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REPRODUCTIVE CHARACTERISTICS OF THE EGYPTIAN BUFFALOES AS AFFECTED BY SEASON OF CALVING AND MILK PRODUCTION LEVEL

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SUMMARY

Thirty two buffalo cows were used to study the effect of calving season and milk production level of the first 100 days on post-partum reproductive performance. Twenty cows calved during the cold season (November - April), while the rest (n = 12) calved during the hot season (May - October). Within each season buffaloes were divided into three categories for milk production within that 100 days: high >900, medium 700-900 and low < 700 Kg milk. Heat was detected twice daily by visual observation using teaser bull. Blood samples were collected twice weekly to determine progesterone concentration. Post-partum ovulation interval (PPOI), post-partum service interval (PPSI), ovulatory cycle length (OCL), number of services per conception (NS/C), conception rate (CR%), service period length (SPL) and days open (DO) were recorded for each group.

Calving season exerted a significant influence on NS/C and CR averaging 1.7±0.3 and 60% in cold season, vs. 2.5±0.2 and 84% in hot season, respectively. In terms of milk productuion effect, the overall means of NS/C were 2.8±0.3, 2.0±0.2 and 1.6±0.2 services, of SPL were 95.0±18, 79.9±18.8 and 90.0±4.3 days and of DO were 156.6±18, 126.7±18.6, and 52.6±9 days for high, medium and low milk producer groups, respectively. The CR decreased with the increase of milk production averaging 55, 70 and 83, respectively. PPOI, PPSI, and OCL were not significantly affected by milk production level. Progesterone concentration in the hot season calvers was significantly lower than in the cold season ones.

Keywords: Buffalo, post-partum, calving season,milk production, reproductive performance

INTRODUCTION

Resumption of ovarian and estrous activities in post-partum period affects, to a great extent, the length of calving interval and consequently animal's productive life. Shortening the calving interval to be ≤ 14 months is one of the main goals of buffalo breeders. Calving interval is influenced by the period elapsing between parturition and onset of first ovulation and estrous incidence. The resumption of both ovarian and estrous activities and related reproductive criteria are reported to be affected by many factors (e.g. suckling, parity, season of calving, nutrition , milk production level, ...etc).

In dairy cattle, milk production level is reported to have a significant effect on post-pratum reproductive characteristics (Bulman and Lamming, 1978 and Nebel and McGilliard, 1993), while, in buffaloes, rare data with contradictory trends are available concerning that effect (Youssef *et al*., 1988; Zeidan, 1990 and Ayesh, 1992). Meanwhile most of the previous studies indicated that season of calving influences the calving interval and the related criteria (El-Fouly *et al*., 1977; El- Shafie *et al*., 1983; Barkawi *et al* ., 1986 and Barkawi, 1993).

According to the available data, this work was designed to study the effect of milking capacity of buffalo cows through the first 100 days post-partum within different calving seasons on post-partum reproductive performance.

MATERIALS AND METHODS

1- Experimental animals and management

Thirty two Egyptian buffalo cows ranging between the 4 *th* and the 12 *th* parities, were used. The experiment was carried out on 20 buffaloes, calved in the cold season (November - April) and 12 buffaloes, calved in the hot season (May - October). Animals were lot-fed on concentrate mixture, according to their live body weight and milk production level. Along with the concentrates, the roughage as Egyptian clover (*Trifolium alexandrinum*) and rice straw were offered *ad lib*. during the cold season, whereas during the hot one the roughage was consisted of Egyptian clover hay and wheat straw.

2- Experimental procedure

Within each season cows were divided into 3 groups according to their milk production level throughout the 100 days post-partum (the experimental period), high >900 kg, medium 700 - 900 kg and low <700 kg producers. The bull was allowed to run with the buffaloes two times daily, at 06:00 and 18:00 h for 60 min/each round and cows which showed standing behavior were served at the first detected post-partum heat.

The reproductive tract was palpated weekly via rectum starting 7 days post-partum to denote uterine involution and it was stopped after the female

had received the first service. Pregnancy was diagnosed applying rectal palpation on the 60 *th* day after insemination.

