed and unexposed cows, respectively. Carruthers and Hafz (1980) found that postpartum anestrus period were 50.2 and 44.8 days in suckling, and non suckling cows, respectively. Wettmann *et al*. (1978) found that the postpartum anestrus mean length in cows was 67 days.

Table 1: Effects of Parity and milk production on some reproductive parameters (LS means ± S.E)in Friesian cows Under subtropical conditions.

Parameters	Parity		Milk production		Overall
	Primparous	Pluriparous	High	Low	Mean ± SE
Postpartum anestrus period (day)	85.3 ± 56.7 (40-234)	70.73 ± 30.28 (44-154)	91.88 ± 67.53 (40-234)	61.23 ± 11.68 (44-85)	80.4 ± 45.04 (44-234)
First postpartum ovulation interval (day)	131.7 ± 58.33 (62-234)	100.27 ± 51.78 (54-238)	166.75 ± 55.38 ** (44-238)	83.54 ± 23.87 (54-117)	116.0 ± 75.18 (54-238)
First postpartum estrus interval (day)	144.7 ± 67.08 (84-285)	108.18 ± 48.58 (55-238)	177.38 ± 66.77 ** (94-285)	93.69 ± 20.81 (55-135)	127.0 ± 60.75 (55-285)
Days open	201.78 ± 85.99 (110-355)	172.00 ± 74.72 (112-371)	230.00 ± 83.91 * (120-371)	160.5 ± 67.42 (110-355)	186.1 ± 79.44 (110-371)
Number of Inseminations/conception	2.4 ± 1.65 (1-6)	2.27 ± 0.4 (1-4)	2.0 ± 1.2 (1-3)	2.54 ± 1.33 (1-6)	2.35 ± 1.27 (1-6)
Number of ovulations/conception	2.4 ± 3.01 (1-9)	3.91 ± 1.04 (2-5)	3.25 ± 2.12 (1-6)	4.38 ± 1.84 (2-9)	3.9 ± 1.9 (1-9)

Differences between high and low milk producing cows
*** (P<0.05), ** (P<0.01)**
The range for each reproductive parameter is shown between parentheses.

Progesterone profile during postpartum anestrus was recorded in Table (2) The overall mean concentration of progesterone was 0.34 and 0.27ng/ml during the first and seventh days of postpartum anestrus (Table 2). During the entire length of postpartum period it was 0.22 ± 0.23 ng/ml. representing the basal level for the hormone that may imply a state of postpartum acyclicity. Staples and Thatcher (1990) noticed that the hormone average was 0.52 ng/ml for the anestrus period of Holstein cows and did not return to normal ovarian activity for 83 days. Bellows *et al*. (1972) showed that progesterone level in suckling, non-suckling and mastectomized cows were 0.33, 0.55 and 0.36 ng/ml, respectively.

Table 2: Mean length of Postpartum anestrus (day) and mean progesterone concentration (ng/ml) during the entire postpartum period and at day o, 1 and 7 postpartum

Reproductive traits	Duration of postpartum anestrus (day)	Progesterone concentration during the entire postpartum interval	Progesterone at day o or 1.of postpartum anestrus	Progesterone at 7 day of postpartum anestrus
X ± SE	80.4 ± 45.4	0.22 ± 0.23	0.34 ± 0.51	0.27 ± 0.31

On the day of calving or the next day about 9.5% of the cows showed progesterone value > 1.5 ng/ml (2 cows). This may imply that corpora lutea of previous pregnancy were still secreting progesterone at that time, but at a low rate while about 33.3% (seven cows) showed progesterone values of 0.4 ng/ml (Table 5). This may be due to the adrenal cortex secretions. In the rest of the cows (12 cows), progesterone level was at basal level <0.4 ng/ml. This may indicate that the corpora lutea of pregnancy had already regressed by this time. However, at day 7 postpartum the progesterone was almost at basal level (< 0.5 ng/ml). This was confirmed by janakiraman (1981) and Jainudeen *et al*. (1982) since they observed that corpora lutea of pregnant animals underwent complete regression within one week or 10 days postpartum, respectively.

