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Duration of oestrus, time of ovulation and progesterone profile in oestrus synchronized yak cows

M BHUYAN[1], B C DEKA[2], B C SARMAH[3], P CHAKRAVARTY[4], J GOSWAMI[5] and M H KHAN[6*]

College of Veterinary Science, Assam Agricultural University, Guwahati, Asom 781022 India

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ABSTRACT

Cyclic yak cows (24) of first to third lactation, maintained in yak farm, National Research Centre on Yak, Indian Council of Agricultural Research, Arunachal Pradesh, India were used for synchronization of oestrus using 3 different concentrations of progesterone in vaginal sponge. The duration of oestrus, time of ovulation and serum progesterone hormone levels during different days of intravaginal sponge implant and after insemination were recorded. In yak cows receiving 500, 600 and 700 mg of progesterone in vaginal sponge, the mean duration of oestrus was 25.76±1.07, 24.41±1.82 and 24.64±2.58 h and the time of ovulation after the end of oestrus was 11.6±0.90, 13.2±1.38, 12.6±1.25 h respectively. In control group out of 5 yaks one exhibited oestrus. The duration of oestrus and time of ovulation of that animal was 17.00 h and 16.00 h respectively. The difference between the treatment groups was not significant. The mean serum progesterone level at 3 days before implantation of intravaginal sponge varied from 1.50±0.38 to 3.97±1.15 ng/ml which increased gradually during the 14 days period of implantation and varied from 6.34±0.92 to 7.24±0.12 ng/ml on 14th day. The serum progesterone level in yaks of treatment and control groups increased gradually from 0 day through 16 days after insemination. Thereafter it dropped in non-pregnant yaks but increased steadily in pregnant yaks.

Key words: Oestrus, Ovulation, Progesterone, Synchronization, Yak

Yak (*Bos grunniens or Poephagus grunniens*) is a unique domestic animal living on and above 3 000 meter of mean sea level. Yaks are shy breeders hence the difficulty of detecting oestrus could be overcome by oestrus synchronization. Oestrus synchronization can decrease the labour associated with AI and can increase the proportion of cows that become pregnant early in the breeding season, resulting in more calves born in the calving season. Most of the oestrus synchronization treatments available today are effective but at the same time each commercial product has it's certain advantages and limitations over the others. However it is important to choose the oestrus synchronization treatment schedule considering the managemental practices prevailing in a particular situation and also the status of the reproductive cycles. Several studies were made on the synchronization of oestrus in cattle, buffalo, sheep and goat (Tjondronegoro *et al*. 1987, Singh 2003, Kridli *et al*. 2003, Veeraiah and Srinivas 2008), but it is very scanty in yak (Sarkar and Prakash 2004, Sengupta 2006). Hence the present study has been planned on oestrus synchronization in yak using vaginal sponge containing progesterone.

Present address: [1]Ph.D Scholar (mitumanjyoti@gmail.com); [2]Professor and Head (bcdeka@gmail.com); [3]Professor and Head, Department of Veterinary Physiology (sarmahbc@yahoo.co.in); [4]Principal Scientist, NRC Yak (ICAR), Dirang 790101, West Kameng, Arunachal Pradesh, India (e mail: chakravartyp @sify.com). [5]Professor, Department of Veterinary Physiology (jeetendragoswami@yahoo.co.in). [6] Scientist, ICAR Research Complex for NEH Region, Umiam, Meghalaya 793103.

MATERIALS AND METHODS

A total of 20 non pregnant yak cows of first to third lactation, maintained in yak farm, National Research Centre on Yak, Indian Council of Agricultural Research, Nyukmadung, West Kameng district, Arunachal Pradesh were used as experimental animals in the present study. The Yak Farm, Nyukmadung is located at an altitude of 2750 m above the mean sea level. The experimental animals were randomly placed in four groups, viz. group 1, group 2, group 3, and control group (group 4) comprising 5 yaks in each group. The yaks were kept in an open enclosure throughout the experimental period. They were provided with concentrate ration comprising wheat bran, mustard oil cake, crushed maize and mineral mixture in 2 divided meals in the morning and evening. Green grasses like *Salyx* tree fodder, maize, *Dactylis glomerata*, *Phrengpa*, *Syluli*, *Blemkar* were provided during early monsoon and hay or dry grasses were offered during winter months.

A total of 20 vaginal sponges were prepared by cutting the sponges into 7 cm in length and 4.5 cm in diameter in

cylindrical shape and tied with a cotton thread for the eventual withdrawal of the sponge from the anterior vagina. The sponges were sterilized in autoclave at 15lb pressure for 15 min. A total of 15 vaginal sponges were impregnated with progesterone in 3 sets comprising 5 sponges in a set in such a way so that each sponge in a set contained 500, 600 or 700 mg of progesterone. Five sponges were kept without medication. The PVC (Polyvinyl chloride) vaginal speculum measuring 30 cm, 2 cm and 2.6 cm in length, internal diameter and outer diameter respectively was fabricated. Prior to insertion of PVC speculum into the vagina of the yak, sponge was introduced into one end of the sterilized PVC speculum. After washing and drying the vulva of the yak, the speculum containing the sponge was slowly and gently introduced up to the anterior vagina. Then with the help of a PVC plunger measuring 45 cm in length and 1.3 cm in diameter the sponge was pushed from the speculum into the anterior vagina of the yak. The three treatment groups of yak i.e. group 1, group 2 and group 3 received the sponges containing 500, 600, and 700 mg of progesterone respectively, while the control group received non medicated sponge. The sponges were kept in situ for 14 days. After14 days, the sponges were removed and PMSG at the rate of 500 IU per animal was injected intramuscularly in the animals of treatment groups.

