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Short Paper

Effect of early tail-docking on luteinizing hormone pulse frequency in fat-tailed Tuj ewe-lambs

Kaya, M.[1*]; Cenesiz, M.[1]; Onder, F.[2]; Uzun, M.[3] and Yildiz, S.[4]

[1]Department of Physiology, Faculty of Veterinary Medicine, Ondokuz Mayis University, Samsun, Turkey; [2]Vocational School of Health Services, Akdeniz University, Antalya, Turkey; [3]Department of Physiology, Faculty of Medicine, Canakkale Onsekiz Mart University, Canakkale, Turkey; [4]Department of Physiology, Faculty of Medicine, Inonu University, Malatya, Turkey

[*]**Correspondence:** M. Kaya, Department of Physiology, Faculty of Veterinary Medicine, Ondokuz Mayis University, Samsun, Turkey. E-mail: kayam@omu.edu.tr

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Summary

The aim of the study was to investigate the effect of tail-docking on the LH pulse frequency in female Tuj lambs. Twelve female lambs were assigned into two equal groups. A rubber ring was applied to the base of the tail for shedding off. Blood samples were collected for 8 h in the 4th and 8th months of age to determine pulsatile secretion of LH. Starting from the age of 6 months, blood samples were taken thrice weekly for progesterone analyses. There was no LH pulse in the first LH analysis but the pulses were observed in both groups in the second LH analysis. However, number of pulses was not different between groups. The plasma progesterone level was less than 1 ng/ml throughout the breeding season. In conclusion, there was no effect of the tail-docking on pulsatility of LH in fat-tailed female lambs.

Key words: Lamb, Tail-docking, Puberty, LH, Progesterone

Introduction

In mammals, and especially in ewe-lambs, there is interplay among hypothalamus, pituitary, pineal gland and gonads. Gonadotropin-releasing hormone (GnRH) and luteinizing hormone (LH) pulsatility play an important role in timing of sexual puberty. While number of LH pulses is either low or absent at the initial prepubertal period, negative effect of oestradiol on LH pulsatility disappears towards the end of this period and then LH pulses are observed (Huffman *et al*., 1987). Finally, number of LH pulses sufficiently increases till the occurrence of puberty. Duration of prepubertal period depends both on internal (hypothalamo-pituitary-gonadal interactions) and external (season, management, nutrition, live-weight etc.) cues (Kinder *et al*., 1995).

Puberty is primarily dependent on attainment of critical body weight (BW) that is a prerequisite for successful pregnancy. Body fat reserve affects both timing of puberty and successful breeding activity during postpubertal period (Houseknecht *et al*., 1998). Leptin is one of the mediators for reproductive axis because its plasma concentration is associated with amount of adipose tissue (Matkovic *et al*., 1997) and body condition score (Delavaud *et al*., 2000).

In some of the fat-tailed sheep breeds such as Morkaraman, Akkaraman and Tuj, native breeds in Turkey, tail fat constitute 5-10% of BW (Teke and Unal, 2009; Tilki *et al*., 2010). We hypothesize that fat in the tail may be a strategic fat resource for reproductive activity of these breeds. Therefore, we investigated whether there is any effect of early tail-docking in female lambs on LH pulsatility throughout prepubertal period in the study.

Materials and Methods

Animals and experimental design

The study was conducted in the Kafkas University farm in Kars, Turkey. This study was approved by the Ethics Committee of University of Kafkas (approval No. 2004/08). The ewes, synchronized by using progestagen impregnated sponges, became pregnant by mating and the female lambs born to them were used in the study. A total of 12 female Tuj lambs were divided into two equal groups as control and docked groups. Tail-docking was carried out within 3 days after birth by using a special elastrator ring. All lambs were kept with their dam throughout the study period. The dams were fed with high quality grass and barley until grazing season. Fresh water and mineral blocks were supplied as *ad libitum*. Body weight and body condition score (BCS) were recorded on postnatal days 3, 15, 30, 45, 60, 90, 135, 240 and 300. BCS was determined according to Russel *et al*. (1969), on the scale of 1-emaciated to 5-obese. Lambs were inspected to determine oestrous behaviour and controlled to detect oestrus using teaser rams from the lambs that were 6-month-old to end of the study.

Blood collection and analysis

Blood samples were collected for 8 h (with 15 min intervals) at 4 and 8 months of age to determine pulsatile secretion of LH. To monitor the ovarian activity, thrice weekly blood samples were taken for 105 days during the natural breeding season in autumn when the lambs were 6-month-old. Serial blood samples were drawn by jugular venipuncture into tubes containing EDTA and immediately centrifuged at 3000 rpm for 15 min. Plasma was separated and stored at -20°C until the analyses. Enzyme immuno-assay method was used to determine LH (Mutayoba *et al*., 1990) and progesterone (Prakash *et al*., 1987) levels.

Statistical analysis

Mean and standard deviation (SD) were calculated using MINITAB statistical package (Version 11.2, MINITAB Inc., State College, PA, USA). Data were presented as mean ± SD. Serial samples for LH were analysed for pulses using PC PULSAR program developed by Merriam and Wachter (1982). BW, BCS and LH data were analysed by Student's t-test for group differences, and were analysed by paired t-test for sampling differences. The differences were considered as significant when P-values were less than 0.05.

Results

There was no difference between the groups in BW and BCS during the study (Table 1).

