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**OESTRADIOL AND PROGESTERONE LEVELS  
 IN THE SERUM OF SHE-CAMEL AS RELATED  
 TO DIFFERENT OVARIAN STRUCTURES**  
 (With Two Tables)

By

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مستوى الاستراديول والبروجستيرون في مصل النوق  
 بالنسبة للتركيبات المختلفة بالبويضات  
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تضمن هذا البحث تقدير مستوى كلا من هرمون الاستراديول وهرمون البروجستيرون في مصل خمس عشرة ناقة حية وثمان وعشرين ناقة مذبوحة من فصيلة الجمل وحيد السنم وذلك باستخدام طريقة الأشعاع المناعي. وقد تبين وجود زيادة معنوية ( $P/0.001$ ) في مستوى هرمون الاستراديول في مصل النوق التي كانت مبايضها تحوي حويصلات ناضجة مقارنة بتلك التي كانت مبايضها تحوي حويصلات نامية أو حويصلات صغيرة مضمحلة. كما لوحظ وجود زيادة حادة في مستوى الاستراديول ( $325.0 \pm 148.02$ ،  $396.2 \pm 85.6$ ،  $148.02 \pm 85.6$  بيكوغرام/مل في النوق الحية والمذبوحة على التوالي) في مصل النوق العشار (مبايضها تحوي أجساما صفراء) في مرحلة متأخرة من الحمل. وقد أظهر مستوى هرمون البروجستيرون في المصل زيادة معنوية ( $P/0.001$ ) في النوق التي كانت مبايضها تحوي حويصلات ناضجة أو حويصلات نامية أو حويصلات صغيرة مضمحلة. هذا بالإضافة الى أنه قد تبين وجود زيادة معنوية ( $P/0.05$ ) في هرمون البروجستيرون في مصل النوق التي كانت مبايضها تحمل حويصلات ناضجة عن تلك التي تحمل حويصلات صغيرة مضمحلة بمناسلتها.

**SUMMARY**

Oestradiol and progesterone levels were estimated, using radioimmunoassay, in the sera of 15 living and 28 slaughtered adult she-camels (*Camelus dromedarius*) having different structures in their ovaries. A significant ( $P/0.001$ ) increase of oestradiol level was observed in the sera of She-camels having mature follicles than those having growing follicles or small atretic follicles in their ovaries. A sharp increase of oestradiol level ( $325.0 \pm 148.02$  and  $396.2 \pm 85.6$  pg/ml in living and slaughtered animals, respectively) was noticed in the sera of pregnant animals (with corpora lutea in their ovaries) at late stage of pregnancy. Serum progesterone level showed a significant ( $P/0.001$ ) increase in she-camels having corpora lutea (pregnant or non-pregnant) than those having mature follicles or growing follicles or small atretic follicles in their ovaries. A significant ( $P/0.05$ ) increase of progesterone level was also observed in the sera of animals with mature follicles than those with small atretic follicles in their gonads.

**INTRODUCTION**

Until approximately 10 years ago, reproductive endocrinology and the hormonal profile of the she-camel (*Camelus dromedarius*) during different states of reproductive activity, was the subject of much speculation but of very little knowledge. An account of the anatomy and histology of the female dromedary gonads was given by TAYEB (1948). SHALASH (1965) described the ovaries of she-camels as well as the cyclic structures, including Graffian follicles and corpora lutea. ABDO *et al.* (1969) studied both the micro- and macroscopic properties of the camel ovary and concluded that although the shape, size and weight may differ from those of other species like cow, sow and mare, the microscopic properties of both the Graffian follicles and corpora lutea, showed no clear differences. MUSA & ABU-SINEINA (1978) and WILLIAMSON & PAYNE (1978) concluded that most corpora lutea were observed only during pregnancy and that ovulation is non spontaneous, requiring copulation. They added that copulation apparently triggers the release of the gonadotrophins essential for ovulation to occur, approximately 36 hours latter. On the other hand, ABDO *et al.* (1969) and NAWAR *et al.* (1978) recorded that post-ovulatory corpora haemorrhagica and mature corpora lutea were seen in the ovary of non-pregnant she camels.

