



Plasma Progesterone Levels of Corpus Luteum during Pregnancy in Microchiropteran Bat *Hipposideros Speoris* (Schneider)

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Abstract

The peripheral plasma progesterone concentrations were measured by radio immunoassay during the complete life span of corpus luteum in the Microchiropteran bat, *Hipposideros speoris* (Schneider). Soon after the ovulation during mid December all the females in the colony become pregnant irrespective of their age. Hence the corpus luteum formed during estrus period itself forms corpus luteum of pregnancy. Due to sinistral dominance the ovulation was restricted exclusively to the left side of the ovary and consequently the corpus luteum was formed in the same ovary every time and the progesterone concentration found to be 16.8 ng/ml. Two types of corpus luteum intra-ovarian and extrovert have been observed. Some of the specimens collected during December and January showed an intra-ovarian large corpus luteum occupying major part of the ovary whereas in the other it was extrovert appearing as an umbrella during late December and the progesterone value was elevated to 20.2ng/ml. During early January it reaches its maximum size just prior to implantation of the blastocyst, when it mushrooms out into a nearly spherical ball, with its main bulk projecting out from the ovarian surface and the progesterone level was 28.8ng/ml. It develops maximally by the time the blastocyst reaches the uterus (mid-January) and was nearly as large as rest of the ovary attached to it by small pedicle, the progesterone level was rose and remained high till the regression (30.3 ng/ml). The commencement of regression of the corpus luteum was synchronised with the formation of the early trophoblastic placenta with shrinkage in its size was noticed until it occurred as a small stump projecting from the surface of the ovary at the time when the chorio-vitelline placenta was well established during early and mid-February and a fall in the mean progesterone level was noted (3.1 ng/ml). The progesterone concentration rose steeply (30.1 ng/ml) and reached a plateau till March and April. Soon after the establishment of the chorio-allantoic placenta the corpus luteum became fibrous and was restricted to a corner. It was reabsorbed during mid-pregnancy (late March) and by late gestation (late April) it was completely lost in the stroma.

Keywords: Plasma progesterone, *Hipposideros*, corpus luteum, pregnancy.

Introduction

The order chiroptera is one of the most diverse taxa of the class Mammalia and as such exhibits numerous specializations in female reproductive morphology and cyclicity. It is divided into two suborders, the Megachiroptera and the Microchiroptera. The bat, *Hipposideros speoris* belongs to the suborder Microchiroptera.

Corpus luteum, is a dynamic gland showing variations in size, structure and physiological activities in different stages of the pregnancy. This dynamic entity secretes progesterone as a principal hormone and estrogen, relaxin, oxytocin, neurophysin-1, inhibin and vasopressin in lesser amount. The hormone progesterone influences secondary sex organs and is concerned with the progestational changes in the uterus. A perusal of available literature on the corpus luteum of bats reveals that no information on cellular components are available. The development of corpus luteum in bats belonging to the genera *Vesperugo*, *Vespertilio* and *Plecotus* was given by Vander Stricht et al¹ and followed by many others including².

Circulating levels of sex steroids reflect gonadal activity; their changes during the reproductive cycle have been studied extensively in several mammalian species³. In contrast, there are only a few reports concerning plasma steroids in bats; until the advent of sensitive radioimmunoassay techniques⁴, accurate measurement of steroids in the small blood samples obtainable from bats⁵ was not feasible. In recent years, plasma progesterone levels during pregnancy have been measured in other bats also⁶.

The original aim of this study was to evaluate the different levels of plasma progesterone in *Hipposideros speoris* (Schneider) so as to know what the changes occurs specially during pregnancy. As in other mammals the level of plasma progesterone is low during estrus period and it increases at term and rapidly decreases while the corpus luteum regresses. Relatively low peripheral plasma progesterone level is an important prerequisite for initiation of labour and corpora lutea are the main sites of progesterone production during pregnancy⁷.

Material and Methods

Hipposideros speoris is a common bat, which occurs, “throughout the greater part of India, specimens have been obtained from the Dehradun, from Chanda (Chandrapur) and other localities in the Deccan and from several places in Southern India”⁸, while Honacki J.H. et al⁹ mentioned that this species was found in peninsular India and Srilanka.

The leaf-nosed bat, *Hipposideros speoris* (Schneider) is selected for the present study because of its easy availability in the vicinity of Nagpur city, India.

