

## Gonadal function arrest in fillies after birth, as reflected by steroid serum concentrations

### Supressão da função gonadal em potras após o nascimento, refletido pela concentração sérica de esteróides gonadais

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#### SUMMARY

Sexual maturation involves restraint of gonadal activity from birth to puberty, while somatic development continues. Fetal gonadal steroidogenesis is very important for the maintenance of pregnancy and foaling in mares. The present study was conducted to evaluate gonadal steroid serum levels in foals after birth. Five fillies born at Equília Stud Farm, Avaré, SP, Brazil, were studied. Blood samples were collected daily in the morning during the first week of life. Progesterone serum levels were measured by a commercial radioimmunoassay (RIA) kit and estradiol serum levels with a sensitized non-commercial RIA. At birth, both progesterone and estradiol serum levels were high ( $13.46 \pm 5.5$  nmol/l and  $7.95 \pm 1.5$  nmol/l) and decreased to undetectable levels at the end of the first week of life. A negative correlation was found between fillie age and gonadal serum steroid concentration. Results show that fetal gonadal activity persists until birth, and decreases gradual and slowly during the first week of life, as reflected by steroid concentrations in the blood.

UNITERMS: Fillies; Steroids; Birth.

#### INTRODUCTION

Equine pregnancy is followed by typical hormonal changes characterized by high fetal gonadal activity during the second half of pregnancy<sup>2</sup>. This elevated fetal gonadal activity is responsible for a high concentration of immunoreactive inhibin in the mare's serum during this period<sup>6</sup>. Although serum progesterone levels decreases during the second half of pregnancy, they rise again from 48 to 24 hours before foaling.

During late pregnancy, the uterine vein transports to the mare mainly 20 $\alpha$ -5P (20 $\alpha$ -hydroxy-5-pregnan-3-one) and 5 $\alpha$ -DPH (5 $\alpha$ -pregnane-3.20-dione), and the fetal gonads produces pregnenolone, which is metabolized by placental 3 $\alpha$  and 20 $\beta$  HSD (hydroxysteroid dehydrogenase)<sup>3</sup>. Since blood progesterone concentration is low in mares during the second half of pregnancy, it was postulated that progesterone metabolites are necessary for the maintenance of pregnancy<sup>12</sup>.

It seems that in the unique process of steroid hormone production by pregnant mares, 5 $\alpha$ -pregnane-3.20-

dione and not the progesterone is the main steroid precursor of other plasma progestin metabolites<sup>11</sup>. Pregnenolone seems to be 5 $\alpha$ -reduced to 3 $\beta$ -5 $\alpha$ , which could be 3-oxidized to 5 $\alpha$ -DHP and become a substrate for other 5 $\alpha$ -pregnanes<sup>10</sup>.

Near parturition, pregnenolone from the fetal gonads is aromatized to estrogens, which are responsible for normal fetal development besides enhancing myometrial sensitivity to oxytocin<sup>5,8</sup>. The consequent rise in estradiol increases prostaglandin production, triggering the beginning of labor.

Progesterone concentration may be used as an index to evaluate foal maturity, since dysmature foals keep high progesterone levels after birth<sup>4</sup>. On the other hand, on the first day of life, fillies have high LH levels, which decrease to levels close to the detection limit of the assay on the next day<sup>13</sup>.

The present study was carried out to evaluate progesterone and estradiol serum concentration during the first week of life in Thoroughbred fillies born on a tropical stud farm.

#### MATERIAL AND METHOD

Five Thoroughbred fillies born from July to September at Equília Stud Farm, Avaré, SP, were kept at the same stud management, maintaining the normal breeding conditions. Blood samples were collected daily from the jugular vein between 9.30 and 10.00 a.m. during the first week of life. At the stud farm, serum was separated from blood and frozen at  $-20^{\circ}\text{C}$  in polypropylene tubes until hormonal quantification.

Progesterone quantification was performed in duplicate serum samples using a commercial kit (Coat-a-Count®, DPC, CA-USA) in a  $^{125}\text{I}$  progesterone assay. Assay sensitivity was 0.32 nmol/L and intra- and inter-assay coefficients of variation were 10.5 and 5.8%, respectively.

Estradiol concentration was measured in duplicate with a sensitized radioimmunoassay<sup>7</sup>, designed for the determination of very low hormone levels using a  $^3\text{H}$ -estradiol (Amershan, UK) and a rabbit antibody. The assay can detect estradiol concentration as low as 1.0 pg/mL and the procedure requires previous extraction with each point with a recovery control.

Data were analyzed by the nonparametric Friedman test to detect differences and by the Spearman test to determine the correlation between age and hormonal levels, with the level of significance set at  $p < 0.05$ .

