



## **Serum Progesterone Profile in Sudanese Dromedary She Camels Bred Under Intensive Systemization: III**

Husna M. Elbasheir<sup>1\*</sup>, B.E. Abdel-Aziz<sup>1</sup>, M.H.M. Elbashir<sup>1</sup>, E.A. Babikir<sup>2</sup>

<sup>1</sup>Tumbool Camel Research Center (TCRC) / Animal Resources Research Corporation (ARRC), POB: 610, St. 1, Building 6, Amarat, Khartoum, Sudan

<sup>2</sup> Faculty of Veterinary Medicine, University of Al-Butana, Tumbool, Sudan

\*Corresponding author: [husname@yahoo.com](mailto:husname@yahoo.com)

### **ABSTRACT**

This study was conducted at Tumbool Camel Research Center (TCRC) that embeds on the middle western edges of the Butana area (east/ central Sudan) where, sizable Arabic herd camel ecotype Darfur (western Sudan) was kept under closed moderate intensive managemental system. Monthly serum samples were collected from 8 mature female camels and three of their progeny heifers at two-year age and serum progesterone (P4) concentrations were measured. After successful mating of the mature dams P4 increased and found ranging between 7.4 to 13.8 ng/ ml. It remained elevated with pregnancy at a monthly mean of  $10.85 \pm 7.12$  ng/ml recording peak concentration at the 9<sup>th</sup> month of gestation (37.66 ng/ ml), and then declined to baseline concentration at parturition. She camels carried male feti were found to had insignificant lower ( $P > 0.05$ ) progesterone levels ( $10.70 \pm 5.73$  ng/ml) than those carrying female feti ( $11.41 \pm 8.53$  ng/ml). She-camels carrying male feti found to had insignificant lower ( $P > 0.05$ ) progesterone levels ( $10.70 \pm 5.73$  ng/ml) than those carrying female feti ( $11.41 \pm 8.53$  ng/ml). Contrarily dams carrying male and female feti respectively recorded gestation lengths of  $386.67 \pm 2.67$  and  $382.5 \pm 2.63$  days ( $P > 0.05$ ) respectively. Sexual activity of the camel heifers was observed to begin at 30 month old and P4 concentrations started to increase to a measurable level (1.0 -5.0 ng/ml) at 30-32 months old with detectable oesrus signs.

**Keywords:** Progesterone, Pregnancy, Puberty, Intensive management system, Dromedary.

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### **INTRODUCTION**

The reproductive efficiency of camels under natural conditions is generally regarded to be low due to the relatively short breeding season, longer prepubertal period and gestation length, and a prolonged period of lactation-related anoestrus leading to a long inter-calving interval (Skidmore, 2005; Bhakat *et al.*, 2005). Short breeding season is an important factor for the low reproductive performance of dromedary camel, and remains as

the major obstacle retarding the growth of dromedaries' population (Marai *et al.*, 2009).

In this study aspects of improving breeding and sexual development will be investigated in the Arabic camels maintained in stalls under fare nutritional and environmental conditions to encourage rapid growth during the pre-pubertal period and its impact on maintaining sexual maturity.

## MATERIALS AND METHODS

This study was carried out at Tumbool Camel Research Centre (TCRC), which is situated Western the Butana Area (East/Central Sudan), about three kilometers north Tumbool rural town, 27 kilometers to the east from the Blue Nile river and 145 kilometers south Khartoum; at latitude 14° 55' N, longitude 33° 25' E & altitude 401.5 meters above sea level. The climate is mainly of poor Savannah Zone.

**Herd management:** the camel herd (*Camelus dromedarius*) used is of the Arabic Darfur ecotype reared in a closed moderate intensive system with fare install feeding, watering and health care under shed housing and at close supervision. Basically the feeding protocol was pre-planned as a strategy to adopt benefiting from the cheep sugar cane industrial by-products (molasses & bagasse) and urea salt (0.46 N) at maximum 2%. Low percent (5-15 %) of crushed sorghum grains, oil seed cakes mainly of ground nut, wheat bran, sorghum hulls and minerals (lick stone, normal salt "1.5 %" and bicarbonates "1-2%") were additions to form all a concentrate ration with proximate analysis estimates of around 9.2 MJ as ME and 11-13 % as CP per kilogram on dry matter-bases. Concentrate meal was given twice a day at the rate between 56-58 % from the total feed intake. Forage allowances (42-44%) were Abu-70 (*Sorghum bicolor*), Pioneer (*Sorghum bicolor x Sorghum sudanense* hybrid), Clitoria (*Clitoria ternate*), Berseem (*Medicago sativa*) and sorghum residues (stover) given according to availability throughout the different seasons.

