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Plasma Estradiol-17β, Progesterone, Cortisol and L.H. Profiles during Mating, Pregnancy, Parturition, and Postpartum Period in the Dromedary Camel

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Abstract: The aim of this study was to investigate the hormonal profiles during mating, pregnancy, parturition and postpartum period in female dromedary camels.

This study was carried out on 9 she-camels, 3-5 years of age. All animals were clinically examined and proved to be healthy. Samples were collected from each animal, postmating, then monthly during the gestation period, at 7 days prepartum, at parturition, and 22 days postpartum. Progesterone, estradiol, LH, and cortisol hormones were estimated. The postmating hormonal profiles revealed that estradiol increased 2 days postmating, progesterone showed no great variations. The cortisol levels decreased from 2.3 µg/d1 after mating, to 0.7 µg/dl 2 days later. The plasma LH level was maintained during postmating and early gestation periods, with a range of 13- 17.5 m.i.u/ml, then it slightly and progressively increased during the first four months of gestation.

Plasma estradiol levels showed a slow increase from early to mid gestation, and a fast increase from mid to late gestation. The plasma progesterone concentrations were higher during first trimester (5.2 ng/ml) than the last two trimesters of gestation. Plasma cortisol levels increased significantly during parturition.

Estradiol showed a fast increase in its level 2 months before parturition and continued increasing 7 days prepartum, while progesterone concentration showed a fast decline at day 7 prepartum (2.9 ng/ml) till at parturition (0.7 ng/ml). Estradiol, progesterone, and cortisol levels declined during the few days postpartum till day 22 postpartum.

Introduction

Arthur (1992) has shown that there is very limited information known about reproductive endocrinology of the one-humped camel.

In Dromedary camel, it was reported that progesterone showed a progressive increase with the progress of gestation (Elias et al., 1984 and Shalaby, 1986). Progesterone peak was reported at the 5^{th} month (Shalaby, 1986) and at the 7^{th} month of gestation (Hassan et al., 1996). While, insignificant variation in progesterone concentration between months of pregnancy was reported by Mohamed (1991). In induced-estrus she-camels the progesterone increased to >1.0 ng/ml within 2-3 days after mating (Elias et al., 1985).

Estradiol level was higher in estrus (Abdo and El-Mougy, 1976). During pregnancy, estradiol showed progressive increase with a peak at 2^{nd}-6^{th} months (Abdo and El-Mougy, 1976), or at the 12^{th} month (Elias et al., 1984 and Hassan et al., 1996) or at last stage of gestation (Mohamed, 1991).

Blood cortisol in camels was assessed by Agarwal et al. (1992) and Abdel-Gawad and Hassan (1996), who traced abrupt peak 1-3 days before birth and then a decline 3 days after.

Luteinizing hormone (LH) was assessed by Homeida et al. (1988) who noticed consistent low LH during the length of estrous cycle in dromedary, and concluded that

this low level of LH could be the cause of failure of spontaneous ovulation in these species. The lowest detected LH level (0.08ng/ml) was recorded by Annousai and Combarnous (1991).

A controlled study on hormonal assay in the plasma of the dromedary camel is the objective of this study. It is considered essential for a better understanding of the endocrinological basis of hormonal control of reproduction in the dromedary camel, and aiming to the future increase of reproductive and productive efficiency of camels.

Materials and Methods

Profiles of reproductive hormones comprising total estrogens, progesterone, cortisol and luteinizing hormone (LH), were assayed in blood samples collected from living dromedaries. The hormonal patterns were investigated during mating, post-mating, during gestation, prior to parturition, at time of parturition, and postpartum period.

Animals: Nine camel-cows out of 12 mated (breeding of the females depended on natural service by mature healthy males) at different times, were pregnant and used for blood sampling .

Blood samples:

Blood samples were obtained by jugular venipuncture in heparinized collecting tubes. Plasma was separated by centrifugation (8000 rpm for 10 minutes). Plasma samples were kept in -20°c deepfreeze until further analysis.

Eighty one venous blood samples out of 543 were assayed for estimation of plasma estradiol-17β, progesterone, cortisol and LH.

The blood samples were collected as follows:

Postmating period: 6 blood samples out of 27 collected samples were used during day one and two postmating (3 samples were taken each day). Estradiol-17β, progesterone and cortisol were assessed in these samples. While, LH was assessed only in day one postmating samples. Another 3 blood samples were collected directly postmating (after dismounting) for assessment of LH.

