ONSET OF PUBERTY IN EWE LAMBS AS INFLUENCED BY DIETARY YEAST CULTURE SUPPLEMENTATION

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ABSTRACT

Twenty-one crossbred ewe lambs, aged four months and weighing 21.4 kg, were used in this study. The lambs were divided randomly into three similar groups each of seven. The first and second group (G_1 and G_2) were fed the control ration supplemented with yeast culture (YC) at a rate of 0.05 and 0.025% of live body weight, respectively. While the third group (G_3) was fed the control diet without any additive. The experiment was terminated after 180 days of feeding. Animals were weighed and blood samples were collected biweekly from each animal for progesterone measurement and assessment of puberty. The average daily gain during the experimental period was higher ($P < 0.05$) in lambs fed 0.05% YC in comparison with those fed 0.025% YC or the control diet. Lambs in G_1 and in G_2 reached puberty 17 and 13 days earlier, respectively, than those fed the control diet without additives. Progesterone concentration at puberty was higher in ewe lambs fed YC than those on the control diet.
Keywords: Lambs, yeast culture, age, progesterone.

INTRODUCTION

Endocrine glands that regulates reproductive functions are greatly affected by the nutritional quality of feed. Onset of puberty and estrus in ewe lambs were affected by weight, body condition and/or nutritional status (Dyrmundsson, 1981). Several authors reported that addition of yeast culture (YC) to ration increased live body weights, average daily gain, dry matter intake in feeder calves and lambs (Cole *et al.*, 1992), nitrogen retention in Merino sheep (Al-Jassim *et al.*, 1986 and Al-Jassim and McManus, 1985) and improved feed conversion efficiency and blood constituents (Metwally *et al.*, 2001). As well as, Rouzbehan *et al.* (1994) and Kmet *et al.* (1992) found that supplementation of YC to ration enhanced cellulase, alpha-amylase and pectinase activities and decreased urease activity in sheep. Adequate nutrition affects body condition, which in turn increases hypothalamic activity, GnRH secretion and ovulation rates (Thomas *et al.*, 1987). The present study was conducted to investigate the effect of dietary

supplementation of yeast cultures (YC) in onset of puberty and estrus on crossbred ewe lambs as monitored by plasma progesterone concentrations.

MATERIALS AND METHODS

Twenty-one young crossbred (1/2 Romanov and 1/2 Rahmani) ewes lambs belonging to the Mehallet Mousa Experimental Station, Animal Production Research Institute, Ministry of Agriculture, were used in this study. The experiment was initiated as ewes aged four months and weighing 21.4 kg. The animals were stratified by weight and randomly divided into three groups each of 7 and were housed in three separate semi open pens. They were fed concentrate mixture (CM) and wheat straw throughout the experimental period. Soybean meal was added to adjust the protein and energy levels according to NRC (1988) requirements. Chemical composition of feed mixture are presented in Table (1). The first and second group (G_1 & G_2) were supplemented with 0.05 and 0.025% yeast culture (YC) per kg of live body weight, respectively, for six months. While the third group (G_3) was used as control without YC addition.

Body weight of lambs was measured bi-weekly. Blood samples were collected from each ewe biweekly by Jugular vein puncture into heparinized tube, then centrifuged at 3000 rpm for 15 minutes. Plasma samples were separated and stored at –20°C until use for progesterone assay by radioimmuonoassay (RIA) technique. The concentration of plasma progesterone was used to detect onset of puberty (first ovulation) as described by Fitzgerald *et al.* (1982) and Day *et al.* (1984). Incidence of estrus was tested using 2 vasectomized rams, which allowed to run 3 times daily with the ewes for 30 minutes each time. Laparoscopy technique was employed to visualize and examine the changes in ovarian structures. The Laparoscopy was conducted using Walf/8933/7 mm, Laparoscope made in U.S.A. The ewes were deprived of feed and water for 16 hours before Laparoscopic examination which was conducted 7-12 days after the detected estrus. Data were statistically analysed using the general linear models procedures according to SPSS (1997).

Table (1): Feed ingredient and chemical composition of the experimental diet.

