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INDUCTION OF SEXUAL ACTIVITY IN FEMALE CAMELS DURING THE NONBREEDING SEASON

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Received for publication: August 11, 1995
Accepted: October 21, 1996

ABSTRACT

Sixteen anestrous adult female camels (Camelus dromedarius) in good health and with inactive ovaries were selected from the herd during the month of June (non-breeding season). The camels were randomly divided into 4 equal groups. To induce ovarian activity, camels in Groups I,II and III were given an intramuscular injection of 250 mg hydroxyprogesterone hexanoate followed by 1000 IU eCG on days 2 and 3 of treatment. The camels were mated on Day 5 after the last eCG injection. Ovulation in Groups II and III was induced by intravenous administration of 3000 IU hCG and 40 mcg GnRH, respectively. Group IV was administered saline and served as the control. Periodic examinations per rectum were performed to explore the status of the ovaries. Blood samples were collected at 8 different stages and sera were analyzed for estradiol 17-B and progesterone using specific RIA kits. All camels in the control and treated groups were mated successfully. Levels of estradiol 17-B did not exhibit any particular trend. Blood progesterone levels suggested ovulation in 2 camels (50%) in Group I and in 3

Acknowledgements

The authors gratefully acknowledge the Indian Council of Agricultural Research, New Delhi, for the support to carry out this investigation.

0093-691X/97/$17.00
PII S0093-691X(97)00017-4

camels (75%) in each of Groups of II and III. This was confirmed by presence of CL in the ovary during per rectum examination. No camel ovulated in the control group. One camel conceived in each of Groups I and III.

Key words : camel, off-season breeding, estrus induction, progesterone, estrogen

INTRODUCTION

Although the dromedary camel (Camelus dromedarius) is a seasonal breeder, the breeding season varies in the different climatic zones of the world (15). In India, it extends from November through March (12). The present study describes the results of inducing reproductive activity during the middle of the nonbreeding season in the Indian camel.

MATERIALS AND METHODS

Sixteen sexually quiescent adult female camels that had calved at least once were used in this study in June 1994. The ambient temperature, vapour pressure and wind velocity during this period ranged from 29.0 to 47.0^{o}C, 15 to 25 mm Hg and 6 to 120 km/h, respectively. The camels at the farm were maintained under a semi-intensive management system. In this system, the camels were stall fed and were sent out for grazing on range land from 9:00 a.m. to 4:00 p.m. The camels were palpated per rectum for the status of the ovaries and the genital tract and were then randomly divided into 4 equal groups, (n = 4 each). Groups I, II and III were treated with 250 mg hydroxy-progesterone hexanoate (Proluton depot[a]) intramuscularly. On the following 2 days they received intramuscular injection of 1000 IU eCG (Trophovet[b]). This constituted the basic treatment of all the treated groups and will be referred to as the premating treatment. The treated animals were mated on the fifth day after the last eCG injection. The camels in Group I received no further treatment,

while those in Groups II and III were administered intravenous injections of 3000 IU LH (Chorulon[c]) or 40 mcg GnRH (Receptal Vet[d]), respectively, 3 h after mating. Camels in Group IV served as the control and received injections of saline in place of hormonal treatment. They were mated along with the treated females. In all, 6 studs were used which had good libido even during the nonbreeding season. Blood samples from all 16 females were collected on the day before the start of the experiment; 24 h after progesterone administration; on the day of mating; and on Days 5, 10, 17, 23 and 31 post mating. Sera were separated and stored at -20°C until analyzed for estradiol 17 B and progesterone using specific DPC RIA kits.[e] The assays were critically evaluated for validity. The antisera were highly specific as reported in the protocol. In addition, sensitivity, parallelism and intra- and inter-assay coefficients of variation were recorded. The respective values for these parameters were found to be 5 pg, r=0.98, 7.08% and 8.18% for estradiol 17-B and 25 pg, r=0.96, 5.88% and 11.78% for progesterone. The camels were examined per rectum for ovarian status and the presence of a corpus luteum (CL) 5 d after mating. They were also observed for the demeanor of pregnant females based on the "Cocking of tail" response (5). They were considered to have ovulated if the progesterone concentration was > 0.2 ng/ml on day 5 or 10 post mating and a corpus luteum was detected upon examination per rectum (2,3).