1- Pregnancy period: 36 blood samples out of 108 were used for hormonal assay during pregnancy. The nine mated camel-cows were in different months of gestation. They were followed after mating and during pregnancy until birth and thereafter. The 36 blood samples represented the 12 months of gestation (3 samples for each month). Estradiol-17β, progesterone and cortisol were assessed in all samples. While, LH was assessed only during the first 4 months of gestation.
2- Prepartum period: 18 blood samples out of 54 collected samples from pre-parturient camel-cows were the only used samples representing days 7,3,2, one day prepartum, 0 day (just before parturition), and at parturition (3 samples for each). Estradiol-17β, progesterone and cortisol were assessed in all samples.
3- Postpartum period: 18 blood samples out of 54 samples collected from parturient camel-cows were used representing the 1^{st}, 2^{nd}, 7^{th}, 12^{th}, 17^{th}, and 22^{nd} days postpartum (3 samples each day). Estradiol-17β, progesterone and cortisol were assessed in 9 blood samples representing the 1^{st}, 2^{nd}, and 7^{th} day postpartum. While, Estradiol-17β and progesterone were only assessed in the rest (n=9) of samples (12^{th}, 17^{th}, and 22^{nd} days postpartum).

Hormonal assay:

Estardiol-17β: plasma estradiol-17β was estimated by RIA using Coat-A-Count I_{125} estardiol-17β kits from Diagnostic Product Corperation (Los-Angeles, USA), according to procedure reported by Bergquist et al. (1983) and Xing et al. (1983).
Progesterone: plasma progesterone was assessed by RIA using Coat-A-Count I_{125} progesterone kits from Diagnostic Product Corperation (Los-Angeles, USA), according to procedure reported by Ewa Radwanska (1981) and Kubasik (1984).
Cortisol: cortisol was estimated using cortisol Elisa coated microtiterplates (Eurogenetic Company).
Luteinizing hormone (LH): LH was measured using I_{125} RIA kit (Incstar Corporation, Stillwater, USA).
Statistical analysis was performed using SPSS/PC+ (Noursis, 1986).

Results

Hormonal profiles during postmating period:

Plasma estradiol-17β, progesterone and cortisol results are presented in Table, 1. It was found that the estradiol increased within the 2 days postmating, while progesterone within this short period showed no great variation. The estrogen-progesterone ratio showed a characteristic decrease. The cortisol level decreased from 2.3 g/dl just after mating, to 0.7 g/dl two days later. Plasma LH was sustained during postmating and early gestation periods with a range of 13 to 17.5 m.i.u/ml. Plasma LH slightly and progressively increased during first four months of gestation of the 1st trimester (Table 2).

Hormonal profiles during pregnancy period:

Estradiol plasma level showed a slow increase from early to mid gestation and fast one from mid to late gestation. The increase was a moderate one from first to second trimester and a sharp one from the second to the third trimester (Table, 3).

The peak level of estradiol was noticed during the last two months of gestation.

The concentration during the second half of gestation (115.2 pg/ml) was greatly higher than the first half of gestation (13.6 pg/ml).

The plasma progesterone level of gestation in she-camel did not show any characteristic changes whether analyzed between different trimesters or halves of gestation (Table, 3). Plasma cortisol concentrations (Table, 3) showed non-significant increase during the last trimester of pregnancy.

Hormonal profiles during prepartum period:

Hormone profiles assayed in plasma of she-camel during prepartum period are presented in Table, 4. Estradiol concentration was maximum 2 days prior to parturition and declined sharply during act of parturition. Plasma progesterone showed a fast decline from 2.9 ng/ml at day 7 prepartum to 0.7 ng/ml at parturition. The P/E ratio showed a progressive decrease from day 7 prepartum until parturition, this might indicate presence of a reversible relationship between estrogen and progesterone during early prepartum period. Plasma cortisol showed a peak level during the act of parturition (3.4 μg/dl).

Hormonal profiles during postpartum period:

Results presented in table 5, showed a decline in the profiles of estradiol and progesterone hormones during the few days postpartum up to day 22. The P/E ratio

was found low up to day 12, and increased from day 17. Plasma cortisol levels showed also a decline from time of parturition till day 22 postpartum.