**Blood sampling and progesterone measurements:** during January 2009 and March 2011, blood samples (10 ml) from eight adult female camels weighing 578.40+64.19 kg as mean live body weight (LBWT) and three

growing heifers (24 months old) initially weighing 283.25±54.85kg as mean LBWT were taken monthly from the jugular vein. Samples were taken before service for adult females and throughout their gestation months and after delivery. Whereas, the heifers were sampled monthly from 24 month old till they reached puberty. Serum samples were separated and stored at -20<sup>0</sup> C for hormonal analysis. Progesterone concentrations were measured in she-camels' sera using enzyme immunoassay technique (EIA) by commercial kits (Immunometric, UK).

**Statistical analysis:** the data were subjected to analysis of variance using Statistical Package for Social Sciences (SPSS, 10.5). Comparisons of means were done using Duncan multiple range test (1955) reformed by Kramer (1957).

## RESULTS

In this study serum progesterone (P4) concentration in adult female camels was found individually varying. It started to increase after successful mating from 1.0 - 2.0 ng/ml before conception to 10.08±1.97 ng/ml within two to three weeks after conception with a range concentration between 7.4 -13.8 ng/ml (Table 1). It remained elevated throughout the gestation period with mean level fluctuated between 8.5 and 12.5 ng/ml except for a slightly lower value (7.45±3.82) at the third month and a higher value (15.44±12.66 ng/ml) at the 9<sup>th</sup> month of gestation. The peak individual concentration of P4 reported in this study was 37.66 ng/ml occurred at the 9<sup>th</sup> month of gestation (Table 1), while a lowest level concentration was at parturition recording a mean of 4.08±3.30 ng/ml and then sharply declined after 15 days (1.14±1.19 ng/ml) post partum (Table 2). An observable first rise in P4 level occurred at 40.5±19.9 days (5 - 69

days range) after parturition with a mean P4 level estimate of  $4.25 \pm 0.72$  ng/ml ranging between 3 and 5.5 ng/ml (Table 3).

She-camels carrying male feti found to had insignificant lower ( $P > 0.05$ ) progesterone levels ( $10.70 \pm 5.73$

ng/ml) than those carrying female feti ( $11.41 \pm 8.53$  ng/ml). The mean gestation lengths were  $386.67 \pm 2.67$  and  $382.5 \pm 2.63$  days ( $P > 0.05$ ) as contrarily values in camels carrying male and female feti respectively.

**Table 1: The mean monthly serum P4 concentration in pregnant she-camels (N=8)**

Time sampling	P4 (ng/ml) Mean $\pm$ SD	Minimum	Maximum
Before service	1.91 $\pm$ 01.14	0.63	3.61
2-3 weeks after	10.08 $\pm$ 01.97	7.43	13.80
1 <sup>st</sup> month	09.15 $\pm$ 10.99	1.98	35.24
2 <sup>nd</sup> month	10.40 $\pm$ 02.66	6.39	12.80
3 <sup>rd</sup> month	07.45 $\pm$ 02.45	3.82	10.31
4 <sup>th</sup> month	12.62 $\pm$ 07.86	3.58	27.22
5 <sup>th</sup> month	12.49 $\pm$ 08.68	3.62	28.72
6 <sup>th</sup> month	12.14 $\pm$ 04.45	3.15	16.58
7 <sup>th</sup> month	08.57 $\pm$ 02.95	3.62	12.80
8 <sup>th</sup> month	10.70 $\pm$ 03.60	8.39	17.86
9 <sup>th</sup> month	15.44 $\pm$ 12.66	6.71	37.66
10 <sup>th</sup> month	11.46 $\pm$ 52.62	6.71	19.93
11 <sup>th</sup> month	12.40 $\pm$ 04.78	6.71	18.67
12 <sup>th</sup> month	11.88 $\pm$ 06.08	4.69	22.63
13 <sup>th</sup> month	08.09 $\pm$ 04.68	2.83	16.00
Overall mean	10.89 $\pm$ 06.55	1.98	37.66

**Table 2: Progesterone concentrations in she camels before and after parturition**

Time sampling (n)*	Mean P4 $\pm$ SD	Minimum	Maximum
30 days before parturition (5)	7.07 $\pm$ 4.90	4.68	15.82
15 days before parturition (7)	5.40 $\pm$ 2.69	1.07	08.79
At parturition (4)	4.08 $\pm$ 3.30	1.11	08.30
15 days after parturition (3)	1.14 $\pm$ 1.19	0.00	02.39
30 days after parturition (6)	2.21 $\pm$ 2.06	0.22	05.19

(n)\* Number of camels.