Ingredients	DM	OM	CP	CF	EE	NFE	Ash
CM	90.18	82.09	18.66	10.25	4.15	49.0	8.09
Wheat straw	90.78	78.18	---	34.15	1.15	42.88	12.60
Soybean meal	91.61	84.00	36.58	9.41	3.49	34.52	7.61
Yeast culture	92.30	82.95	26.70	6.92	2.77	46.56	9.25

RESULTS AND DISCUSSION

Average daily gain during the experimental period (180 days) was greater ($P < 0.05$, Table 2) for the lambs fed the 0.05% YC (91.7 g/day) than those fed 0.025% YC (77.8 g/day) and control diet (75.0 g/day). In the meantime, there was no significant difference in daily gain between lambs fed 0.025% YC and control diet. Ewe lambs supplemented with YC also had heavier ($P < 0.05$) body weight at puberty than control. These results are in harmony with those obtained by Adams *et al.* (1981) and Garcia and Elias (1990). This increase in body weight by YC supplementation might be due to stimulation of rumen microbial synthesis of protein and/or volatile fatty acids production, improvement of feed conversion efficiencies and maintenance of a desirable rumen pH (Hutjens, 1993, Rouzbehan *et al.*, 1994 and Metwally *et al.*, 2001). Cole *et al.* (1992) found that steers or lambs fed on yeast culture (YC) tended to maintain heavier weights and higher dry matter intake than did steers or lambs fed control diet. In the present study, ewe lambs treated with 0.05 and 0.025% YC (Table, 2) reached puberty 17 and 13 days earlier ($P < 0.05$) than those fed on control diet.

Table (2): Live body weight, body weight gain and age at puberty as affected by YC supplementation.

Items	Treatments		
	0.05% YC (G_1)	0.025 YC (G_2)	Control (G_3)
Number of lambs	7	7	7
Initial age (day)	118 ± 0.57	121 ± 0.68	118 ± 0.47
Initial weight (kg)	22.0 ± 1.22	21.75 ± 0.63	20.50- ± 0.87
Final weight (kg)	38.50 ± 2.07^{a}	35.75 ± 1.33^{ab}	34.0 ± 0.71^{bc}
Daily gain (g)	91.7	77.8	75.0
Age at puberty (day)	231.0 ± 5.23^{a}	235.4 ± 4.56^{a}	248.1 ± 3.55^{b}
Weight at puberty (kg)	32.6 ± 2.25^{a}	31.6 ± 2.01^{a}	30.1 ± 2.17^{b}

a, b , c between treatments for each character, with different superscripts significant at ($P < 0.05$)

Fast growing ewe lambs would exhibit their first estrus and reach sexual maturity at a younger age and heavier body weight than those growing at slower rates (Dyrmundsson, 1981). Accordingly, inadequate nutrition of ovine and bovine females during sexual development resulted in a delay in onset of puberty (Day *et al.*, 1986; Kurz *et al.*, 1989 and El-Barody *et al.*, 1993). In our study, the delay in puberty in lambs fed the

control diet might be attributed to restrict the response of the pituitary to LHRH and therefore a decrease in the secretion of LH. The occurrence of first estrus (puberty) as well as any other estrus are generally followed by ovulation and *Corpus luteum* development, and an increase in plasma progesterone concentration. The mean biweekly values of plasma progesterone concentration in the three treated groups (Fig. 1, 2 and 3 and Table 3) throughout the first 100 days were similar and remained below 0.4 ng/ml. Then progesterone concentration increased reaching 1.5, 1.3 and 1.1 ng/ml at (puberty) 231, 235 and 248 days for G_1, G_2 and G_3, respectively. The present findings agreed with those reported by Fitzgerald *et al.* (1982) and El-Barody *et al.* (1993). In fact the physiological signal linking the first ovulation, normal *Corpus luteum*, function and progesterone secretion to nutrition and growth rates appears to be directly related to pulsatile LH secretion (Foster *et al.*, 1984). Plasma progesterone concentration during day of estrus (day 0) and the subsequent 3 days was very low in the three treatments (Fig. 4) ranging from 0.1 to 0.4 ng/ml. Thereafter, the concentration in all treatments gradually increased reaching a peak between day 9-12 which varied between treatments in day of peak and progesterone concentration (4.8-6.0 ng/ml). Then concentration gradually decreased reaching a minimum value on day 17 and 18.

Table (3): Mean of progesterone concentration during the first estrus (puberty) for different treatments.