Table (1): hormone profiles during mating in she-camel

Hormones	**One Day Postmating (n=3)**	**2 Days Postmating (n=3)**	**Total mean**
Estradiol-17β (pg/ml)	10.7 ±0.7 a	16.0±7.0 a	13.3 ±3.3
Progesterone (ng/ml)	2.30±1.6 a	1.60±1.2 a	1.9±0.9
P/E ratio	1/4.7	1/10	----
Cortisol (µg/dl)	2.3 ±0.2 a	0.7 ±0.4 b	1.5 ±0.4

± Standard Error. Means with different superscripts (a,b,c) in the same row, are significantly different at P<0.05 (LSD).

Table (2): LH profiles during postmating and early gestation in she-camel

Periods	**Luteinizing Hormone (LH) (m.i.u./ml)**
Directly postmating	14.0±4.0
Next day postmating	13.0±1.0
5 days postrnating	14.0±4.0
Postmating Mean	*13.6±0.45 a*
1st month of gestation	13.0±1.0
2nd month of gestation	15.5±0.5
3rd month of gestation	16.0±2.0
4th month of gestation	17.5 ±2.5
Early pregnancy Mean	*15.5 ± 1.6 a*

± Standard Error. Means with different superscripts (a,b,c) in the same column, are significantly different at P<0.05 (LSD).

Table (3): Hormone profiles during pregnancy in she-camel

Trimesters of pregnancy	Estradiol-17β (pg/ml)	Progesterone (ng/ml)	*P/E* ratio	Cortisol (µg/d1)
1st trimester	14.3 ±2.7 a	5.2 ±0.7 a	1/3	0.68 ±0.2 a
2nd trimester	23.9±6.4 a	4.2±.6 a	1/5.6	0.57±0.1 a
3rd trimester	154.9±44.7 b	4.3±0.6 a	1/47.3	0.91 ±0.3 a
First Half	13.6±2.1 *	4.7 ±0.5	1/3.1	0.67±0.1
Second Half	115.2±32.7 *	4.5 ±0.5	1/34.1	0.77±0.2

± Standard Error. Means with different superscripts (a,b,c) in the same column, are significantly different at P<0.05 (LSD). Means with (*) in the same column, are significantly different at P<0.05.

Table (4): Hormone profiles during prepartum period in she-camel

Prepartum Periods	Estradiol-17β (pg/ml)	Progesterone (ng/ml)	*P/E* ratio	Cortisol (µg/dl)
-7 days	540.0±70.2 a	2.9 ±0.5 ab	1/186.2	3.2 ±0.9 b
-3 days	583.3±16.7 a	3.4±1.3 b	1/171.6	0.6±0.5 a
-2 days	975.0±24.5 b	3.1±1.1 ab	1/314.5	2.3±0.7 ab
-1 day	523.3± 129.9 a	1.6±0.9 ab	1/327	0.6±0.3 a
0 day	188.3±106.1 c	0.7±0.1 a	1/269	1.3±0.1 a
At parturition	100.0±36.0 c	1.2±0.6 ab	1/83.3	3.4±0.5 b
Total mean	456.1±72.4	2.1±0.4	---	1.8±0.3

± Standard Error. Means with different superscripts (a,b,c) in the same column, are significantly different at P<0.05 (LSD).

Table (5): Hormone profiles during postpartum period in she-camel

Periods postpartum	Estradiol-17β (pg/ml)	Progesterone (ng/ml)	*P/E* ratio	Cortisol (µg/dl)
One day postpartum	10.0±0.0 a	0.2±0.0 a	1/50	1.75±1.6 a
2 days postpartum	81.6±44.2 a	0.6±0.2 ab	1/136	0.70±0.15
7 days postpartum	65.0±25.0 a	1.1±0.4b	1/59	1.0±0.2 a
12 days postpartum	15.0±5.0 a	0.1±0.0 a	1/150	1.2±0.3 a
l7 days postpartum	9.0±1.0 a	1.0±0.05 b	1/9	1.2±1.1 a
22 days postpartum	11.0± 1.0 a	0.9±0.15 b	1/12.2	0.9±0.0 a
Total Mean	33.0± 11.2	0.6±0.1	---	1.06±0.20

± Standard Error. Means with different superscripts (a,b,c) in the same column, are significantly different at P<0.05 (LSD).