The Short-Low peak progesterone cycles (SLP) was showed in Table (6) The overall mean length of the SLP was 9.97 days. Ranging between 6-14 days (Table 6). The overall average of peak progesterone concentration of these cycles was 2.2 ng/ml. The SLP cycles were silent and were not accompanied with signs of estrus. This may be due to the inadequate estrogen / progesterone ratio necessary to exhibit the estrus signs. It could be observed that 44.1% of SLP cycles are followed by normal cyclicity or pregnancy and 55% were followed by anestrus. Mean lengths of SLP cycle was 10.15 and 9.84 days for cycles followed by cyclicity and acyclicity, respectively. The difference between the two means was not significant (Table 6). The increased progesterone level in these cycles followed by cyclicity could initiate the cyclicity in anesterus animal. Youssef (1992) working on buffalo cows proposed that the minor progesterone rise stimulates directly or indirectly, the adenohypophysis to release the ovulatory surge of LH that evokes estrus manifestation and ovulation for the first time after a state of true anestrus. Thereafter, ovulation occurs spontaneously unless the animals become pregnant. The hypothalamus and/or the adenohypophysis may not respond to the ovarian messages. Here the animal enters a phase of true anestrus and need another minor rise of progesterone to bring the hypothalamus-hypophyseal axis into action, whenever it is ready to respond. If it is not ready to respond, ovaries remain acyclic till another rise of progesterone level. The activity of the ovary was not influenced significantly by the peak of progesterone concentration (Table 6).

The SLP cycles length was 9.63 and 10.3 days for primiparous and pluriparous cows respectively (Table 6), with non-significant differences between the two means. But in the case of progesterone concentration peak of the overall means for the two groups were 1.84 and 2.59 ng/ml respectively, and the difference was significant ($P < 0.05$) (Table 6). Season

of calving had no significant effect on both the length and peak progesterone level of SLP cycle. The mean length was 8.8 and 10.5 days, and progesterone peak average 2.35 and 2.15 ng/ml for hot and temperate seasons, respectively (Table 6).

3-Regular progesterone cycles (RPC)

The Length of regular progesetron cycles (RPC) were given in Table (6). It could be noticed that the overall mean length of RPC was 22.36 days. These results are in agreement with the finding of Marion and Gier (1968), who found that the length of regular cycles averaged 22 days and ranged 18 and 23 days. Dlezel et al. (1993) however reported that the length of estrous cycles ranged from 9 to 56 days with an average of 20 days. Dtcker and Morant (1984) also indicated a cycle mean length of 20 days.

The average lengths of RPC was 22.23 and 22.33 days for primiparous and pluriparous cows, respectively (Table 6). This finding agrees with the results obtained by Rajamahendran and Taylor (1990). The present study revealed that the level of milk production had no significant effect on the length of RPC (Table 6). These means were 22.67 and 22.05 days for the high and low yield cows, respectively. The mean length of progesterone cycles in hot season was longer than that in the temperate season (Table 6). It was 24.27 and 20.67 days for hot and temperate seasons respectively, with significant ($p<0.1$) differences. The high temperature may inhibit the release of Prostaglandin (PGF) and cause the persistence of corpus luteum. Consequently, the length of releasing progesterone was increased in hot season.

The overall means of the peak for the regular progesterone concentration *(RPC)* were 6.98 and 5.9 ng/ml for primiparous and pluriparous cows respectively, (Table 6), while the average was 6.24 and 6.58 ng/ml for low and high yielders, respectively (Table 6). The average concentration of this peak was 7.86 and 5.01 ng/ml for hot and temperate season respectively (Table 6). This difference was significant ($p<0.01$). This finding agrees with that of El-Sobhy *et al*. (1987) and Folman *et al*. (1979) who reported that in normal cycles, progesterone concentration was higher in hot season than in cold one.

4-Postpartum interval to first ovulation

The overall mean and length of postpartum interval to first ovulation was 116.3 days. It ranged between 54 - 238 days (Table 1). The level of milk production was the most important factor affecting length of postpartum interval to first ovulation, where the high milk producing cows had a longer period than the low producing ones (166.75 and 83.54 days respectively). The high level of milk production had highly significant effect ($P<0.01$) on the postpartum interval to first ovulation (Table 1). The increase of postpartum anestrus in high producers prolonged the interval between parturition and the first ovulation.

These results are confirmed by those obtained by Butler *et al*. (1981), Ducker *et al*. (1985), and Berglund *et al*. (1989). They indicated that ovulation

takes place much later after calving in the high producing cows than in the low producing ones.

The mean length of the period from calving to first ovulation in the primiparous cows was a little longer than in the pluriparous ones. It was 131.7 and 100.3 day for primiparous and pluriparous cows, respectively (Table 1).