RESULTS

All the female camels, both in the treated and control groups, were mated. Neither the studs nor the females exhibited any reluctance or indifferent behavior toward mating.

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a German Remedies Ltd., Goa, India.

b Indian Immunologicals, Hyderabad, Indian.

c Intervet International B.V., Boxmeer, Holland.

d Hoechst Veterinar Gmbh, Germany.

e Diagnostic products corporation, Los Angeles, CA USA.

Examination per rectum on Day 5 post mating revealed the presence of a CL in 2 Group I camels (pre mating treatment + mating), in 3 Group II camels (pre mating treatment + mating + chorulon) and in 3 Group III camels (pre mating treatment + mating + receptal). No CLs were detected in the control camels (Group IV; Table 1). In addition, small follicles (5 to 7 mm) were detected in 2 camels (1 female per group) in Groups II and III and in the control (Group IV).

The estradiol and progesterone concentrations for each animal in the 4 groups are presented in Tables 2 and 3, respectively. Estradiol concentrations showed an irregular pattern and could not be correlated with reproductive status of the individual camel. It has been reported that progesterone levels are maintained at basal levels in camels that fail to ovulate but peak sharply between Days 5 and 10 post mating in animals that ovulated. The higher progesterone levels persist in the camels which conceive (2 and 3). Analysis of our results based on the above criteria of the treated animals revealed that 2 females (camels 296 and 93) in Group I ovulated and 3 each in Group II (camels 24, 191 and 214) and Group III (camels 74, 326 and 243) ovulated. No animal ovulated in the control group. The progesterone profiles correlated well with the palpation findings of the 4 Groups and indicated that treatment stimulated ovarian activity in 67% of the camel versus 0% in the control group. The behavior of 3 of the camels confirmed pregnancy on Day 20 post mating; however, by Day 31 post mating, only 2 camels, 1 in Group I and 1 in Groups III exhibited pregnancy. In the third female (camel 24) of Group II embryo degeneration had apparently occurred because progesterone levels declined precipitously after Day 17 (Table 3).

DISCUSSION

It was observed that all the camels, including those in the control group, could be mated successfully. While the females in the control group did not respond when approached by

Table 1. Reproductive performance of anestrous camels following various treatments

Treatment group	Treatment	n	No. ovulated %	No. developed CL	No. conceived	Conceived versus ovulated %	Overall conception rate %
I	PMT+M	4	2 (50)	2	1	50.5	25
II	PMT+M+hCG	4	3 (75)	3	0	0	0
III	PMT+M+GnRH	4	3 (75)	3	1	33	25
IV	S+M+S (Control)	4	0 (0)	0	0	0	0

PMT = Pre-mating treatment (Consisted of intramuscular injections of 250 mg hydroxy-progesterone followed by 1000 IU eCG on 2 consecutive days); M = mating; S = saline.

Table 2. Estradiol concentration (pg/ml) in camels under different treatment groups

Treatment group	Camel ID No.	Day of progesterone administration		Day of Mating	Day post mating				
		-1	+1	0	5	10	17	23	31
I PMT+M	296	26	18	27	19	18	18	21	26
	93	26	22	26	30	20	24	38	23
	265	28	21	22	27	24	20	24	23
	208	17	12	23	24	22	28	17	14
II PMT+M+C	83	23	22	22	27	36	36	38	46
	24	30	14	28	38	27	24	30	20
	191	30	20	32	28	28	19	30	22
	214	30	30	32	23	26	28	28	38
III PMT+M+R	74	19	27	23	26	19	23	23	30
	381	40	36	30	28	30	32	34	34
	326	23	22	32	27	32	42	50	38
	243	30	28	28	34	34	30	32	26
IV Control	382	30	27	14	21	18	30	14	21
	105	34	32	30	20	30	30	38	42
	270	24	30	22	23	26	30	30	23
	295	14	26	22	26	32	26	20	18

PMT = pre mating treatment; M = mating; C = hCG; R = GnRH.

