

THE PROFILES OF WEEKLY PROGESTERONE AND ESTRADIOL CONCENTRATIONS DURING PREGNANCY IN EWES: THEIR CORRELATIONS WITH LAMB BIRTH WEIGHT

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ABSTRACT

Thirty nine-pregnant ewes (20 and 19 carrying a single and multiple fetuses, respectively) were used to study the correlations of weekly maternal serum progesterone and estradiol concentrations during pregnancy with lamb birth weight at parturition. Blood samples were drawn weekly (weeks 0 to 20) during gestation period for determination of progesterone and estradiol concentrations. At parturition lamb birth weight was determined around 12 h post partum. Regardless of litter size, concentrations of progesterone during the fetal stage of pregnancy positively correlated with lamb birth weight. In the ewes carrying a single fetus, maternal serum progesterone at weeks 2, 4, 8, 10 to 12, 14, 16 and 18 to 20 of pregnancy positively correlated with lamb birth weight. In the ewes carrying multiple fetuses, maternal serum progesterone at weeks 0, 8, and 10 of pregnancy positively correlated with lamb birth weight. Regardless of litter size, concentrations of estradiol at weeks 0, 2, and 4 during the embryonal stage of pregnancy positively correlated with lamb birth weight. During the fetal stage of pregnancy, maternal serum estradiol concentrations positively correlated with lamb birth weight except at weeks 8, 9, and 20 of pregnancy. In the ewes carrying a single fetus, maternal serum estradiol at weeks 1, 2, 4, 6, 8, 10, 12, and 14 of pregnancy positively correlated with lamb birth weight. In the ewes carrying multiple fetuses, maternal serum estradiol concentrations at weeks 0, 1, 2, 4, 6, 8, 10, and 14 of pregnancy positively correlated with lamb birth weight.

Keywords: progesterone, estradiol, lamb birth weight, pregnancy, sheep

Progesterone and estradiol, along with other hormones directly related to pregnancy, are known for their roles in the maintenance of pregnancy through their effects on uterine stromal cell differentiation (Bell, 1984), secretion of uterine milk protein and stimulation of placental growth and hormone secretion during the embryonal stage of pregnancy (Bell, 1984; Wheeler *et al.*, 1987; Mulholland *et al.*, 1994). During the fetal stage of pregnancy (8 to 20 weeks of gestation), progesterone and placental lactogen are reported to influence nutrient flow to the placenta through their effects on the maternal tissue metabolism (Shirling *et al.*, 1981; Sutter-Dub *et al.*, 1981; Fowden, 1995).

Secretions of estradiol and progesterone increase dramatically with the changes in ovarian activity during the estrous cycle and pregnancy. In ovine, secretion of estradiol increases during proestrous along with the maturation of the

follicle in the ovary, then decreases significantly during the embryonal stage of pregnancy, and increases precipitously during the fetal stage of pregnancy until parturition (Umo *et al.*, 1976; Pant *et al.*, 1977; Manalu *et al.*, 1996). Progesterone increases 2 days after ovulation, and it shows a marked rise from day 5 to a peak between days 7 and 13 (Umo *et al.*, 1976; Pant *et al.*, 1977). It remains almost stable during the first 7 weeks of pregnancy and increases dramatically after week 8 of pregnancy (Manalu *et al.*, 1996).

Previous observations suggest lower peripheral progesterone in overfed animals as a reason for the lower embryonal survival and birth weight (Hard and Anderson, 1979; Parr *et al.*, 1987; Ashworth, 1991). Supplementation of progesterone in the overfed animals during early pregnancy has been demonstrated to restore fetal growth and birth weight similar to those in the control animals (Kendall and Hays, 1960; Parr *et al.*, 1987; Ashworth, 1991). These results indicated that progesterone, and probably other hormones and factors secreted by the ovary, corpus luteum, placenta and uterus, could have significant roles in improving prenatal growth.

The dramatic changes in progesterone secretion with the increased litter size and the advance of pregnancy in sheep and goats could have physiological effects on prenatal growth. However, there are limited experiments to explore the possible correlation of the endogenous secretion of progesterone during pregnancy with prenatal growth in polytocous animals. This present study was designed to correlate weekly maternal serum progesterone and estradiol concentration during pregnancy with lamb birth weight at parturition in Javanese thin-tail ewes.

METHODS

Experimental Conditions and Animals

This experiment was conducted during the hot (25 to 32°C) and wet (70 to 80% relative humidity) season in the humid tropics of Indonesia. Experimental animals were 20 Javanese thin-tail ewes (5, 9, 4, and 2 ewes carrying 0, 1, 2, and 3 fetuses, respectively) with similar body weight (20 to 22 kg) and age (2 to 3 years) at breeding. Javanese thin-tail sheep is a meat-type indigenous breed well recognized for its high prolificacy (Bradford *et al.*, 1986; Sutarna *et al.*, 1988). The experimental ewes were injected twice with PGF_{2α} (i.m.) (Folligon, Intervet, North Holland, The Netherlands) at an 11-day interval. Three days after the last injection, the

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