

A comparison of the changes in LH, FSH and testosterone in spring-born ram lambs of two different breeds.

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Summary. LH, FSH and testosterone variations were compared during the prepubertal period in Romanov and Ile-de-France ram lambs born in the spring. Mean plasma LH levels increased significantly between the 1st and 8th week of age in the Romanov and between the 1st and 12th week of age in the Ile-de-France. At 1 month of age, the number of LH and testosterone pulses per hour was higher in Romanov than in Ile-de-France lambs.

The mean plasma testosterone levels, higher in the Romanov, increased from 1 week of age onwards.

Mean plasma FSH levels increased from the first neonatal week till the 8th week in the Romanov and till the 12th week in the Ile-de-France. The levels of FSH did not differ significantly between the two breeds.

The higher and earlier secretion of LH and production of testosterone in the Romanov might be a cause of its better reproductive performance.

Introduction.

Thimonier, Pelletier and Land (1972), Bindon and Turner (1974), Thimonier (1975) and Garnier *et al.* (1978) all observed genetic variations in the mean plasma levels of LH and testosterone in ram lambs. LH and testosterone pulsatility has been shown to also differ between pubertal and adult rams (Pelletier *et al.*, 1982 ; Sanford *et al.*, 1982).

The present work was designed to observe changes in the mean plasma levels of FSH, LH and testosterone and the pulse frequency of the two latter hormones in growing spring-born ram lambs, and to compare two breeds (Ile-de-France and Romanov) known to have a different ovulation rate and prolificacy (Thimonier, 1975).

Material et methods.

Eighteen Romanov ram lambs born between the 1st of March and the 1st of April (Lafortune *et al.*, 1984) were compared to 28 Ile-de-France ram lambs born at the beginning of February. Blood was sampled by jugular venipuncture twice weekly during the first 3 months and thereafter twice a month until 42 weeks of age. Serial samples were collected every 30 min for 4 h at 1 and 3 months of age.

After centrifugation, the plasma samples were stored at -15°C until assay. Plasma FSH (Blanc and Poirier, 1979) and LH (Pelletier *et al.*, 1968) were measured by double antibody radioimmunoassay using NIH-P-56 HG-FSH 225 (2.6 NIH FSH S3) and LH CNRS M3 (= 1.8 NIH LH S1), respectively, as standards. Testosterone was radioimmunoassayed directly without extraction according to the method of Cotta *et al.* (1975).

Mean serial plasma levels were calculated from the serial values for each hormone at 1 or 3 months of age. Pulses of LH or testosterone were defined as obvious rises in hormone concentration, followed by at least two declining values. The number of pulses per hour was calculated for LH and testosterone at each serial sampling period.

The data were analysed using either the analysis of variance, Student's t-test or the non-parametric U-test.

Results.

A) *LH*. — Mean plasma levels of LH increased significantly between the 1st and 8th week of age in Romanov lambs (3 to 8.2 ng/ml) and between the 1st and 12th week of age in Ile-de-France lambs (0.9 to 7 ng/ml). After these rises, mean LH levels decreased sharply in the Ile-de-France but were maintained at relatively high levels in Romanov lambs (fig. 1). The monthly mean LH levels were higher in the Romanov between neonatal weeks 4 and 8 (7.5 ± 0.8 ng/ml) than in the Ile-de-France (3.6 ± 0.6 ng/ml) but were not significantly different at 12 weeks of age (Romanov : 5.0 ± 0.5 ; Ile-de-France : 4.8 ± 0.6 ng/ml).

At 4 weeks of age, the number of LH pulses per hour was higher in the Romanov (0.48) than in the Ile-de-France (0.20) ($P = 0.01$). At 12 weeks of age, the mean number of LH pulses was higher (but not significantly so) in the Romanov (0.49) than in the Ile-de-France (0.37). The mean LH levels during serial sampling at 4 and 12 weeks of age were significantly higher in Romanov (4 weeks : 5.7 ± 0.6 ; 12 weeks : 4.3 ± 0.6 ng/ml) than in Ile-de-France (4 weeks : 0.9 ± 0.2 ; 12 weeks : 2.5 ± 0.1 ng/ml) lambs (table 1).