**Table 3: Mean concentration of P4 at first rise after parturition**

Parameter	Mean +SD	Range	No. of She-camels
Days to P4 rise after parturition	40.50 $\pm$ 19.90 days	5-69 days	8
P4 concentration	04.25 $\pm$ 00.72 ng/ml	3 - 5.49 ng/ml	8

In the present study the mean body weight of the three sampled heifers at 12, 18 and 24 months old were  $283.25 \pm 54.85$ kg,  $325.0 \pm 47.70$ kg and  $366.66 \pm 35.12$  kg respectively. They showed regular signs of oestrus behaviour at 30-32 months old. The

monthly mean P4 concentrations as shown in Table 4 and Figure (1) started to increase from baseline concentration of zero to a detectable level when heifers aged more than two years. Higher P4 concentrations were detected in two heifers at 30 months

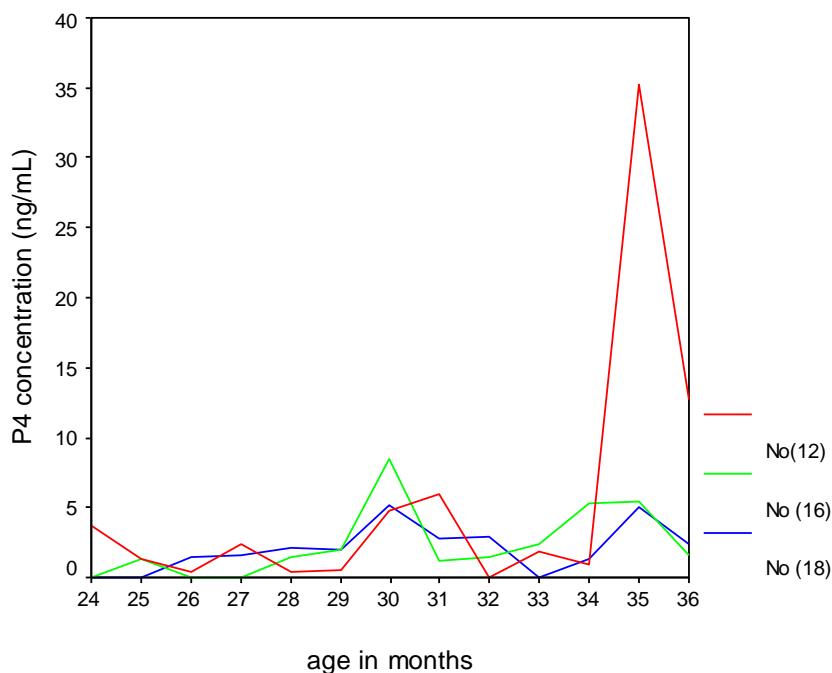
old (4.74 and 8.43 ng/ml). The third one showed a P4 level (5.97 ng/ml) at 31 months old. A complete desire for mating was observed at 32-34 month

old. However, one heifer (No.12) got pregnant from a single mating at 34 months old (Figure 1).

**Table 4: Serum P4 concentrations in camel heifers from two years old till puberty (N=3)**

Age at sampling	P4 (ng/ml) Mean $\pm$ SD	Minimum	Maximum
24 <sup>th</sup> month	1.23 $\pm$ 2.13 (n=3)	0.0	3.70
25 <sup>th</sup> month	0.88 $\pm$ 0.76 (n=3)	0.0	1.33
26 <sup>th</sup> month	0.60 $\pm$ 0.75 (n=3)	0.0	1.44
27 <sup>th</sup> month	1.29 $\pm$ 1.18 (n=3)	0.0	2.33
28 <sup>th</sup> month	1.30 $\pm$ 0.89 (n=3)	0.35	2.14
29 <sup>th</sup> month	1.50 $\pm$ 0.85 (n=3)	0.50	2.00
30 <sup>th</sup> month	6.10 $\pm$ 2.02 (n=3)	4.74	8.42
31 <sup>th</sup> month	3.32 $\pm$ 2.41(n=3)	1.25	5.97
32 <sup>th</sup> month	1.51 $\pm$ 1.47(n=3)	0.04	2.97
33 <sup>th</sup> month	2.08 $\pm$ 0.34(n=2)*	1.84	2.32
34 <sup>th</sup> month	3.10 $\pm$ 3.14(n=2)	0.88	5.23
35 <sup>th</sup> month	5.22 $\pm$ 0.31(n=2)	5.00	5.44
36 <sup>th</sup> month	2.14 $\pm$ 0.53(n=2)	1.65	2.40

\*One heifer conceived at this age



**Figure 1: Serum P4 concentration in three camel heifers from 24 months old till puberty**

## DISCUSSION

The basic reproductive physiology of dromedary and Bactrian camels is summarized by Skidmore (2011). Oestrus behaviour is highly variable in duration and intensity and the concentrations of progesterone remains

low in non-mated animals. In this study the monthly P4 concentration started to increase in mated camels within 2-3 weeks from a baseline concentration (0.63- 3.61ng/ml) to a mean of 7-13 ng/ml indicating a successful ovulation and conception.