ELIAS *et al.* (1984 a) studied the peripheral blood levels of progesterone in female camels during various reproductive stages. They recorded that progesterone concentrations were  $\leq 0.6$  ng/ml in the examined females before mating, after which, progesterone values increased to  $> 1$  ng/ml within 2-3 days. ELIAS *et al.* (1984 b) also determined oestradiol concentrations in the serum of female one-humped camels during the various reproductive stages. They mentioned that serum concentrations of oestradiol increased at the beginning of follicular growth and that 2 peaks were noted on days 11 and 16 after PMSG injection, however by early pregnancy, oestradiol values decreased. EL-WISHY *et al.* (1984) studied the changes in the levels of estrogen and progesterone in the blood of pregnant and non-pregnant she-camels. They observed that estrogen levels were least in non-pregnant heifers ( $43.6 \pm 9.8$  pg/ml) and in pluriparous animals ( $29.0 \pm 14.2$  pg/ml) and that follicular growth was accompanied by a substantial increase of estrogen level. They added that during pregnancy, the level of progesterone fluctuated considerably between animals ( $0.19 \pm 0.05$  to  $1.93 \pm 0.81$  ng/ml) irrespective of their age, stage of gestation or weight of the corpus luteum.

EL-BAGHDADY *et al.* (1990) studied the patterns of serum progesterone and total oestrogen throughout the reproductive cycle in female dromedary. They found that the non-cyclic camels possessed high serum total oestrogens (57.62 pg/ml) and negligible serum progesterone (0.15 ng/ml). In oestrus camels, these figures were 162.86 pg/ml and 0.19 ng/ml for the two hormones, respectively. At early pregnancy, serum progesterone showed sharp increase to 3.01 ng/ml and a sharp increase in oestrogens level (486.14 ng/ml) was observed during the last month of pregnancy.

The present work was carried out to estimate the serum levels of oestradiol and progesterone hormones as related to the different cyclic structures in the ovaries of the female one humped camels (*Camelus dromedarius*).



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**MATERIAL and METHODS**

The material of the present work was collected from 15 adult living she-camels kept with the farmers at Bani-Adi area and from 28 adult she-camels slaughtered at Bani-Adi slaughter-house, Assiut Governorate (Table 1).

**Table (1):** Number and reproductive status of the examined living and slaughtered she camels.

Ovarian structures and reproductive State	Number of examined animals		
	Living	Slaughtered	Total
1- Mature follicles	4	8	12
2- Atretic follicles	3	7	10
3- Growing follicles	3	4	7
4- Corpora lutea :			
Pregnant	3	5	8
non pregnant	2	4	6
Total	15	28	43

Concerning living camels, each she-camel was examined rectally and special attention was given to both ovaries for the presence of ovarian structures including small follicles, growing or mature follicles, corpora lutea and these findings were recorded. Blood sample was collected, through jugular venipuncture, after rectal examination of each animal into sterile centrifuge tubes.

Blood samples were also collected before slaughtering by jugular venipuncture from slaughtered she-camels into sterile centrifuge tubes. All collected blood samples from living and slaughtered animals were transferred in a thermos-flask containing ice-cubes to the laboratory where they were centrifuged at 3000 r.p.m. for 15 minutes. Clear serum was separated by careful aspiration and stored at  $-20^{\circ}\text{C}$  until the time of the hormone assay.

After evisceration of slaughtered animals, ovaries and reproductive tract were transferred to the laboratory. Both ovaries were removed, stripped from the surrounding structures and examined grossly for the presence of different structures, as mentioned above with living animals. Uterine horns were opened and examined for the presence of any conceptus. In pregnant animals, the approximate age of the foetus was estimated according to the procedure of EL-WISHY *et al.* (1981).

Oestradiol and progesterone hormone assay was carried at the hormone-assay unit in the central laboratory, Faculty of Medicine, Assiut University. This was achieved using coat-A count oestradiol 17-B and coat-A count progesterone radioimmunoassay kits supplied by Diagnostic Product Corporation, U.S.A. and following the techniques of the manufacturer and ENGLAND *et al.* (1974) and ELIAS *et al.* (1984 a).