Blood samples (about 10 ml each) were collected twice weekly, at 3 to 4 day interval, via the jugular vein from all the buffaloes for progesterone (P_4) determination to monitor ovarian activity throughout the experimental period. Sampling started 15 days post-calving until time at which the cow had been diagnosed pregnant. Samples were centrifuged for 15 min at 3000 r.p.m. for plasma separation. Thenafter, plasma samples were stored at -20 °C till the assay time. Direct radioimmunoassay (RIA) technique was performed for plasma P_4 determination using ready antibody coated tube kits " SPECTRIA Orion Diagnostic, Espoo, Finland".

3- Studied traits

Post-partum ovulation interval (PPOI, the period from parturition to the first ovulation), post-partum service interval (PPSI, the period from parturition to the first service), service period length (SPL, the interval between the first post-partum service and the successful fertilizing service), days-open (DO, the interval between parturition and conception), number of services per conception (NS/C) , conception rate (CR, the percentage of cows which conceived out of the total number of cows from the 1*st* and the 2*nd* services and ovulation cycle length (OCL, the interval between two successive ovulation cases) were recorded for each cow. The ovulation cycles were classified into; short <18 days , normal 18-24 days and long > 24 days. Quiet ovulation percentage was calculated as the ratio between the average of ovulations/ cow and average of estrus/ cow.

Ovulation date was estimated by P_4 concentration. In quiet ovulation cases, ovulation date was determined by subtracting 3 days from the time at which P_4 level reached ≥1.0 ng/ml and continued at that level for 2 consecutive samples. In the case of ovulatory estrus, day of estrus was considered as the day of ovulation providing that estrus was followed by an increase in P_4 level to ≥1.0 ng/ml within the 7 days post-detected estrus and continued at that level for 2 consecutive samples at least. Any cow showing P_4 level ≤1.0 ng/ml and continued at that level for ≥ 3 successive weeks was considered in anestrous.

4- Statistical analysis

Relevant statistical analyses of data were carried out applying SAS Package (1990). The analysis of variance was done according to nested design. Differences among means were checked according to Duncan (1955).

RESULTS

I- Post-partum reproductive performance

It was found that PPOI ranged between 25 to 86 days (Figure 1) with an average of 40.1 ± 2.2 days (Table 1). The frequency distribution of PPOI showed that about 80% of the buffaloes displayed their first ovulation within 60 days post-partum (Figure 1). The resumption of ovarian activity occurred insignificantly earlier in cold than in hot calvers. Also, it tended to be shorter, however insignificant, with the increase in milk production level.

Table 1. Least squares means ± S.E of post-partum reproductive performance in Egyptian buffalo cows as affected by season of calving and milk production level (MPL)