Ismail *et al.* (1998) reported that Plasma progesterone level remains very low throughout the follicular wave in the absence of ovulation and starts to rise after mating and during pregnancy then falls just before parturition. However, outside the breeding season, mating activity ceases and the ovaries are inactive or only have a few small follicles (Zeidan, 2011) this was recorded also by Seri *et al.* (2000) and Husna *et al.* (2001). The mean monthly P4 concentration recorded in this study is higher than previously reported by Agarwal *et al.* (1987) as 4 - 5 ng/ml; Ayoub *et al.* (2003) as 6.45ng/ml; and Babiker *et al.* (2011) in Sudanese camels as 6.46 ng/ml which might be attributed to the good nutritional status and management system adopted in our present research. However, Progesterone concentration in camel milk was also used to monitor ovarian activity during the service period (Abdel Rahim and Nazier, 1987; Husna *et al.*, 2001) who reported that P4 concentration in camel milk was more than 5.0 ng/ml in pregnant camels whereas, in the non- pregnant animals the level fell to below 1.0 ng/ml. The fluctuation of monthly P4 concentration findings is in agreement with El-Wishy *et al.* (1981) who stated that an increase in the production of estrogens coincides with an increase in fetal growth and a substantial increase in the volume of fetal fluids between 9 and 12.5 months of gestation in dromedaries and that placental estrogens are important for fetal growth in camels. Similarly, Skidmore *et al.* (1996) reported that, as in the cow, a major change in steroid synthetic capability and/or enzyme content of the placenta may occur at around 80% of day 300 of the gestation in the pregnant camel. The steady decrease in P4 concentration shown in this study at 30 days before parturition

and the declined at 15 days before parturition and to least levels at parturition is consistent with values (1.19-2.47 ng/ml) reported by Ayoub *et al.* (2003) after parturition. Contrary to our results, Agarwal *et al.* (1987) showed that camels carrying a male fetus had higher progesterone levels ( $5.13 \pm 0.69$  ng/ml) than those carrying a female fetus ( $3.45 \pm 0.28$ ). The data result may suggest that, the steroid hormone levels are influenced by the stage of pregnancy and sex of the fetus. However, cases of unnoticed abortion and unsuccessful conception could be easily identified by P4 profile. The time of resumption of follicular activity following parturition is highly variable among she camels and influenced by nutritional status and lactation (Skidmore, 2011). In this study a mean time for P4 rise recorded around  $40 \pm 19.9$  days ranging as early as 5 days post parturition suggesting their earlier resumption of ovarian activities. However, this finding is in agreement with Ayoub *et al.* (2003) who showed that females that lose their offspring or have offspring which are weaned have a mature follicle develop within 10–12 days. Whereas, lactating females may develop mature follicles between 30-60 days postpartum, as indicated by their P4 rise within such duration in our study. On the other hand, female heifers reach their puberty at 30 -34 months old as shown by the pattern of their progesterone profiles. Puberty is the age at which an animal becomes capable of reproduction, while at sexual maturity this capability is increased to the optimum level. Peaks of P4 concentrations at 5.0-8.4 ng/ml may indicate functional activities of their ovaries. These findings are supported by close observations and follow up of their behavioural activities within the herd, where they showed regular heat signs every 3

weeks and complete desire for mating at 34 months old. This is further confirmed by the successful conception recorded for heifer No12. Generally, the results obtained in this study showed better reproductive performance compared to previous research that indicated camels are sexually mature at 4 - 5 years of age (Ayoub *et al.*, 2003). It is suggested that the encouragement of rapid growth during the pubertal period in camels managed under good nutritional and environmental conditions could assist early sexual development and breeding maturity.

### CONCLUSIONS

Fertility and breeding habits of the camel can be associated with improved nutritional status and management. Better selection, disease control, and improved husbandry system can successfully shorten the time for earlier puberty, age at first calving and so forth as well herd's growth dynamics.

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