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Statistical analysis of the obtained results was carried out following the procedures of MINIUM and CLARKE (1982).

## RESULTS

The results of the hormone assay of oestradiol and progesterone in both living and slaughtered she-camels are summarized in table (2).

Concerning oestradiol hormone in living she-camels, a significant ( $P/0.001$ ) increase was observed in the serum of animals having mature follicles than in those with growing follicles or those with small atretic follicles. Although the average level of the hormone in the serum of animals with corpora lutea in their gonads (two of them were at late stage of pregnancy) was too high ( $325.0 \pm 148.02$  pg/ml) than in those with mature follicles, the difference between them was non-significant statistically. In slaughtered she-camels, oestradiol level showed a significant ( $P/0.001$ ) increase in the serum of animals with mature follicles than those with growing follicles and those with atretic follicles in their ovaries. However, a significant ( $P/0.05$ ) increase of the hormone level was observed in the serum of animals with corpora lutea (3 of them were at late stage of pregnancy) than those with mature follicles.

Relating the serum level of progesterone hormone in living and slaughtered she-camels, a significant ( $P/0.001$ ) increase was observed in the sera of animals having corpora lutea than those with mature follicles or small atretic follicles. Moreover, a significant ( $P/0.05$ ) increase of the hormone level was detected in the serum of slaughtered animals having mature follicles than those with small follicles in their ovaries. On the other hand, no significant differences were found between living and slaughtered she-camels concerning the serum levels of both hormones.

## DISCUSSION

Instead of oestrus cycles comparable to those of spontaneous ovulators, she-camel exhibits follicular cycles, with follicles developing and regressing successively and ovulation will occur only when mating has taken place (XU *et al.*, 1985). CHEN *et al.* (1983) and Chen *et al.* (1985) demonstrated that ovulation is induced by some components of the seminal plasma. Moreover, EL-WISHY *et al.* (1981) revealed that successful fertilization is accompanied by maintenance of a large functioning corpus luteum.

The results of the present work indicated that oestradiol level in the serum of both living and slaughtered she-camels was markedly related, not only to the presence of follicular activity in the ovaries, but also to the size and the state of the present follicles. Animals with mature follicles (average diameter about 10 mm) in their ovaries expressed higher levels of the hormone in their sera ( $75.0 \pm 2.74$  and  $80.0 \pm 2.32$  pg/ml in living and slaughtered animals, respectively). Statistically significant ( $P/0.001$ ) difference was obvious on comparison of the hormone level in the sera of the above animals and those having growing follicles (3-5 mm in diameter) or small atretic follicles (less than 2 mm in diameter). Nearly similar findings were recorded



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by EL-WISHY *et al.* (1984), who revealed that the least estrogen levels were noted when the ovaries of heifers or pluriparous camels ( $43.6 \pm 9.8$  and  $29.0 \pm 14.2$  pg/ml, respectively) contained atretic organized follicles. They added that in the presence of small follicles (3-5 mm), estrogen levels increased to  $105 \pm 25.5$  in heifers and  $168.02 \pm 59.4$  pg/ml in pluriparous camels. On the other hand, higher levels of oestradiol were recorded by ELIAS *et al.* (1985) who found that 2 peaks of the hormone level (about 300 pg/ml) were noted on days 11 and 16 in the sera of she-camels injected with 7000 I.U. of PMSG for induction of oestrus during seasonal anoestrus. Conversely, lower values of oestradiol concentrations in the peripheral plasma of she-camels were reported by XU *et al.* (1985). They mentioned that the hormone levels were  $26.8 \pm 9.0$  pg/ml during the follicular phase and  $30.8 \pm 5.1$  pg/ml when the follicle was maximum size and these values fell after ovulation.

Moreover, the results of the present work showed a marked elevation of the hormone levels in the sera of she-camels having well-developed corpora lutea, particularly those animals which were at late stage of pregnancy (both living and slaughtered). This finding coincided with the findings of AGARWAL *et al.* (1987) and EL-BAGHDADY *et al.* (1990), who revealed that oestrogen concentration in the pregnant camels tended to peak before parturition. They suggested that in camels like other ruminants, near the end of pregnancy, the placenta appears to switch solely to oestrogen synthesis, as it was recorded by WILLIAMS and GROSS (1986).