Table 3. Progesterone concentration (ng/ml) in camels under different treatment groups

Treatment group	Animal ID No.	Day of progesterone administration		Day of Mating	Day post mating				
Days		-1	+1	0	5	10	17	23	31
T PMT+M	296	0.042	0.042	0.037	1.800	1.800	0.050	0.032	0.020
	93	0.050	0.135	0.042	2.100	4.250	2.800	2.100	1.700
	265	0.070	0.290	0.170	0.240	0.010	0.020	0.013	0.016
	208	0.010	1.200	0.016	0.010	0.010	0.010	0.010	0.010
II PMT+M+C	83	0.016	0.010	0.020	0.310	0.070	0.010	0.037	0.010
	24	0.010	0.180	0.120	2.100	2.000	0.700	0.290	0.135
	191	0.180	0.060	0.075	0.750	0.700	0.075	0.050	0.037
	214	0.090	0.090	0.110	1.600	0.950	0.060	0.032	0.075
III PMT+M+R	74	0.055	0.110	0.280	0.450	0.050	0.045	0.010	0.040
	381	0.100	0.090	0.150	0.034	0.045	0.034	0.034	0.034
	326	0.065	0.010	0.010	0.200	1.150	0.950	0.750	0.650
	243	0.100	0.040	0.025	0.750	0.550	0.017	0.017	0.010
IV Control	382	0.180	0.150	0.250	0.075	0.035	0.060	0.105	0.090
	105	0.010	0.035	0.026	0.550	0.070	0.010	0.010	0.010
	270	0.100	0.70	0.085	0.010	0.010	0.010	0.016	0.010
	295	0.042	0.050	0.050	0.042	0.037	0.028	0.085	0.028

PMT = pre mating treatment; M = mating; C = hCG; R = GnRH.

the male they did not struggle upon being lightly restrained and made to sit in the mating posture and allowed mating to occur. Since the camel is an induced ovulator, this procedure was repeated with the control groups to provide an equal opportunity for the control animals to ovulate and conceive. The studs, although they expressed good libido and bred the females, may have undergone some deterioration in seminal quality. Degenerative changes with diminished number of mature spermatozoa in the testis (1) and a higher percentage of abnormal and immature spermatozoa in the epididymis of camels have been reported previously (10) during the nonbreeding season, suggesting an adverse effect on fertility.

Hormonal treatment evidently triggered ovarian activity with the development of mature follicles that ovulated after proper stimuli. Of the treated animals 67% ovulated versus 0% in the control group. Ovulation rates of 66.6% in folligon treated prepubertal camels (14) and 41.7% in anestrous adult camels during nonbreeding season (4) have been reported and which reflect our results. Cooper et al. (6) observed that dromedary camels did not ovulate consistently in response to treatment with either hCG or GnRH. Dafalla et al. (7) induced estrus in 2 anestrous camels but observed signs of estrus in only 1 camel. In our study, a higher ovulation rate (75%) was observed in animals which in addition to mating were administered LH or GnRH preparations. Feng et al. (11) also demonstrated a beneficial effect of LHRH analogue on ovulation in the camel.

The treated camels which had ovulated showed presence of corpus luteum in their ovary and several folds increase in serum progesterone concentration on day 5 or 10 post mating as compared to pre mating values. In control animals, all the pre and post mating values were less than 0.2 ng/ml except one value of 0.55 ng/ml on Day 5 for camel 105. On transrectal examination of this animal no corpus luteum was detected. A little higher progesterone value in this animal may be due to formation of some transient luteal tissue in the ovary.