## RESULTS AND DISCUSSION

Assay sensitivity for estradiol was 3.67 pmol/L, net recovery was 92% and parallelism with physiological levels was demonstrated. The intra- and inter-assay coefficients of variation were 10.2 and 12.2%, respectively.

During the first week of life, progesterone and estradiol concentrations varied significantly. Fillies were born with high progesterone and estradiol levels, which decreased to undetectable concentrations during the first week of life. Progesterone concentration was negatively correlated with fillies age ( $r = -0.89$ ,  $p = 0.01$ ) during the first week of life, as also was estradiol concentration ( $r = -0.91$ , Spearman correlation test, Fig. 1).

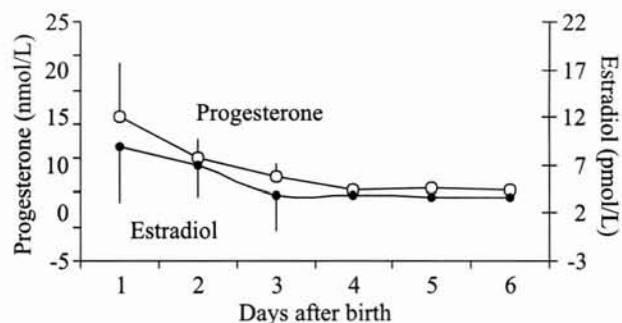
The decrease of progesterone and estradiol levels within the first week of life agrees with those reported elsewhere<sup>2</sup> and confirm reports that the gonads of fillies are the major producers of steroid precursors for progesterone synthesis<sup>3,9</sup>.

This reduction of steroid concentration may reflect a restraint of gonadal activity after birth. Fillies had higher LH concentrations than foals<sup>13</sup>. In addition, foals showed higher progesterone concentration than mares after birth, which continued to be detectable for a long period,

suggesting that the fetal gonads contributed to the progesterone pool<sup>2</sup>. It was also observed that this hormonal pattern was similar for both ovariectomized and intact mares<sup>5</sup>.

This typical reduction of steroid concentration just after birth reflects fillies maturity, since prolonged high steroid levels may suggest immaturity, as well as hepatic or renal failure<sup>4</sup>.

According to Ammons *et al.*<sup>1</sup>, mare progesterone concentration was 39.68 nmol/l during the last 2 weeks of gestation, dropped below 25 nmol/l within one day after parturition and continued to decrease below 9.5 nmol/l by the 3rd day after foaling. An earlier report disclosed lower progesterone concentrations before mare parturition (12 nmol/l and 1.9 nmol/l one day after)<sup>2</sup>. It was also observed<sup>4</sup> that progesterone concentrations decreased from 22.3 nmol/l within 24 hours of birth to 6.35 nmol/l at about 48 hours after foals birth.



**Figure 1**

Correlation with age (days after birth) and seric concentration of progesterone (nmol/L) and estradiol (pmol/L) of foals on the first week of life ( $n = 5$ ). There was a significant ( $p < 0.05$ ) decrease on progesterone and estradiol levels from the 3<sup>rd</sup> day after birth.

## CONCLUSION

Since the fillies showed a decreasing serum gonadal steroid concentration after birth, it seems that they were mature and still had gonadal secretory activity, which became restrained within the first week of life.

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## RESUMO

A maturação sexual envolve a supressão da atividade gonadal entre o nascimento e a puberdade, enquanto o desenvolvimento somático prossegue. A esteroidogênese na gônada fetal é muito importante para a manutenção da prenhez e para o parto das éguas. O presente trabalho foi conduzido para avaliar os níveis séricos de esteróides gonadais em potras após o nascimento. Cinco potras nascidas no Haras Equiflora, Avaré, São Paulo, foram estudadas. Procedeu-se à colheita de sangue diariamente pela manhã, durante a primeira semana de vida. Os níveis de progesterona foram medidos por meio de um kit comercial de radioimunoensaio (RIA), enquanto os níveis de estradiol foram por um RIA sensibilizado não-comercial. Ao nascimento, tanto os níveis de progesterona quanto os de estradiol mostraram-se altos ( $13,46 \pm 5,5$  nmol/L e  $7,95 \pm 1,5$  nmol/L), diminuindo a níveis não detectáveis no fim da primeira semana de vida. Uma correlação negativa foi detectada entre a idade das potras e a concentração de esteróides das gônadas. Os resultados mostram que a atividade secretora da gonada fetal persiste até o nascimento, diminuindo gradativamente durante a primeira semana de vida, demonstrada pela variação na concentração sérica de esteróides.

**UNITERMOS:** Potras; Esteróides; Nascimento.

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