B) *Testosterone*. — Mean plasma levels of testosterone differed significantly during the first week of age (Romanov : 2.0 ng/ml ; Ile-de-France : 0.4 ng/ml ; $P = 0.05$). After the first week, they increased significantly in both Romanov (2 to 18 ng/ml) and Ile-de-France (0.4 to 6 ng/ml) lambs. The monthly mean

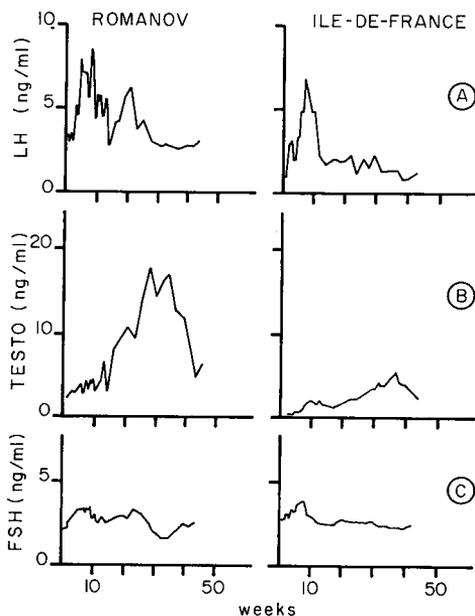


FIG. 1. — Comparative changes in LH (1A), testosterone (1B) and FSH (1C) in Romanov and Ile-de-France ram lambs born in spring.

testosterone values between 8 and 12 weeks of age were increased by a factor of 1.5 in the Romanov and by a factor of 4 in the Ile-de-France as compared to the birth values ; the levels in the Ile-de-France were half those in the Romanov (fig. 1).

At 4 and 12 weeks of age, the mean number of testosterone pulses per hour was significantly higher in the Romanov (1 month : 0.36 ; 3 months : 0.48) than in the Ile-de-France (1 month : 0.12 ; 3 months : 0.29).

The mean testosterone levels during serial sampling were higher in the Romanov (4 weeks : 3.20 ± 0.20 ; 12 weeks : 4.51 ± 0.46 ng/ml) than in the Ile-de-France (4 weeks : 0.66 ± 0.21 ; 12 weeks : 1.19 ± 0.16 ng/ml) (table 1).

C) *FSH*. — Mean plasma levels of FSH increased from the first neonatal week until 8 weeks in the Romanov (2.0 to 3.20 ng/ml) and till 12 weeks of age in the Ile-de-France (2.75 to 3.80 ng/ml) ; these mean levels decreased slightly and plateaued later on in both groups of lambs (fig. 1). FSH was not secreted in a pulsatile manner in either group. At 4 and 12 weeks of age, the mean plasma FSH levels during serial sampling were similar in the Romanov (4 weeks : 2.88 ± 0.12 ; 12 weeks : 2.58 ± 0.16 ng/ml) and the Ile-de-France (4 weeks : 2.89 ± 0.20 ; 12 weeks : 2.62 ± 0.02 ng/ml) (table 1).

D) *Ratio of testosterone to LH*. — The ratio of mean plasma testosterone to mean plasma LH did not differ significantly between the breeds at 4 weeks of age but was doubled in Romanov as compared to Ile-de-France at 12 weeks of age.

TABLE 1

A comparison of the hormonal parameters in spring-born Romanov and Ile-de-France ram lambs during serial sampling at 4 and 12 weeks of age.