In the present study, the conception rate was found to be low (16.6%). The reason may be that the uterine environment was not conducive for implantation of the conceptus. Some deterioration in spermatogenesis and semen quality during the nonbreeding season (1,10) may also have contributed to poor fertility and the low pregnancy rate. Other studies (8,9) have reported poor conception rates and high embryonic mortality following induction of estrus during the nonbreeding season. A low pregnancy rate after the induction of estrus and mating during the seasonal anestrous period has been explained in terms of inadequate luteal function (9). However, Minoia et al. (13) induced estrus in camels with 2000 IU of eCG with and without progesterone and found that the pregnancy rate varied from 12 to 81%. They also suggested that a combination of eCG plus progesterone gave better results than eCG alone.

The results of our study suggest that although ovarian activity can be successfully induced during the nonbreeding season in the Indian camel, fertility first needs to be improved before the treatment is used under field conditions. Additional work is needed on hormonal and morphological changes (histological, clinical and ultrasound findings) in the non-breeding and early breeding periods in both male and female camels and in normal untreated as well as in treated animals.

REFERENCES

1. Abdel-Raouf M, Fateh El-Bab M R, Owaida M M. Studies on reproduction in the camel (Camelus dromedarius) V. Morphology of the testis in relation to age and season. J Reprod Fertil 1975; 43:109-116.
2. Agarwal S P, Agarwal V K, Khanna N D, Dwaraknath P K. Serum estrogen and progesterone levels in camels (Camelus dromedarius) during the estrous cycle. Indian Vet J 1989; 66:605-608.
3. Agarwal S P, Rai A K, Khanna N D. Serum progesterone levels in female camels during estrous cycle. Indian J Anim Sci 1991; 62:37-39.
4. Agarwal S P, Rai A K, Khanna N D. Effect of low dose FSH administration on ovarian activity during nonbreeding season in the camels. Indian J Anim Sci 1993; 63: 387-390.

5. Banerjee S P. Comparative Efficiency of Different Diagnostic Techniques for Pregnancy in Camels (Camelus dromedarius). MVS Thesis, University of Udaipur, Rajasthan, India, 1974.

6. Cooper M J, Skidmore J, Ali M, Billah T, Wensvoort S, Billah A, Allen, W R. An attempt to induce and synchronise ovulation and superovulation in dromedary camels for embryo transfer. Proc Workshop : Is it possible to improve the reproductive performance of the camel ? 1990; 313-326.

7. Dafalla E A, Musa B E, Homeida A M, Rath D, Merkt H. Induction of oestrus in a camel (Camelus dromedarius) using PMSG and diagnosis of ovarian activity. Zuchthygiene 1987; 22:229-231. (Anim. Breed. Abstr. 56 1988; No. 1081).

8. Dahir A M, Jumale M A, Halane I M, Prandi A. Effect of progesterone-PMSG treatment on oestrus activity and fertility of she-camel dromedaries at the end of the dry season. Proc Workshop : Is it possible to improve reproductive performance In the camel ? 1990; 189-196.

9. Elias E, Bedrak E, Cohen D. Induction of oestrus in the camel (Camelus dromedarius) during seasonal anoestrus. J Reprod Fertil 1985; 74:519-525.

10. Farrag A A, Serur B H, Gomaa A A. Seasonal variations of epididymal spermatozoa in camel (Camelus dromedarius). Assiut Vet Med J 1986; 17:163-166.

11. Feng J Z, Xue Z Y, Qin L G, Lu Z M, Wang D C, Cui L Z, Zhu Z J, Yan S F, Li Y F. Effect of LHRH analogue on ovulation and conception rate in female camels (Camelus dromedarius) Chin J Anim Sci 1988; 6:14-16.

12. Khanna N D, Tandon S N, Rai A K. Breeding parameters of Indian camel. Indian J Anim Sci 1990; 60:1347-54.

13. Minoia P, Moslah M, Lacalandra G M, Khorchani T, Zarrilli A. Induction of oestrus and management of reproduction in the female dromedary camel. Ist Int Camel Symp 1992; 119-123.

14. Rai A K, Agarwal S P, Agarwal V K, Khanna N D. Induction of early puberty in female camels. Indian J Anim Sci 1991; 61:1265-1268.

15. Wilson R T. Reproductive performance of the one humped camel. The empirical base. Revue Elev Med vet Pays trop 1989; 42:117-125.