The specimens of *Hipposideros* were collected corresponding to its breeding habits i.e. from mid-December till full term pregnancy (April/May) with the help of a mist net from the natural population inhabiting abandoned mines in Khapa, Nagpur, Maharashtra. A field diary giving the salient features of each specimen was maintained and is appended (Table-1). The animals were weighed and their crown-rump lengths were recorded after sacrificing by decapitation or with chloroform. The reproductive organs were dissected out and fixed in Bouin’s fluid and 10% Neutral formalin and buffered formalin.

For the determination of progesterone level in blood the bats would be anaesthetized by ether and 2 ml of blood would be drawn by cardiac puncture with 2 ml sterile syringe. The blood would be allowed to clot at room temperature for half an hour and it would be used for RIA.

Results and Discussion

The concentrations of plasma progesterone during pregnancy in *Hipposideros speoris* are shown in table 1. The data shows

the various stages of pregnancy. During mid February when female is in estrus the plasma progesterone level is found to be 3.4-4.2ng/ml. The level increases late January i.e. formation of implanted bilaminar blastocyst takes place and the value of Plasma progesterone is now 26.3-29.6 ng/ml. During mid February the level declines to 14.8-17.0 ng/ml and so on up to 7.0-9.8 ng/ml till mid February during limb bud stage. From late February i.e. from limb bud stage till the full term pregnancy the plasma progesterone level inclines upto 43.8-44.6 ng/ml.

Transient peaks in plasma progesterone, such as we found in *H. speoris* at ovulation, and blastocyst formation have not been reported in *Antrozous pallidus*¹⁰, *Tadarida brasiliensis Mexicana*¹¹ or *Macrotus californicus*¹²; in all of these bats, progesterone levels are reported to rise subsequently. From the study it seems that the periovulatory rise in progesterone is due to the ovulatory surge of the pituitary Luteinizing Hormone, since similar LH- induced progesterone peaks occur in the rats¹³, mice^{14,15}, hamsters¹⁶ and guinea pigs¹⁷.

The presence of discrete peak in plasma progesterone correlated with the beginning of blastocyst formation is strange; so far as we are aware, similar progesterone peaks have not been noted in other mammals. In fact, progesterone peaks do not occur when blastocysts are forming in rats, mice and guinea pigs; however, in these species, blastocyst form 24 hour or less before implantation, and the rise in the progesterone appears intuitively to be related to nidation. On the other hand, transient peaks in plasma progesterone are not seen in carnivores¹⁸ or in ungulates, although both have long preimplantation periods, and blastocysts formation and implantation are clearly separated.

Table-1
Values of the progesterone in *Hipposideros speoris* during pregnancy

Sr. No.	Status of Bats	Date of Collection	Values of Progesterone
1.	Female in estrus	16.12.2010	3.4- 4.2 ng/ml
2.	Pre-implantation stage	28.12.2010	10.6- 12.3 ng/ml
3.	Pre-implantation stage	05.01.2011	15.3-16.1 ng/ml
4.	Implanted bilaminar blastocyst	16.01.2011	28.2-33.5 ng/ml
5.	Implanted bilaminar blastocyst	25.01.2011	26.3-29.6 ng/ml
6.	Implanted bilaminar blastocyst	02.02.2011	14.8-17.0 ng/ml
7.	Neural groove stage	12.02.2011	8.9-10.2ng/ml
8.	Limb Bud Stage	20.02.2011	7.0-9.8 ng/ml
9.	Limb Bud stage	26.02.2011	8.0-9.2 ng/ml
10.	Limb Bud Stage	06.03.2011	11.3-12.8 ng/ml
11.	Mid pregnancy	15.03.2011	15.6-19.4 ng/ml
12.	Advanced Pregnancy	28.03.2011	23.6-25.8 ng/ml
13.	Advanced Pregnancy	08.04.2011	33.5-34.9 ng/ml
14.	Advanced Pregnancy	18.04.2011	38.7-41.2 ng/ml
15.	Advanced Pregnancy	30.04.2011	43.8-44.6 ng/ml

In both groups, the corpus luteum is the paramount source of progesterone, and plasma levels, which are quiet low at ovulation, rise steeply and continuously during early pregnancy. A recent study showed that ovarian progesterone content did not differ between ovaries with or without corpora lutea during earlier stages of pregnancy¹⁹.

Plasma progesterone levels rose very rapidly after implantation and reached peak values in the final two weeks of pregnancy, inspite of the decrease in the levels during neural groove stage and limb bud stage. A significant decrease in plasma progesterone in *A. pallidus* during the middle third of pregnancy show a similar but not statistically significant decline just after midpregnancy in *P. pipistrellus*²⁰.

Conclusion

We saw no evidence of a prepartum decline in plasma progesterone, although such a decline has been reported in all other bats studied. The present data do not show the possibility of a prepartum fall in progesterone levels.

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