Items	Treatments		
	G_1	G_2	G_3
Number reached puberty	7/7	7/7	7/7
Progesterone level (ng/ml)	1.5 ± 0.11	1.3 ± 0.12	1.1 ± 0.13

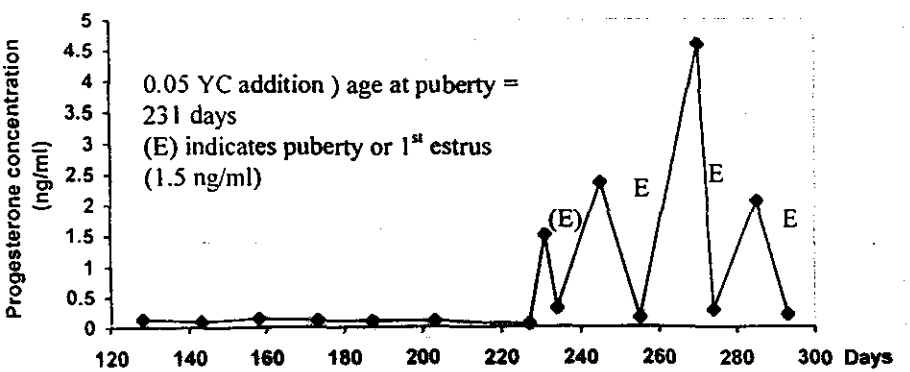

Fig. (1): Plasma progesterone concentration before and after puberty in 0.05 YC supplemented lambs.

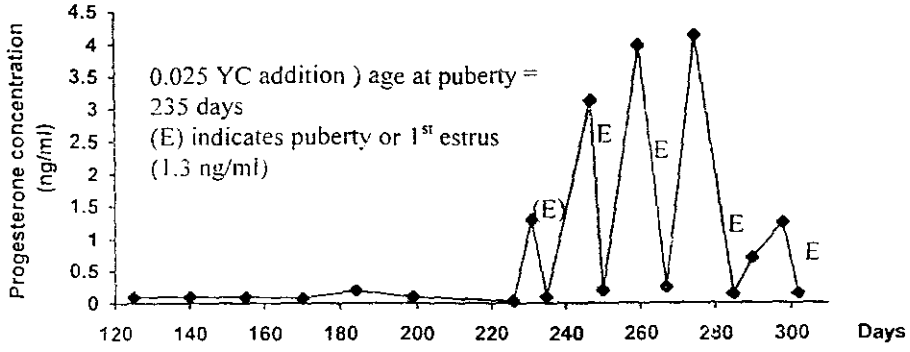

Fig. (2): Plasma progesterone concentration before and after puberty in 0.025 YC supplemented lambs.

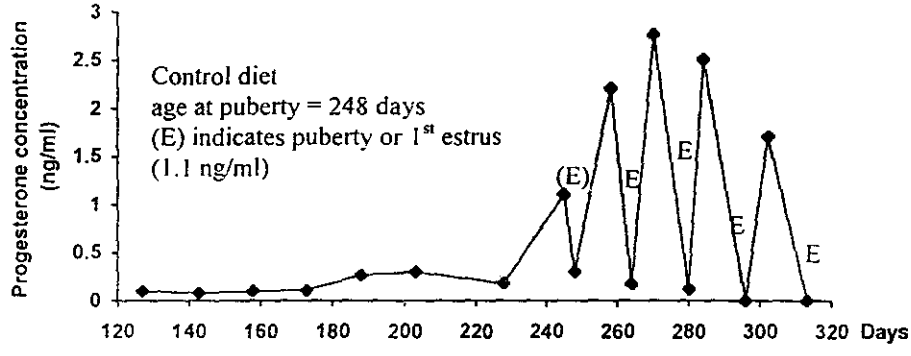

Fig. (3): Plasma progesterone concentration before and after puberty in control diet lambs.

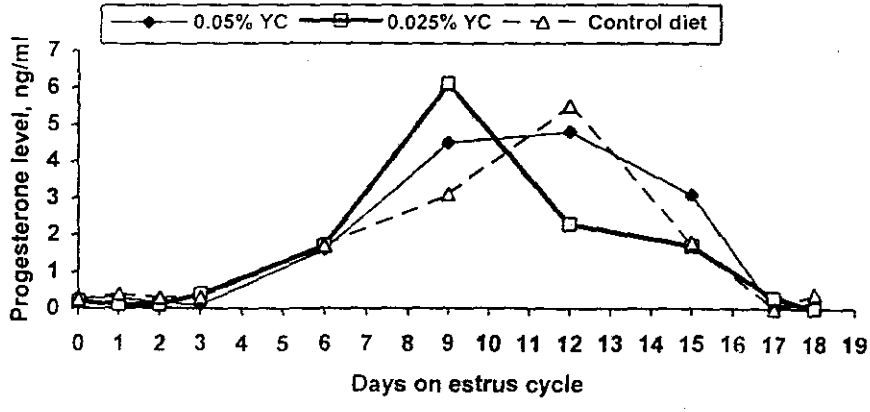

Fig. (4): Plasma progesterone concentration profile in the different trends crossbred ewe lambs.