Discussion

Hormonal profiles during postmating period

In this study, there was an increase in estradiol and decrease in progesterone from day of mating to the 2nd day postmating. This was confirmed by Taha et al. (1984) who reported that estradiol level increased at day 3 postmating. The low progesterone levels during mating may be presumably related to the failure of spontaneous ovulation and the subsequent absence of a true luteal phase in the camel. Similar report was established by Homeida et al.(1988) who stated together with other authors (Musa and Abu Sineina, (1978); Arthur & Rahim, (1987) and Marie & Anouassi, (1987) that progesterone began to rise from a well-developed corpora lutea after successful mating. Skidmore (2004) reported that plasma progesterone

concentrations remain low for the first 3 - 4 days after ovulation and then rise steadily to a peak of around 2.7 ng/ml on day 8 or 9 before falling sharply again on days 10 - 11 to reach mean values of 0.5 ng/ml by days 11 or 12. He added that if the camel is not mated then the Serum progesterone levels remain low all the time.

On the other hand, an increase in estradiol during mating may be due to a peak of estrogen secretion by mature follicle, and its decrease after mating and during early pregnancy might be due to ovulation of the follicle and then development of the corpus luteum of pregnancy. This interpretation finds good support by findings of Homeida et al. (1988). The increase in the cortisol on the day of mating and its drop thereafter might due to stress factors stimulating release of adrenocorticotrophic hormone of anterior pituitary which in turn initiate glucocorticoid production by adrenal cortex (Noseir, 1996).

Literatures on camel postmating LH assays are lacking. A maintained LH levels in plasma of she-camel during and after mating might be in response to a direct effect of mating or coitus which is capable of inducing ovulation. Musa and Abu Sineina (1978) stated that in the camel the neuroendocrine reflex involving the initiation of LH release is delayed until coitus occurs. Skidmore and Adams (2000) reported that in the dromedary camel LH plasma levels increase within one hour of mating and reach a maximum (3-19 ng/ml).

The continued increase in LH during 1st trimester of gestation, in this study could be considered an important finding which reflects the essential role of LH on the corpus luteum gravidities which is the main source of progesterone during early pregnancy in most species (Arthur et al., 1985).

Hormonal profiles during pregnancy period

In the present study, estradiol showed a slow increase from early to mid gestation and a fast one from mid to late gestation, and achieved its peak during 11th and 12th month of gestation (203.3 and 333.3 pg/ml, respectively). Other studies are consistent with this result (El-Mougy, 1984; Elias et al., 1984; Mohamed, l991 Arthur, 1992 and Hassan et al., 1996). A similar estradiol pattern was demonstrated by Hassan et al. (1996) who found a progressive estradiol increase with advance of gestation, while peak levels were found between 10th and 12th month of gestation (288 and 550 pg/ml respectively). Similar results were reported by Zhao et al. (1998) who stated that serum 17 beta-estradiol in the Bacterian camel, increased significantly from 11-12 month of pregnancy with peak mean concentrations of 617.47±32.56 pg/ml. The rapid rise in estradiol during the 3rd trimester (late gestation) probably originates from placenta and this belief finds support by Elias et al. (1984) and Skidmore (2004). It is also evident in this work that the estradiol characteristic increase at the last 2 months of gestation coincided with the plasma progesterone decrease. This finding is in agreement with that reported by Elias et al. (1984).

Plasma progesterone concentrations showed a minimum changes with the progress of gestation. The levels were found higher in the 1st trimester and lower and similar in the 2nd and 3rd trimester. This insignificant variation was also noticed by Hassan et al. (1996). Also, Mohamed (1991) reported that there was no significant difference in progesterone levels between stages of gestation in she-camels. It seems that absence of variation in progesterone level during gestation is she-camel may confirm that the main source of progesterone is from corpus luteum and not from placenta as usually reported in other species. Similar conclusion was reported by Skidmore (2004) who stated that progesterone concentrations during pregnancy in the camelidae confirm that these species depend on ovarian progesterone throughout their pregnancy. However, other authors showed that the progesterone levels during

gestation increased gradually from early to late gestation and the drop in its levels only noted at end of gestation or prior to parturition (El-Mougy, 1984; Shalaby, 1986; Agrawal et al., 1987 and Adam et al., 1992).

Plasma cortisol levels during months of gestation in she-camel revealed a slight increase at the end of gestation. Hassan et al. (1996) showed that the cortisol plasma levels in she-camel remained of nearly similar levels during different months of gestation until the last month where a rise was noted (13.2 ng/ml).