5-Postpartum interval to first ovulatory estrus

The present study showed that the postpartum interval to first ovulatory estrus was 127 days . It ranged between 55 and 285 days (Table 1). Dunn and kalthenbach (1980) found that this period ranged between 46 and 168 days, while Custer *et al*. (1990) reported 60 and 90 days range. Holness *et al*. (1987) and Hansen *et al*. (1982) and El-Sobhy *et al*. (1987) attributed the prolonged period to first estrus to poor heat detection. In the temperate season (December to May), where the animals are in pasture and labour, there is insufficient time to observe estrus carefully. And it may also be due to the increased percentage of quiet ovulations, since the first postpartum ovulation almost occures without exhibiting the estrus signs was increased. The mean length of this period was 144.7 and 108.18 day in the primiparous and pluriparous cows, respectively. However, the difference between the two means was not significant, while it was significant ($p< 0.01$) between the high milk producing cow and the low milk producing ones. The mean length was 177.38 and 93.69, respectively. The obtained data agree with those of Whitemore *et al*. (1974), Harrison *et al*. (1989) and (1990), who reported that low producing cows were under less stress compared to the high producers which, in turn, have favored higher fertility.

6-Days open

The postpartum period to the fertile insemination (days open) was 186.1. ranging between 110 and 371 days (Table 1). This long interval of days open in the present study could be due to the long anestrus period, which may be due to a low level of nutrition, and a high percentage of quiet ovulation.

The mean length of days open was 201.8 and 172 days in the primiparous and pluriparous cows respectively. However, this difference was not significant (Table1). These results agree with those of Schaeffer and Henderson (1972) and Basu *et al*. (1979). While for high milk producing ones it was significantly ($P<0.05$) different (230 vs 160.5 days).Longer days open for high producers was due to a longer anestrus period and delayed first ovulatory estrus.

7- Number of ovulations per conception (O/C) and number of inseminations per conception (I/C)

The overall mean of the number of ovulations per conception was 3.9. It ranged between 1 and 9 (Table 1). There was no effect of either parity or level of milk production on number of ovulations per conception.

The overall mean of the number of inseminations required for conception was 2.35 with a range between 1 and 6 (Table 1). Salama *et al*. (1976) found that the average number of inseminations per conception was

1.95. with a range between 1.62 and 1.98 (Azage Tagegen *et al*., 1981), however a range between 2.2 and 2.6 was reported by Carstairs *et al*. (1980).

There was no significant effect of parity and level of milk production on number of services per conception. These results were confirmed by Marion and Gier (1968), whitmore *et al*. (1974) and Ruegg *et al*. (1992) who reported that the level of milk production had no significant effect on number of inseminations per conception. These results are notably in contrast with those obtained by Basu and Ghai (1981) and Berglund *et al*. (1989) who found that high milk producing cows requiered more inseminations per conception than the low producers.

8-Quiet ovulation

The total percentage of quiet ovulation in the present study was 41.7%. The distribution of this trait indicated that it was low between August and September (12.5%), and high between November and March (46%). The average of the percentage of quiet ovulation between April and October (hot season) was 39% (Table 3). These results agree with those of El-keraby and Aboul-Ela (1982), they reported higher incidence of quiet ovulation in winter than in summer (60.6% vs 24.1%). The percentage of quiet ovulation for the first postpartum ovulation was 71.4%. It declined to 42.1% and 27.3% in the second and third ovulation, respectively (Table 4). This trend was also found by several investigators such as Morrow *et al*. (1969), who showed that the percentage of quiet ovulation was 77%, 54% and 36% for the first, second and third postpartum ovulation respectively. However, Sharp and king (1981), showed that in the first, second and third postpartum ovulation values of 81%, 38.1% and 42.1% of ovulation were recorded without detectable estrus signs.

Table 3: Number of ovulation, quiet ovulation and ovulatory estrous periods during temperature (November-March) and hot season of the year (April-October)

Reproductive traits	No. of Ovulation	No of quiet ovulation	No of ovulatory Estrus	quiet ovulation %
Total	84	35	49	41.7
Nov. - March	33	15	18	45.5 %
Apr - Oct	51	20	31	39.2 %

Table 4: Percentage of quiet ovulation in the first, second and third postpartum (p.p.) ovulation

Rank of p.p. ovulation	Percentage of animals	
1 st. ovulation	71.4	(15/21)
2 nd ovulation	42.1	(8/19)
3 rd. ovulation	27.3	(12.44)

Table 5: Plasma progesterone level ng/ml on the day of calving or the first day postpartum.

Number of Cows	Progesterone	Percentage of animals
2	> 1.5	9.5
7	0.4	33.3
12	<0.4	57.1

Table 6: Effects of Parity, season of the year and milk production on normal and short – low progesterone cycles in Friesian cows.

