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Studies on the Oestrous Cycle of Camel (*Camelus dromedarius*)

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دراسات على دورة تناسل الإبل ذات السنام الواحد

الملخص : يهدف هذا البحث إلى دراسة دورة لتناسل الإبل العربية. تم استخدام ثماني نوق (مجاهيم) في هذه الدراسة ، أخذت منها عينات الدم يوميا ولمدة ٦٠ يوما وفصلت بلازما الدم وحفظت عند درجة ٢٠ مئوية تحت الصفر لحين تحليل هرموني البروجستيرون والاستراديول باستخدام طريقة التحليل المناعي الإشعاعي. أوضحت النتائج أن دورة التناسل تراوحت بين ٢٥ و ٣٠ يوما وأن طول فترة الشياع تراوحت من ٥ إلى ٧ أيام . ظلت مستويات البروجستيرون منخفضة (٣,٢ نانومول/لتر) طوال فترة الدورة بينما كانت مستويات هرمون الاستراديول عالية خلال فترة الشياع. كان الجسم الأصفر غائبا خلال دورة التناسل الطبيعية مما يؤكد أن الإبل ذات السنام الواحد إحداثية الإباضة .

ABSTRACT: The aim of this study was to investigate the oestrous cycle of the Arabian camel. Eight female camels (Majaheem) were used. Daily blood samples were collected for 60 days to measure Oestradiol - 17β (E_2) and progesterone (P_4) levels using radioimmunoassays. The duration of the follicular wave cycle ranged from 25-30 days and the length of oestrous from 5-7 days. P_4 levels were low (<3.2 nmol/l) throughout the cycle, while E_2 levels were high during oestrous. The corpus luteum was therefore not present during the natural cycle suggesting that Arabian camels experienced induced ovulation.

The Arabian camel contributes effectively both as a source of food and welfare to the people living under harsh desert conditions. In earlier work, Skidmore *et al.* (1996) studied the follicular wave pattern in camels by using ovaries obtained from abattoirs and by serial palpation of ovaries. They found that the duration of the follicular wave cycle ranged from 17.2 to 23.4 days. It has been observed that Graffian follicle(s) will develop during the cycle in one or both ovaries maturing in about 6 days with a range of 2-14 days (Nawito, 1967; Joshi *et al.*, 1978; Musa and Abusineina, 1978a; Musa, 1990). The size of the follicle remains unchanged for about 5-19 days (average 13 days) and gradually regresses within 7-10 days (average 8 days). El-Baghdady *et al.* (1990) and Elias *et al.* (1984) studied the E_2 and P_4 profiles during the oestrous cycle and found that oestrogen levels were high (599 pmol/l) during oestrous, while P_4 levels were low (0.6 nmol/l) throughout the cycle. The aims of the present study were to determine the length of the oestrous cycle, the duration of the oestrous and the levels of steroid hormones during the cycle in Arabian camel.

Materials and Methods

Eight she-camel dromedaries (Majaheem) with an average body weight of 640 ± 25 kg and aged 8 to 12 years were used during January and February 1996. The she-camels were non-lactating during the time the study was conducted. The animals were housed in an open shaded barn (about 10 x 40 m) at the livestock farm of the Animal Production Department, King Saud University in Riyadh. Animals were fed on concentrates and roughages according to their actual requirements. The concentrate mixture contained 13.4% digestible protein and 72% total digestible nutrients. Alfalfa served as a source of roughage. Water and salt licks were provided *ad libitum*. All females were palpated per rectum to ensure that only those which had reproductive tracts free from abnormalities (anatomical abnormalities or the presence

of cystic follicles in the ovaries) were used. Females were considered to be in oestrous when they sat in front of the male in the mating position. Daily blood samples were collected from the jugular vein for 60 days with heparinized vacutainers. Blood samples were chilled immediately and plasma was then separated and stored at -20°C until hormone concentrations were measured using radioimmunoassays (RIA). P_4 and E_2 concentrations were measured by a direct solid phase ^{125}I RIA method (Coat-A-Count TKPG and TKE; Diagnostic Product Corporation, Los Angeles, CA, U.S.A.) according to the manufacturer's methods with slight modifications for assaying E_2 (Bevers and Dieleman, 1987). The main cross reactivities for P_4 were 2.4, 2.0, 1.7, 1.3 and <1% for 11-deoxycortisol, dihydroprogesterone, 11-deoxycorticosterone, 5-Pregnane-3, 20 dione and other steroids, respectively, and for E_2, 10.0, 4.4, 1.8, 1.8 and <1% for oesterone, D-equilenin, oestrone-β-D-glucuronide, oethinylestradiol and other steroids, respectively. The intra-assay coefficient of variation (CV) was 4.1 and 5.1% and the inter-assay CV was 7.6 and 5.8% for P_4 and E_2, respectively. The sensitivity for P_4 and E_2 assays was 0.03 nmol/l and 8 pmol/l, respectively.