Character	MPL	Season of calving				Overall means	
		Cold		Hot		± S. E	
Post-partum ovulation interval (PPOI) (days).	L	40.5 ± 1.2		--		40.5 ± 1.2	
	M	29.8 ± 1.9		45.0 ± 4.7		38.0 ± 3.1	
	H	30.4 ± 4.7		37.2 ± 3.6		37.8 ± 2.9	
Overall mean ± S.E		34.0 ± 1.6		41.1 ± 2.9		40.1 ± 2.2	
Post-partum service interval (PPSI) (days).	L	45.9 ± 4.7		--		45.9 ± 4.7	
	M	32.8 ± 3.9		48.6 ± 4.2		41.4 ± 3.3	
	H	49.4 ± 3.4		39.8 ± 3.2		43.7 ± 2.5	
Overall mean ± S.E		41.1 ± 2.7		44.2.± 2.6		42.5 ± 2.6	
Number of services per conception (NS/C).	L	1.6 ± 0.2 ^{b}		--		1.6 ± 0.2 ^{b}	
	M	1.8 ± 0.5 ^{ab}		2.0 ± 0.2 ^{ab}		2.0 ± 0.2 ^{ab}	
	H	1.5 ± 0.5 ^{b}		3.0 ± 0.3 ^{a}		2.8 ± 0.3 ^{a}	
Overall mean ± S.E		1.7 ± 0.3		2.5 ± 0.2		2.19 ±0.2	
		1st	*2nd*	*1st*	*2nd*	*1st*	*2nd*
Conception rate (CR%).	L	33	50	--	--	33	50
	M	33	22	25	63	29	41
	H	20	20	--	75	11	41
Overall mean ± S.E		30	30	17	67	25	44
Service period length (SPL) (days).	L	9.0 ± 4.3 ^{b}		--		9.0 ± 4.3 ^{b}	
	M	133.5 ± 34.9 ^{a}		33.9 ± 4.3 ^{b}		79.9 ± 18.8 ^{a}	
	H	104.3 ± 38.1 ^{a}		88.8±17.6 ^{ab}		95.0 ± 18.0 ^{a}	
Overall mean ± S.E		92.9 ± 21.1		61.4 ± 9.2		75.4 ± 18.2	
Days open (DO) (days).	L	52.6 ± 8.9 ^{c}		--		52.6 ± 8.9 ^{b}	
	M	177.3±35.5 ^{ab}		83.2±2.1 ^{b}		126.7 ± 18.6 ^{ab}	
	H	189.8 ± 45.0 ^{a}		140.0±14.4 ^{a}		156.6 ± 17.9 ^{a}	
Overall mean ± S.E		153.5 ± 24.1		111.6 ± 8.1		128.5 ± 18.9	

Values with different superscript within columns or rows within each character are significantly different (P<0.05).

MPL=Milk production level throughout the first 100 days post-partum, L=low <700, M=medium 700-900 and H=high >900 kg milk.

There was no available animals which had low milk production during hot season.

CR % was calculated considering the first and the second services only.

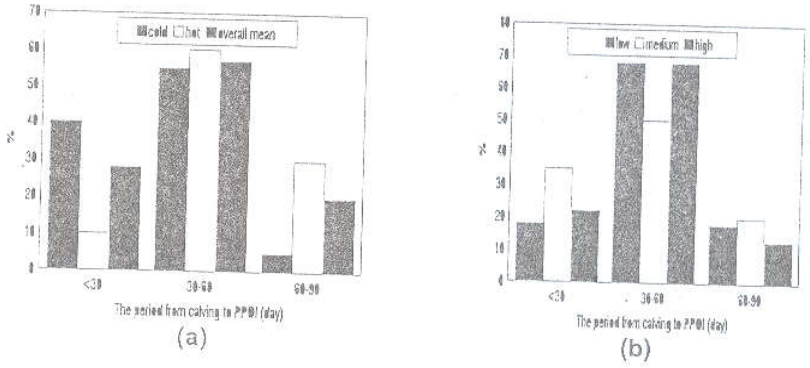

Figure 1. Frequancy destribution (%) of post-partum ovulation interval (PPOI) as affected by season of calving (a) and milk production level (b).

Since the cows were inseminated in the first detected estrus, PPSI was considered as the interval from parturition to the first estrus. The average of PPSI was almost equal to PPOI (Table 1). The frequency distribution of PPSI indicated that 87% of the cows, relative to those displayed ovulation, were served within 60 days post-partum (Figure 2). Percentage of cows served within 60 days post-partum in cold and hot seasons were 95 and 75%, respectively. Season of calving and milk production have no significant effect on PPSI.

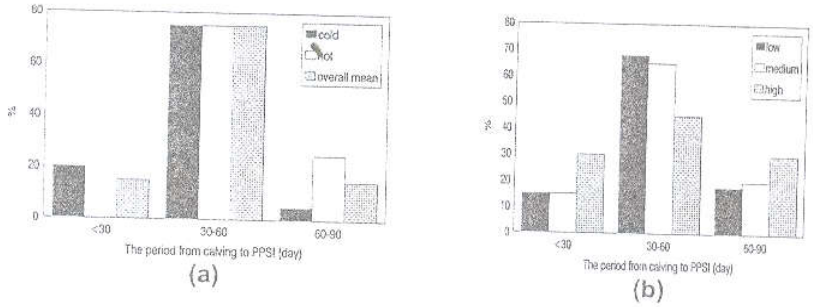

Figure 2. Frequancy destribution (%) of post-partum service interval (PPSI) as affected by season of calving (a) and milk production level (b).