Concerning progesterone concentrations in the sera of both living and slaughtered animals, the obtained results revealed that there was a marked increase of the hormone levels in the sera of she-camels having functioning corpora lutea than those having other structures in their ovaries. Nearly the same trend of behaviour of progesterone hormone in the sera of she-camels was previously recorded by XU *et al.* (1985). They revealed that during the follicular phase, peripheral plasma progesterone values were low ( $0.36 \pm 0.28$  ng/ml), but values increased to reach  $1.37 \pm 0.74$  ng/ml at 3 days and  $2.4 \pm 0.86$  ng/ml at 7 days after ovulation. Moreover, EL-BAGHDADY *et al.* (1990) mentioned that concentrations of progesterone in the non-cyclic camels were  $0.15 \pm 0.01$  ng/ml and they were  $0.19 \pm 0.02$  ng/ml in cyclic camels at oestrus "follicular phase". They added that these values increased to 3.01-3.24, 2.17-2.11 and 2.28-2.86 ng/ml during first, second and third trimester of pregnancy "luteal phase", respectively. On the other hand, ELIAS *et al.* (1985) found that serum levels of progesterone were less than 0.6 ng/ml in non-cyclic and in animals induced for oestrus (during oestrus phase). These values exceeded 1 ng/ml (from 3 to 7 ng/ml) within 2-3 days after mating of these she-camels. Meanwhile, EL-WISHY *et al.* (1984) reported that progesterone content of the blood of non-pregnant camels was always low ( $0.037 \pm 0.01$  to  $0.17 \pm 0.09$  ng/ml) except in the presence of active corpora lutea of infertile services ( $0.44 \pm 0.15$  ng/ml). They added that the hormonal level in the blood of pregnant camels was  $0.19 \pm 0.05$  to  $1.93 \pm 0.81$  ng/ml. These differences in the hormone level between the obtained results and the previously recorded results by other authors might be attributed to variations between the examined animals, steroids content in

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their sera, stage of sampling, state of activity of the corpus luteum and the reproductive future of the induced ovulation whether was followed by fertile (pregnancy) or infertile service (short luteal phase with regressive changes in the corpus luteum).

Finally it can be concluded that hormonal assay of oestradiol and progesterone in the peripheral blood of she-camels can be used for confirmation of the rectal findings and determination of the optimum time for service or insemination, as a step on the way of improvement of reproductive performance of this animal.

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**Table (2):** Serum levels of oestradiol and progesterone of living and slaughtered she-camels in relation to ovarian structures.

Ovarian structures	No. of animals	Oestradiol ( pg / ml )	progesterone ( ng / ml )
<b>1- Mature follicles</b>			
-Living animals	4	75.00 ± 2.74	0.143 ± 0.004
-Slaughtered..	8	80.13 ± 2.82	0.173 ± 0.014
<b>2- Atretic follicles</b>			
-living animals	3	22.67 ± 4.37 <sup>***</sup>	0.140 ± 0.003
-Slaughtered..	7	23.57 ± 2.33 <sup>***</sup>	0.137 ± 0.003 <sup>*</sup>
<b>3- Growing follicles</b>			
-Living animals	3	46.67 ± 2.73 <sup>***</sup>	0.150 ± 0.020
-Slaughtered..	4	51.00 ± 2.55 <sup>***</sup>	0.177 ± 0.005
<b>4-Corpora lutea</b>			
<b>A- Living animals</b>			
- Pregnant	3	325.00 ± 148.02	2.47 ± 0.100 <sup>***</sup>
- Non-pregnant	2	30.00 ± 10.03	2.95 ± 0.150 <sup>***</sup>
<b>B - Slaughtered animals</b>			
- Pregnant	5	396.20 ± 85.60 <sup>*</sup>	2.90 ± 0.160 <sup>***</sup>
- Non-pregnant	4	43.00 ± 8.82	2.91 ± 0.170 <sup>***</sup>

\* = Significant at ( P < 0.05 ).

\*\*\* = Significant at ( P < 0.001 ).

± = Standard error.