Results

Individual animal in hormonal profiles were divided into three groups according to specific criteria as: (i) animals that showed two follicular cycles (ii) animals that showed one cycle and (iii) acyclic animals. All data for those females indicating oestrous were arranged according to oestrous before plotting the hormonal profiles P_4 and E_2 concentrations in she-camels that showed two follicular wave cycles (Figure 1). The length of the follicular wave cycle was from 28 to 30 days and, during these two cycles, the P_4 concentration remained low (<3.2 nmol/l), while E_2 showed a peak that appeared two times (28-30 days apart). These peaks ranged from 64 to 141 pmol/l. Figure 2 illustrates P_4 and E_2 concentrations in she-camels that showed one follicular cycle. The P_4 concentration remained low throughout the study, similar to the group in Figure 1. In contrast E_2 concentrations increased to peak levels (65.0, 85.0 and 128.0 pmol/l in the three females), then they decreased thereafter. The P_4 and E_2 concentrations in she-camels that did not show a follicular wave cycle are presented in Figure 3. In this group, P_4 and E_2 concentrations were low throughout the observation period.

Discussion

The length of the oestrous cycle was determined by the appearance of E_2 peaks at the start of the wave.

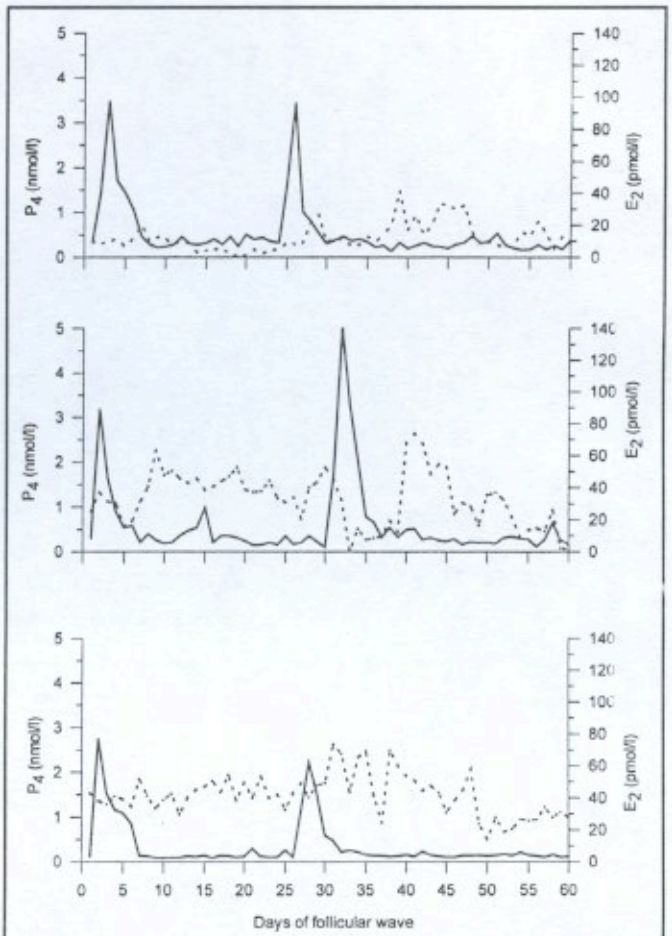

Figure 1. Progesterone (P4; ---) and Oestradiol (E2; —) concentrations in three female camels that showed two follicular wave cycles during the study (note the two peaks of E_2 which represent the two cycles)

The results showed that the length of the cycle ranged from 25-30 days and the duration of oestrous was around 5 days. The findings of this study agree with Musa and Abusineina (1978b), Bakkar and Basmaeil (1988) and Al-Eknah *et al.* (1993). They stated that the length of the oestrous cycle and the duration of oestrous in dromedary camels ranged grom 11-30 and 4-6 days, respectively.

The number of oestrous cycles appearing during the study period was different between she-camels. Some females showed two cycles which means that the length of cycle in these females is around 30 days (the normal length). While other animals exhibited only one cycle during the observation period. This can possibly be explained by the fact that, in some oestrous cycles, the non-follicular stage (lasting for about 20 days) can be represented by the absence of any follicle detectable by rectal palpation (Shalash, 1987; Musa *et al.*, 1992). Other females did not show any cycle (Figure 3) which could be explained by the possibility of some females having inactive ovaries (Barmintsev, 1951). Similarly, several studies found that the length of the follicular