Table 1: Average body weight and body condition score in control and tail-docked groups (Mean±SD, P>0.05 throughout the study period)

Days	BW (kg)		BCS	
	Control group	Docked group	Control group	Docked group
0	4.6±0.7	4.3±0.3	2.5±0.2	2.5±0.1
15	7.4±0.2	7.2±0.7	2.6±0.2	2.6±0.2
30	9.5±1.2	9.6±1.8	2.5±0.2	2.6±0.3
45	11.5±2.0	11.4±1.5	2.5±0.2	2.6±0.3
60	12.0±1.0	13.9±1.4	2.4±0.1	2.4±0.2
90	15.1±1.5	17.6±0.5	2.5±0.2	2.7±0.3
135	23.8±7.2	25.8±2.5	2.6±0.2	2.7±0.2
240	30.8±0.6	28.7±2.9	2.7±0.3	2.5±0.0
300	30.4±2.9	33.7±3.2	2.6±0.3	2.8±0.1

BW: Body weight, and BCS: Body condition score

There was no LH pulse in the first LH sampling period and also the mean concentration of LH of the control was similar to that of the docked group (Table 2). There was no difference in groups for LH pulses observed in the second LH sampling period. Mean LH concentration of the control in the second LH sampling period was higher ($P<0.05$) than those of the others. Pulsatile LH release during the first and second LH sampling period was shown in Fig. 1 for a representative tail-docked lamb. There was no correlation among LH parameters, BW and BCS.

Plasma progesterone level was less than 1 ng/ml during the study and not different in the groups. Oestrous behaviour was not detected in lambs.

Discussion

This is the first study to investigate the

Table 2: LH data obtained from control and docked groups at 1st and 2nd sampling periods (Mean±SD)

LH parameters	1st sampling period		2nd sampling period	
	Control group	Docked group	Control group	Docked group
Mean concentration (ng/ml)	0.57 ± 0.17[a]	0.58 ± 0.38[ab]	0.75 ± 0.24[b]	0.66 ± 0.11[ab]
The frequency of pulses (pulses per 8 h)	-	-	1.33 ± 0.52	1.50 ± 1.05
The amplitude of pulses (ng/ml)	-	-	2.63 ± 0.69	2.64 ± 0.39
Duration of pulses (min)	-	-	60.00 ± 33.20	32.50 ± 24.40

[a, b]: Different letters at the same row denote statistical difference (P<0.05)

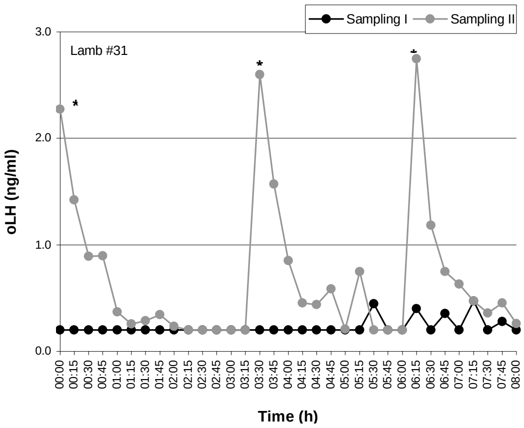

Fig. 1: Individual LH pulse graphics at the 1st and 2nd sampling time of a representative tail-docked lamb (* denotes pulses detected by PCPULSAR program)

effect of early tail-docking on pulsatile LH release and there was no effect according to data which was obtained from the study.

Hypothalamus is the crossroad between neuronal and hormonal system and takes all internal and external cues to decide commencement of reproductive activity. Galloway and Pelletier (1974) reported that there was an increase in the amount of pituitary LH stores in lambs from the 1st to 20th week and LH secretion can be induced by GnRH. Our previous study in Tuj lambs (Kaya *et al*., 2005) supported the phenomenon. LH pulse was not detected in the first LH analysis of this study. This result was consistent with that of Foster *et al*. (1975), Huffman *et al*. (1987) and Meikle *et al*. (1998) who reported that LH level was very low or there was no LH peak in prepubertal female lambs.

In the second LH analysis of this study, LH parameters were not different in the groups. In our study, the reason for detecting low LH values in the second LH analysis may be attributed to lambs' BW which was insufficient for puberty. Ebling *et al*. (1990) also stated that even if the pituitary function was sufficient, inadequate BW caused a low frequency of episodic LH secretion and delayed puberty. I'Anson *et al*. (1997) reported that lambs with growth retardation had low LH pulse (0-1 pulse/4 h), and fewness in frequency of LH pulse lasted till lambs reached appropriate BW.

The rise in plasma progesterone level above 1 ng/ml was accepted as an indicator of ovarian activity and was used to determine puberty (Meikle *et al*., 1998). In the present study, progesterone levels did not rise above 1 ng/ml and neither ovarian activity nor oestrous behaviour was observed in lambs.

We hypothesize that fat in the tail may play a crucial role as a fat resource for pubertal improvement of fat-tailed breeds. Some substances secreting adipose tissue such as leptin, adiponectin, resistin are associated with improvement of reproductive activity (Wilkinson *et al*., 2007). Although tail-docking prevents fat accumulation in the tail, it might promote accumulation of adipose tissue in other parts of the body such as subcutaneous, omental, perirenal (Marai *et al*., 1987; Bingol *et al*., 2006) and carcass fat (Bicer *et al*., 1992).

In conclusion, early tail-docking did not affect LH pulsatility in prepubertal period. The reason is probably due to compensation of fat deposits accumulated in the different parts of the body.

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