Progesterone cycle	Parity		Season		Milk production		Overall
a-Normal cycles	Primparous X ± SE	Pluriparous X ± SE	Hot X ± SE	Temperate X ± SE	High X ± SE	Low X ± SE	Mean ± SE
Mean length (day)	22.23 ± 3.9	22.33 ± 3.9	24.27 ± 3.63	**20.67 ±3.34	22.67 ± 4.14	22.05 ± 3.8	22.36 ± 3.9
Frequency	31	33	30	34	25	39	32
Mean peak concentration of progesterone (ng/ml)	6.98 ± 4.96	5.9 ± 3.32	7.86 ± 2.98	**5.01 ± 2.98	6.58 ± 3.7	6.24 ± 4.13	6.37 ± 3.93
b-Short low peak cycles					Cyclicity after SLP cycle		
					Cyclicity	Acyclicity	
Mean length (day)	9.63 ± 2.15	10 ± 2.42	8.8 ± 3.11	10.5 ± 1.7	10.15 ± 2.4	9.84 ± 2.23	9.7 ± 2.3
Range (day)	6-12	6-14	6-14	7-12	6-14	6-14	6-14
Frequency	16	18	10	22	15(44.1%)	15(55.9%)	16.7
Mean peak concentration of progesterone (ng/ml)	1.84 ± 0.76	2.59 ± 1.12	2.35 ± 1.43	2.15 ± 0.84	2.18 ± 0.55	2.27 ± 1.26	2.2 ± 1.03

**** Differences between hot and temperate seasons are significant (P<0.01)**

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النشاط المبيضى فى ماشية الفرزيان تحت الظروف المصرية

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الهدف من هذا البحث هو دراسة النشاط المبيضى فى فترة ما بعد الولادة فى وجود أو عدم وجود دورات تناسلية فى ماشية الفرزيان . تم الحصول على عدد ٢١ بقرة فرزيان حامل من قطيع محطة البحوث الزراعية سخا كفر الشيخ, وتم استخدام هذه الأبقار قبل ميعاد الولادة المتوقع ب ١٥ ـ ٢٠ يوم وحتى بعد شهرين من التلقيحة المخصبة التالية . ولقد تم ملاحظة الشياع مرتين يومياً فى الأبقار قبل حدوث الحمل التالى.

تم أخذ عينات الدم مرتين أسبوعياً على فترات من ٣ إلى ٤ أيام . استخدمت البلازما لتقدير مستوى هرمون البروجستيرون باستخدام طريقة التقدير الإشعاعى المناعى **(RIA)** .

أوضحت النتائج أن إجمالى متوسط طول فترة الهدوء الجنسى بعد الولادة فى الأبقار كان ٨٠,٤ يوم وخلال هذه الفترة تم تسجيل مستوى هرمون البروجستيرون فى البلازما عند المستوى القاعدى (أقل من ٠,٥ نانو جرام / مل) ووجد أن فترة الهدوء الجنسى تطول فى الأبقار عالية الإدرار عنها فى الأبقار منخفضة الإدرار (٩١,٨٨ مقابل ٦١,٢٣ يوم) وذلك بالرغم من أن الفرق بين متوسط تلك الفترة فى الأبقار العالية الأدرار والمنخفضة الأدرار لم يصل إلى درجة المعنوية .

أظهرت النتائج أن إجمالى متوسط طول الفترة اللازمة لحدوث التبويض الأول ١١٦,٣ يوماً بينما كان طول الفترة من الولادة حتى الشبق الأول المصحوب بتبويض هى ١٢٧ يوماً ووجد أن متوسط طول فترة التلقيح (الأيام المفتوحة) ١٨٦,١ يوم . ولقد دلت النتائج أن إنتاج الحليب له تأثير معنوى (احتمال خطأ أقل من ٠,٠١) على كل من الفترة اللازمة للتبويض الأول وكذلك الفترة اللازمة للشياع الأول بعد الولادة ، ووجد أن متوسط عدد التبويضات والتلقيحات اللازمة هى ٣,٩ ، ٢,٣٥ على التوالى ولم تتأثر هاتان الصفتان معنوياً بإنتاج اللبن .

اتضح من النتائج أن نسبة التبويض الصامت بلغت ٤١,٧% وكانت هذه النسبة ٧١,٤ ، ٤٢,١ ، ٢٧,٣ فى كل من التبويض الأول والثانى والثالث بعد الولادة على التوالى . ووجد أن ٤١% من دورات البروجستيرون القصيرة منخفضة القمة كان طولها ٩,٩٧ يوم . وكان المتوسط فى تركيز هرمون البروجستيرون لتلك القمة هو ٢,٢ نانو جرام / مل ، ووجد أن متوسط الإجمالى لطول دورة البروجستيرون الطبيعية المنتظمة هو ٢٢,٣٦ يوم مع قمة تركيز هرمون البروجستيرون ٦,٣٧ نانو جرام / مل .