Table (1) shows that the average of NS/C is 2.2. In hot season, NS/C was significantly ($P<0.05$) more than that in cold season. Services required for conception increased with the increase in the level of milk production. High milk yielders had the greatest value of NS/C during hot season, while a reverse trend was observed in cold season.

The overall mean of CR after the first and the second services was 69%. It was found that CR was greater in the hot season than in the cold one (Table 1). Even though more animals were served during cold season, lower CR was achieved. The CR by both 1*st* and 2*nd* services decreased with the increase of milk production level, anyhow not significantly, hence, milk yield could reduce or limit conception of buffalo cows.

The average of SPL was 75.4 ± 18.2 days with a maximum value of 294 days (Table 1). During cold season SPL was significantly longer than that in hot season. The overall mean of SPL tended to be significantly longer with increase of milk production. The overall mean of DO (128.5 ± 18.9 days) ranged between 25 and 322 days. DO was significantly ($P<0.05$) longer in cold season than in hot one, and its length increased significantly ($P<0.05$) with the increase in milk production level in both seasons (Table 1) leading to extended CI.

II- Post-partum ovulatory and estrous activities

1- Ovulatory cycles

The overall mean of the 1*st* ovulatory cycle length was longer than that of the subsequent ones as indicated from the overall mean of the ovulatory cycles. The average number of ovulations / cow was higher than the average of estrus/cow. The ratio between the two averages indicated that about 31% of the total ovulations was quiet (Table 2).

The first ovulatory cycles were longer, but not significant, for hot than those of the cold season calvers. This trend was not clear on the overall mean of all ovulatory cycles. This may be due to that the percentage of abnormal cycles in cold season was less than that in the hot season. Ovulatory and estrous activities of hot season calvers were better than those of the cold season as expressed by the average of ovulations and estrus / cow.

Concerning the milk production level, medium producer cows showed shorter length of ovulatory cycles. This is due to that this group showed lower percentage of abnormal cycles compared to the other two groups (Table 2). However, the high yielders showed higher average of ovulations and estrus/ cow, the low yielder group showed the lowest percentage of quiet ovulations (15%) compared to medium (33%) and high (32%) yielder groups.

2- Progesterone (P_4) profile

Throughout the post-partum anestrous period (from parturition to the 1*st* ovulation), P_4 concentration was less than 0.5 ng/ml. The concentration of P_4

in the first ovulatory cycles indicated that the life span of the corpus luteum was limited in both normal and long cycles.

Table 2. Ovulatory and estrous characteristics of Egyptian buffalo cows as affected by season of calving and milk production level

Character	MPL	Season of calving		Overall means
		Cold	Hot	± S. E
First ovulatory cycle (days)	L	21.3 ±3.7	--	21.3 ± 3.1
	M	22.4 ±2.8	22.3 ±3.0	22.5 ±1.5
	H	27.5± 3.7	28.3 ± 3.7	28.9 ± 3.6
Overall mean ± S.E		24.2 ± 2.0	25.2 ± 2.5	24.7±1.5
All ovulatory cycles (days)	L	23.3 ± 2.3	--	26.2 ± 3.7
	M	22.6 ± 1.6	20.7 ± 1.0	21.8 ± 0.9
	H	23.4 ± 3.8	25.4 ± 2.4	24.7 ± 2.1
Overall mean ± S.E		23.0 ±1.4	23.0 ± 1.4	23.0 ± 1.0
Estrous cycle (days)	L	24.4 ± 2.9	--	24.4 ± 2.9
	M	23.4 ± 2.5	20.7 ± 1.9	21.7 ± 1.2
	H	22.4 ± 2.9	26.3 ± 2.0	25.1 ± 2.0
Overall mean ± S.E		23.4 ± 1.5	23.3 ± 1.4	23.4 ± 1.0
Abnormal cycles %	L	8	--	4
	M	16	12	14
	H	24	40	32
Overall mean ± S.E		48	52	50
Ovulation / cow	L	2.0	--	2.0
	M	2.8	2.5	2.6
	H	2.6	4.0	3.2
Overall mean ± S.E		2.5	3.0	2.7
Estrus / cow	L	1.7	--	1.7
	M	1.7	1.9	1.8
	H	1.6	3.0	2.2
Overall mean ± S.E		1.7	2.3	1.9