Hormonal profiles during prepartum period

The increase of plasma estradiol, in this study, few days prepartum in she-camel was found consistent with reports of Elias et al.(1984) and Hassan et al. (1996) who stated that plasma estradiol increased abruptly at the 12th month of gestation (just before parturition) to 550 pg/ml. Hassan et al. (1996) stated that the estradiol levels diminish 24 hours prior to parturition (175 pg/ml). In the present study, estradiol level decreased from 523.3-188.3 pg/ml 1-0 days of parturition to 100 pg/ml during parturition. It could be possible to say that the high prepartum estrogen played an important role in initiation of oxytocin release and uterine contractions needed for fetal expulsion. Progesterone decline at parturition, in this study, was also reported by Elias et al. (1984) who demonstrated a level of 1.16 ng/ml one day prior to parturition in she-camel. El-Mougy et al. (1984) stated that the declined level at parturition was 1.8 ng/ml. It seems that this characteristic drop of progesterone at parturition may be a sequel of luteolysis.

Agarwal et al. (1992), Hassan, Abd El-Salam and Rakha (1995) and Hassan et al. (1996). Agarwal et al. (1992) stated that the cortisol concentrations were high at parturition and reported a periparturient concentration of 2.5-3.0 µg/dl which is nearly similar to the present work (3.4 µg/dl). They stated that the plasma cortisol concentrations remained relatively low and constant until the last week of pregnancy before parturition where high levels were noted and believed that the maternal adrenal gland is activated during the last 2 to 3 days prior to parturition in response to stress stimulus through the hypothalamus.

Hormonal profiles during postpartum period

Results have shown a decline in the profiles of estradiol-17β, progesterone and cortisol during the studied postpartum period. Similar results were reported by Agrawal et al (1992), Abdel-Gawad and Hassan (1996), and Hassan et al. (1996). The low level of progesterone encountered in parturient she-camel on day 1 postpartum and the further fall in its concentration during the first nine days after birth could have been due to slow regression of the corpus luteum gravidities leading finally to complete lactation-related ovarian inactivity (Agrawal et al., 1992). They added that cortisol level in the mother after parturition may have a physiological role in providing extra energy by virtu of glycogenolytic and glycogenic properties of this hormone. The drop in estradiol levels after parturition in this work is also supported by Hassan et al. (1996) who found a declined level during the first day after parturition.

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مستوى هرمونات إستراديول ١٧ بيتا وبروجستيرون وكورتيزول والهرمون الليوتيني أثناء الجماع والحمل والولادة وبعد الولادة في النوق وحيدة السنام

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ملخص البحث: تهدف هذه الدراسة إلى معرفة مستوى الهرمونات أثناء الجماع والحمل والولادة وبعد الولادة في النوق وحيدة السنام.

استخدمت في هذه الدراسة ٩ من النوق تتراوح أعمارها بين ٣ – ٥ سنوات. تم جمع عينات الدم من هذه الحيوانات بعد الجماع وشهرياً اثناء الحمل وسبعة أيام قبل الولادة، وعند الولادة وبعد الولادة ب (٢٢ يوماً). أظهرت نتائج البحث حدوث زيادة بعد الجماع في مستوى هرمون إستراديول لمدة يومين ولم يحدث أي تغيير في مستوى هرمون بروجستيرون وانخفض مستوى هرمون كوريتزول. وازداد الهرمون الليوتيني بعد الجماع في مرحلة الحمل المبكرة. ثم ازداد في الشهور الأربعة الأولى من الحمل.

حدثت زيادة في مستوى الإستراديول ببطء حتى منتصف فترة الحمل وازداد بسرعة في النصف الأخير من الحمل. مستوى هرمون البروجستيرون كان أعلى في الثلث الأول من الحمل أكثر من الثلثين الأخيرين وارتفع مستوى هرمون الكوريتزول أثناء الولادة مسجلاً أعلى قيمة له. ازداد مستوى هرمون الإستراديول قبل شهرين من الولادة واستمر لمدة ٧ أيام بعد الولادة وانخفض مستوى هرمون البروجستون بسرعة في اليوم السابع قبل الولادة وحتى الولادة. انخفض مستوى كل من هرمونات الإستراديول والبروجستيرون والكورتيزول بعد الولادة واستمر الانخفاض حتى ٢٢ يوماً بعد الولادة.

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