Age		Romanov	Ile-de-France	
4 weeks	LH	no. of puls./h	0.48	0.20
		mean (ng/ml)	5.7 ± 0.6	0.9 ± 0.23
	Testosterone	no. of puls./h	0.36	0.12
		mean (ng/ml)	3.2 ± 0.2	0.66 ± 0.21
	FSH		2.88 ± 0.12	2.89 ± 0.02
	12 weeks	LH	no. of puls./h	0.49
mean (ng/ml)			4.32 ± 0.6	2.53 ± 0.08
Testosterone		no. of puls./h	0.48	0.29
		mean (ng/ml)	4.51 ± 0.46	1.19 ± 0.16
FSH		mean (ng/ml)	2.58 ± 0.16	2.62 ± 0.02

Discussion.

Differences in mean plasma levels of LH have been observed previously between the Romanov and the Ile-de-France breeds (Thimonier, 1975). However, a comparison between weekly sampling and the frequency of LH pulsatile discharges in serial sampling in both breeds indicates that the LH pulses should have peaked around the second month in the Romanov (Lafortune *et al.*, 1984) and the third month in the Ile-de-France. This might explain why the increase in LH pulsatility between 1 and 3 months of age in Ile-de-France lambs was not observed in the Romanov. An increase of this type has been noted in crossbred lambs (Foster *et al.*, 1978 ; Savoie *et al.*, 1979).

The changes in mean plasma testosterone levels are also similar to those reported previously (Cotta *et al.*, 1975 ; Lee *et al.*, 1976 ; Garnier *et al.*, 1978 ; Walton *et al.*, 1980), thus confirming a genetical difference in testosterone secretion during the first week of age (Garnier *et al.*, 1978).

Breed differences have not been observed previously ; they could be related to the fact that there are twice as many LH binding sites per Leydig cell in Romanov as in Ile-de-France lambs at 120 days of age, but the total number of Leydig cells per testis is only 1.5 times higher in the former than in the latter (Barenton *et al.*, 1983).

Mean plasma FSH levels did not differ significantly between Romanov and Ile-de-France lambs. Comparisons between ram and ewe lambs of low and high fecundity revealed no differences in plasma FSH levels in the rams, while in the

ewes the level of FSH was increased at 6 weeks of age in the high fecundity flock (Findlay and Bindon, 1976). Similar results have been reported in the Lacaune breed showing that the male offsprings of the high-fecundity flock did not differ from the others, while the female offsprings had higher FSH levels at 3 weeks of age as compared to the low-fecundity flock (Ricordeau, Blanc and Bodin, 1984).

However, there are considerable differences in the total number of Sertoli cells per testis (de Reviens *et al.*, 1980 : higher in the Ile-de-France than in the Romanov) and in the number of FSH binding sites per Sertoli cell (Barenton *et al.*, 1983 : higher in the Romanov than in the Ile-de-France).

In conclusion, we have shown differences in LH secretion and in testicular testosterone production during the same season, the highest levels occurring in the Romanov. The prolificacy of this breed is higher than that of the Ile-de-France breed.

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Résumé. *Evolutions comparées des teneurs plasmatiques de LH, de FSH et de la testostérone chez des agneaux nés au printemps, de races Ile-de-France ou Romanov.*

L'effet de l'origine génétique des agneaux de race Ile-de-France et Romanov sur les teneurs plasmatiques, en hormones gonadotropes et en testostérone, a été analysé durant la période prépubertaire chez des agneaux mâles nés au printemps. Le niveau maximum de LH dans le plasma est atteint au cours de la 8^e semaine dans la race Romanov et au cours de la 12^e dans la race Ile-de-France. A l'âge de 4 semaines, les nombres de décharges pulsatiles de LH et de testostérone sont plus élevés chez les agneaux de race Romanov que chez les Ile-de-France.

Les teneurs plasmatiques moyennes de testostérone sont toujours plus élevées chez les agneaux Romanov que chez les Ile-de-France.

Les teneurs plasmatiques moyennes de FSH augmentent comme celles de LH dans les 2 races mais ne diffèrent pas significativement entre races.

Les sécrétions plus élevées et plus précoces de LH et de testostérone chez le Romanov comparées à l'Ile-de-France pourraient être reliées à la prolificité supérieure de cette race.

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