MPL=Milk production level , L=low <700, M = medium 700-900 and H=high >900 kg milk.
There was no available animals which had low milk production during hot season.

Luteal phase of ovulatory cycles of hot season calvers was shorter and had lower P_4 concentration compared to cold season ones in any of the three types of ovulatory cycles (short, normal and long). Peak of P_4 was recorded 7 days following ovulation in buffaloes with short ovulatory cycles, while in normal and long cycles, it was detected 7-10 days following ovulation during both seasons (Table 3). Profile of P_4 throughout the ovulatory cycle was not significantly affected by level of milk production.

Table 3. Mean value of blood plasma progesterone (ng/ml) in cases of ovulatory cycles with different length in cold and hot seasons

Cycle length (days)	Short (< 18)		Normal (18 - 24)		Long (> 24)	
Days following estrus	Cold	Hot	Cold	Hot	Cold	Hot
0	0.4	0.2	0.3	0.2	0.1	0.1
+3	2.0	2.6	3.0	1.9	2.7	1.4
+7	3.2	2.9	2.3	3.6	6.5	2.2
+10	1.7	0.2	4.1	0.6	5.7	4.8
+14	0.4	0.2	0.4	0.1	5.4	0.8
+17	0.2	0.1	0.3	0.2	5.4	0.2
+21	--	--	0.2	0.2	1.1	0.1
+24	--	--	--	--	2.0	0.2
+28	--	--	--	--	1.1	0.2
+31	--	--	--	--	0.9	0.1
+34	--	--	--	--	0.1	0.1
+38	--	--	--	--	0.1	--

DISCUSSION

Results of the present study indicate that hot season buffalo calvers under any level of milk production have poor post-partum reproductive criteria compared to the cold season calvers. This finding is in agreement with El-Fouly *et al.* (1976) who stated that the reproductive activity of she-buffalo reaches its peak during the cold months of the year. Similar results particularly for PPOI and PPSI were also observed by Mohamed and El-Sheikh (1983), and El-Wardani (1995). The climatic temperature, cold or hot, is not the only effector but it is confounded with other effectors (e.g. daylight, nutrition and humidity). Feeding animals on surplus of green berseem during the cold season may have a positive effect on reproductive aspects due to the estrogenic factors it contains.

The general view of the results indicates that the high capacity of milk production interferes, to some extent, with the effect of climatic conditions, which were clearly observed in conception rate, number of services per conception, service period and days open (Table 1).

The results of milk production level within the studied seasons indicated that no significant differences, concerning PPOI and PPSI, existed among the studied groups which may be due to the low milk production of buffaloes, generally. However, it is worthy to point out that high yielders had lower conception rate (Table 1) compared to the other two groups. This of course is due to the long days open of high producer cows (156.6 days) compared to the low producer ones (52.6 days).

The present finding clarified that the poor reproductive criteria of high producer cows were not attributed to the delay in resumption of ovarian

activity.The endocrine balance in high producers, particularly during the period from 60-120 days (Time of milk prodction peak) may direct the physiological process towards the milk production. This endocrine balance may result in irregularity of ovulation cycles and high frequency of quiet ovulation (Table 2) resulting in low conception rate and long periods of days open (Table 1).

High milk producing cows are assumed to have high circulating level of prolactin. The role of prolactin, as a prime hormone of milk production, in the reproduction of bovine needs further elucidation Nalbandov (1976) mentioned that prolactin has an antigonadotropic effect which inhibits the synthesis or release of FSH and LH. Jaindueen and Hafez (1987) reported that prolactin has a negative role on reproduction process in bovines.