Results of plasma progesterone concentrationare are relatively higher than those reported by Dickie and Holzmann (1992) and Deghedy (2000). They stated that maximum luteal phase progesterone concentration was approximately 2-4 ng/ml, and its lowest concentration at the day of estrus ranged from 0.15 to 0.25 ng/ml. In situation of adequate nutrition, the hypothalamus remains hyperresponsive to positive feedback of estradiol and secretion of LHRH and thus LH and gonadal steroids are high (Cupps, 1993).

Table (4): Number of mature follicles and *Corpus luteum* as affected by yeast culture (YC) supplementation.

Groups	No. of ewes	No. cycle/ ewe	Mature follicles						*Corpus luteum*					
			R.O		L.O		Average No/cycle		R.O		L.O		Average No/cycle	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
G_1	7	2	1.38	57.6	1.0	42.4	2.38	100	1.07	55.6	0.86	44.4	1.93	100
G_2	7	2	1.0	56.0	0.79	44.0	1.79	100	0.86	54.6	0.71	45.6	1.57	100
G_3	7	2	0.86	54.5	0.71	45.5	1.57	100	0.64	56.3	0.50	43.7	1.14	100

R.O = Right ovary L.O = Left ovary

Data in Table (4) show that all ewe lambs were endoscoped 7-12 days after the first two successive exhibited estrus. It was also appeared that the average number of mature follicle/ewe/cycle in both right and left ovaries in lambs fed 0.05% YC (G_1) was higher (2.38) than those fed 0.025% YC (G_2) and control diet (1.79 and 1.57, respectively). Meanwhile, the corresponding values for the presence of *Corpus luteum* (CL) were 1.93, 1.57 and 1.14 for the three groups, respectively. The present results showed also that the right ovary was more active than the left one in all treated groups. The present finding agrees but values are relatively higher than that observed by Scaramuzzi and Downing (1997) and Deghedy (2000). The interaction which exists between nutrition and reproduction in sheep is well known (Scaramuzzi and Murray, 1994).

Increased nutrient intake might cause an increase in hepatic oxidase activity, thereby increasing the rate of degradation of steroids and lessening the inhibition of the hypothalamic-pituitary axis and resulting in increased gonadotropin secretion and ovulation rate (Thomas *et al.*, 1987).

The results of the present study showed that the addition of dietary YC led to an increase in daily gain, attainment of puberty at earlier age and heavier body weight and an increase in the number of mature follicles and *Corpus luteum*/ewe/cycle (ovulation rate) than those lambs fed diet without YC addition.

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بداية البلوغ فى اناث الحملان وتأثره بإضافة الخميرة

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الملخص العربى

استخدم فى هذه الدراسة عدد (٢١) حمل عمر ٤ شهور ووزن ٢١,٤ كجم وقد قسمت الحملان عشوائيا إلى ثلاثة مجموعات متشابهة كل مجموعة بـــها (٧) حملان. فى المجموعة الأولى والثانية أضيفت الخميرة بنســب ٠,٠٥ ، ٠,٠٢٥% من الوزن الحى للحيوان بينما المجموعة الثالثة ظلت بدون إضافة وقــد اســتمرت فترة التجربة لمدة ١٨٠ يوم وقد تم وزن الحيوان وتجميع عينات الدم مـــرة كــل أسبوعين من كل نعجة وذلك لقياس تركيز هرمون البروجسترون وكذلــك تجديــد البلوغ.

كان متوسط الزيادة اليومية فى الوزن مرتفعا للحملان التى أضيــف إلــى عليقتها ٠,٠٥% خميرة بالمقارنة بالمجموعة الثانية والثالثة. الحملان التى أضيفت إليها الخميرة فى المجموعة الأولى والثانية وصلت إلى البلوغ مبكرا بمقــدار ١٧ ، ١٣ يوم عند مقارنتها بالمجموعة الضابطة. تركيز هرمون البروجســترون عنــد البلوغ كان عاليا فى مجموعتى الحملان التــى غذيــت علــى الخمــيرة مقارنــة بالمجموعة الضابطة.

وجد من هذه الدراسة أن إضافة الخميرة للحملان النامية أدى إلــى زيــادة معدل نموها ووصولها إلى مرحلة البلوغ مبكرا وكذلك أدت إضافة الخمــيرة إلــى زيادة نشاط المبيض من حيث عدد الحويصلات الناضجة أو عدد الأجسام الصفــواء لكل دورة شياع عند مقارنتها بمجموعة الكنترول.