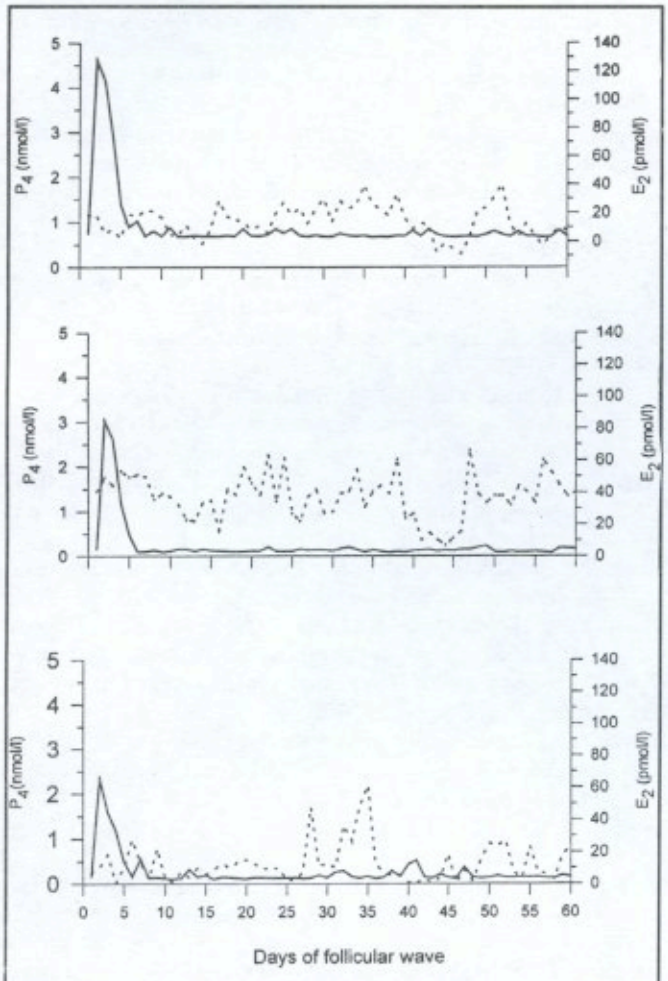

Figure 2. Progesterone (P4; ---) and Oestradiol (E2; —) concentrations in three female camels that showed one follicular wave cycle during the study (note the one peak of E_2 which represents one cycle)

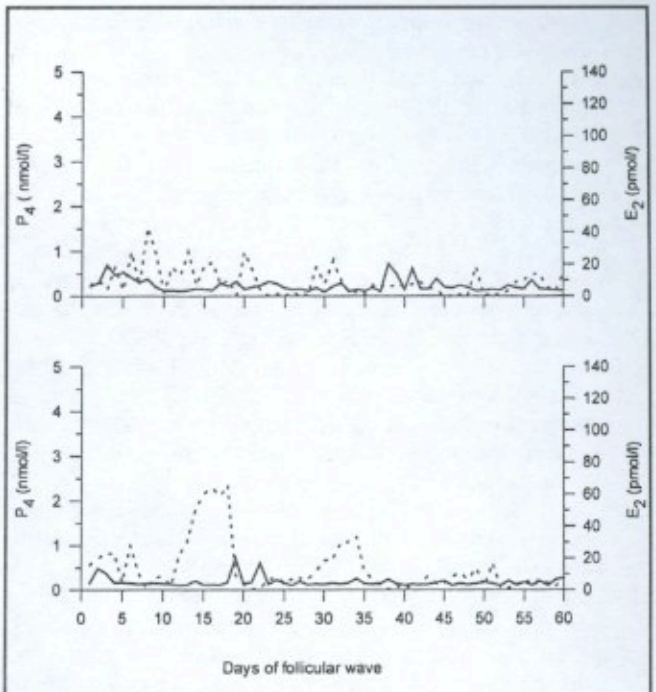

Figure 3. Progesterone (P4; ---) and Oestradiol (E2; —) concentrations in two female camels that did not show any follicular wave cycle during the study

cycle varied from 11-35 days (Nawito, 1967; Joshi *et al.*, 1978; Musa and Abusinema, 1978b; Shalash, 1987). E_2 and P_4 profiles confirm the presence or the absence of follicles and corpora lutea, respectively (Dieleman and Bevers, 1987; Ireland, 1987; Ireland and Roche, 1987; Fortune *et al.*, 1988, Dieleman *et al.*, 1986; Callesen *et al.*, 1989). These results suggest that ovulation in the camel is induced since the level of P_4 was low (<3.2 nmol/l) throughout the study period and E_2 levels were high during oestrous. Similar observations have been reported by several other researchers (Shalash and Nawito, 1964; Elias *et al.*, 1984; Chen *et al.*, 1985; Skidmore *et al.*, 1996). They observed that, in non-mated she-camels, P4 concentrations were low with the absence of corpora lutea. The same researcher reported that ovulation was not observed in the absence of external stimuli, such as mating, artificial insemination or hormonal treatment. It has been shown that during the breeding season, follicular wave development, maturation and atresia occur in both ovaries (El-Wishy, 1988; Musa, 1969). The results of the present study show that P_4 and E_2 concentrations can be used to determine the functional status of the ovaries in camels.

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