However, milk production level in the present study, had no effect on average of ovulation/cow, the effect was very clear on the estrous activity. The high incidence of quiet ovulation is the other reason for the reported long DO. No concrete data are available to explain the effect of milk production on estrous activity.

The short sustenance of corpus luteum (life span) for those cows which delivered in hot season may be attributed to the low circulating LH level (luteotrophic factor in cattle) during the hot months (Aboul-Ela and Barkawi, 1988). Further studies, to monitor the pattern of changes in pituitary hormones in relation to season of calving and milk production level, are needed. Such data will help in understanding the reasons of the wide variation in the reproductive response among individuals.

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الخصائص التناسلية للجاموس المصرى متأثرة بموسم الولادة ومستوى إنتاج اللبن

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استخدم ٣٢ جاموسة لدراسة تأثير موسم الولادة ومستوى إنتاج اللبن خلال المائة يوم الأولى بعد الولادة على الاداء التناسلى بعد الولادة . عشرون جاموسة وضعت خلال الموسم البارد (نوفمبر-ابريل) اما البقية (عددها ١٢) فقد وضعت خلال الموسم الحار (مايو-اكتوبر) ولكل من هاتين المجموعتين تم تسجيل الصفات التالية:- الفترة من الوضع حتى أول تبويض ، الفترة من الوضع حتى أول تلقيحة، طول الدورة المبيضية؛ عددالتلقيحات اللازمة للحمل، معدل الحمل، طول فترة التلقيح، الأيام المفتوحة. كما قسمت الحيوانات تبعا لإنتاجها من اللبن خلال فترة المائة يوم الأولى بعد الوضع إلى عالية الإنتاج (>٩٠٠ كجم)، متوسطة الإنتاج (٧٠٠-٩٠٠ كجم) ، منخفضة الإنتاج (< ٧٠٠ كجم لبن).

ولقد تم كشف الشبق مرتين يوميا بإسلوب الملاحظة فى وجود الطلوقة الكشاف وجمعت عينات الدم بمعدل مرتين/أسبوع لتقدير تركيز هرمون البروجسترون. ولقد كان لموسم الوضع تأثيرا معنويا على كل من عدد التلقيحات اللازمة للحمل ومعدل الحمل حيث كانت المتوسطات خلال الموسم البارد ١,٧±٠,٣، ٦٠٪ بينما كانت خلال الموسم الحار ٢,٥ ± ٠,٢، ٨٤٪ على الترتيب. اما بخصوص تأثير مستوى إنتاج اللبن فلقد تأثرت الصفات التالية معنويا حيث كانت متوسطات عدد التلقيحات اللازمة لحدوث الحمل ٢,٨± ٠,٣ ، ٢,٠ ± ٠,٢ ، ١,٦ ± ٠,٢ تلقيحة ، طول فترة التلقيح ٩٥,٠ ± ١٨,٠ ، ٧٩,٩ ± ١٨,٨ ، ٩٠,٠ ± ٤,٣ يوما ؛ عدد الأيام المفتوحة ١٥٦,٦ ± ١٨,٠ ، ١٢٦,٧ ± ١٨,٦، ٥٢,٦ ± ٩,٠ يوما للحيوانات عاليه ومتوسطة ومنخفضة الإنتاج على الترتيب ولقد إنخفض معدل الحمل إنحفاضا معنويا مع زيادة إنتاج اللبن فكانت المتوسطات ٥٥ ، ٧٠ ، ٨٣٪ على الترتيب. ولم يظهرتأثير معنوى لمستوى إنتاج اللبن على كل من الفترة من الوضع حتى أول تبويض، الفترة من الوضع حتى أول تلقيحة ، وطول الدورة المبيضية . أما تركيز هرمون البرجسترون فلم يتأثر معنويا بمستوى إنتاج اللبن ولكنة إنخفض إنخفاضا معنويا فى ولادات الموسم الحار بالمقارنة مع ولادات الموسم البارد.