All the experimental animals including the animals of control group were closely observed for the occurrence of oestrus by allowing vasectomized bull to move around animals round the clock. First acceptance of the male by the female was considered as the onset of oestrus. The period from the first to last acceptance of bull by the female was considered as the duration of oestrus and it was recorded in h. Oestrus females were artificially inseminated after 12 h of onset of oestrus.

For determination of the time of ovulation, the ovaries were palpated per rectum at every 2 h starting from 6 h from the end of oestrus. The ovulation was confirmed by the presence of ovulation depression on the surface of the ovary. The time from the end of oestrus to the palpation of ovulation depression was considered as the time of ovulation.

For studying the serum progesterone profile blood samples were collected from the jugular vein on day –3, 0, 1, 2, 4, 6, 8, 10, 12 and 14 of progesterone impregnated sponge implantation and day 0, 1, 2, 4, 8, 16, 30, 45 and 60 of A.I. The blood was allowed to clot and then serum was separated by centrifugation at 3000 rpm for 15 min. The serum was stored at – 20°C in plastic vials and hormone assay was done by RIA technique.

The data were subjected to statistical analysis as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The mean duration of synchronized oestrus in yaks receiving 500, 600 and 700 mg of progesterone in intravaginal sponge was recorded as 25.76±1.07, 24.41±1.82 and 24.64±2.58 h respectively (Table 1). In control group, only 1 yak showed oestrus and the duration of oestrus was 17.00 h. Statistical analysis revealed no significant difference in duration of synchronized oestrus between treatment groups. The mean duration of synchronized oestrus observed in the present study was longer than that reported by Sengupta (2006). This might be due to differences in synchronizing hormone, protocols and methods of detection of oestrus.

The duration of synchronized oestrus in the three treatment groups of yak cows in the present study ranged from 18.41 to 30.50 h which was comparable with that of natural oestrus in yak (Marwaha 1982, Jain and Yadav 1985, Quan-kai and Wang 2007). On the other hand, the duration of natural oestrus in yak was reported to vary widely i.e., from 16 to 56 h (Jain and Yadav 1985), 24 to 72 h (Marwaha 1982) and 25 to 48 h (Quan-kai and Wang 2007). The duration of natural oestrus was reported to be much longer (3.7 days) in Tuva yaks (Katzina and Mutorova 1989) than that observed in the present study. However, much shorter duration of natural oestrus was reported in Mongolian yaks (0.5±6.5, 6.5 to 12.5 and 12.5 to 18.5 h) by Purevzav and Beshlebnor (1967), Tianzhu white yak (12–18 h) by Wang (1997) and in Himachali yaks (12–18 h) by Singh *et al*. (1999). The variations in duration of natural oestrus in yaks in different studies might be due to genetic make up of yaks, age, feeding and management, nutritional bio-availability, climatic condition, altitude etc.

The time of ovulation in yak cows receiving intravaginal sponge impregnated with 500, 600, 700 and 0 mg (control) of progesterone was 11.6±0.90, 13.2±1.38, 12.6±1.25 and 16.00 h respectively. The corresponding ranges in time of ovulation in first three treatment groups were 10 to14, 9 to16

Table 1. Duration of oestrus and time of ovulation in different groups of yak receiving intravaginal sponge containing different progesterone concentrations

Group	Progesterone concentration (mg)	No. of animal	Duration of oestrus (h)		Time of ovulation (h)	
			Mean±SE	Range	Mean±SE	Range
1	500	5	25.76±1.07	24.50 – 29.58	11.6±0.90	10–14
2	600	5	24.41±1.82	18.41 – 27.91	13.2±1.38	9–16
3	700	5	24.64±2.58	19.00 – 30.50	12.6±1.25	11–17
Control	0	1	17.00		16.00	

Table 2. Serum progesterone profile (mean±se) of non pregnant (NP) and pregnant (P) yaks of different groups at different days after breeding

Days	Serum progesterone profile (ng/ml) Progesterone concentration in the sponge						
	Group 1 (500 mg)		Group 2 (600 mg)		Group 3 (700 mg)		Control (0 mg)
	NP (n=2)	P (n=3)	NP (n=3)	P (n=2)	NP (n=2)	P (n=3)	NP (n=1)
0	0.50±0.01	0.54±0.01	0.55±0.12	0.80±0.13	0.59±0.01	0.65±0.01	0.48
1	0.58±0.11	0.57±0.11	0.58±0.13	0.82±0.14	0.60±0.01	0.64±0.01	0.52
2	1.20±0.32	1.30±0.35	1.30±0.57	1.35±0.45	1.35±0.12	1.39±0.55	0.57
4	1.84±0.68	2.00±0.92	1.75±0.93	2.10±0.97	2.04±0.67	2.43±0.92	2.13
8	3.20±0.96	3.40±0.98	3.30±0.70	3.45±0.58	3.35±1.00	3.39±0.65	3.80
16	3.10±0.97	5.60±1.00	3.20±0.71	5.65±1.65	3.30±1.12	5.35±0.92	3.50
30	0.51±0.01	6.25±1.11	0.60±0.11	6.29±1.31	0.70±0.08	6.75±1.26	0.45
45	0.23±0.01	7.25±1.29	0.25±0.01	7.30±1.26	0.29±0.01	7.25±1.65	0.60
60	0.51±0.01	8.30±1.22	0.55±0.11	8.50±2.14	0.55±0.01	8.54±1.22	0.51

and 11 to 17 h (Table 1). The analysis of variance showed no significant difference in time of ovulation between three treatment groups of yak cows. The present finding was comparable with that reported by Yu *et al*. (1993), who reported that the time of ovulation was within 12–13 h after the end of oestrus. On the contrary, the time of ovulation recorded in the study was found to be longer than that reported by Magash (1991) and Sarkar and Prakash (2005). This might be due to differences in genetic make up, age, method of detection of ovulation, individual variation, and feeding and management of yak.

The mean serum progesterone levels in yak cows at different days of implantation of intravaginal sponge and at different days after insemination are presented in Fig. 1 and Table 2 respectively. The mean serum progesterone level at 3 days (–3 days) before implantation of intravaginal sponge containing 500, 600 or 700 mg of progesterone varied from 1.50±0.38 to 3.97±1.15 ng/ml. During the 14 days period of implantation of intravaginal sponge, the mean serum progesterone level increased gradually from 2.67±0.35 to 6.92±0.05, 1.81±0.20 to 6.34±0.092 and 5.96±1.18 to 7.24±0.012 in the treatment groups respectively. On the other hand, in yak cows of control group the serum progesterone level fluctuated between 1.41±0.43 and 3.45±1.00 ng/ml during the same period of time (Fig. 1).

While studying serum progesterone profile in yak cows during 60 days after insemination, it was observed that serum progesterone level increased gradually from day 0 to day 16 in all yak cows which indicated the functional dominance of corpus luteum during this period. However after day 16, the level declined in non-pregnant yak cows which ranged from 0.23±0.01 to 0.70±0.08 ng/ml. The serum progesterone level was much higher on day 16 post insemination in pregnant yak cows than in non-pregnant cows. In case of pregnant yak cows the higher serum progesterone level observed on day 16 increased further as the pregnancy advances and on day 60 post insemination it ranged from 8.30±1.22 to

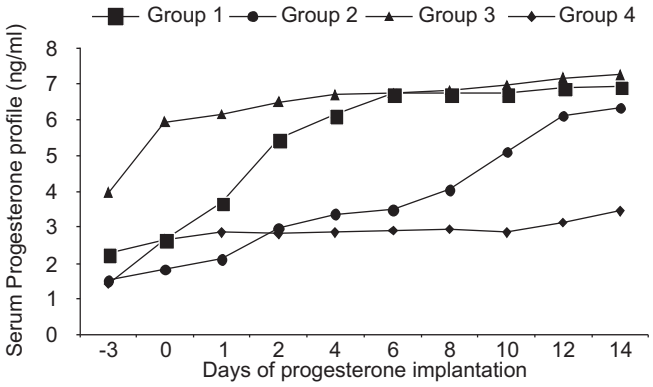

Fig. 1. Serum progesterone profile at different days of sponge implantation containing different progesterone concentrations.

8.54±1.22 ng/ml in the yak cows synchronized with vaginal sponge containing 500,600 or 700 mg of progesterone (Table 2). The serum progesterone level decreased in non pregnant yaks after day 16 in treatment and control groups. These animals did not come into oestrus and were on seasonal anoestrus. Yak is a seasonal breeder (Deka 2009) and the present study was conducted during non-breeding season. It was further observed that the serum progesterone level in pregnant yak cows increased steadily during the study period i.e. upto 60 days after insemination which was in agreement with the reports of Yu *et al*. (1993), Sengupta (2006) and Chakravarty *et al*. (2009).

The serum progesterone level in yak cows of control group and in yak cows of treatment groups prior to insertion of sponges were almost similar. However serum progesterone level in yak cows receiving vaginal sponges containing 500, 600 and 700 mg of progesterone increased form 2.67±0.35 to 6.92±0.05, 1.81±0.20 to 6.34±0.92 and 5.96±1.18 to 7.24±0.12 respectively during the 14 days period of implantation of intravaginal sponge. The increased serum progesterone level in yaks of the treatment groups was due to absorption of progesterone from the sponge.

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