

EFFECT OF AGE ON OVA WASTAGE, UTERINE EFFICIENCY AND LITTER SIZE IN CAMBRIDGE SHEEP

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SUMMARY

A total number of 59 adult ewes (>2 years) and 32 ewe lambs (8 months old) of Cambridge breed of sheep was used for the study. Ewes were detected for estrus by vasectomized teaser ram and then mated to fertile rams. Ewes were examined for ovulation rate (OR) by endoscopy at 5-10 days after seen in estrus.

Age had a highly significant effect ($P < 0.01$) on OR. Adult ewes produced more ova than ewe lambs (2.78 vs 2.28). Increasing disproportionality of ovulation rate between ovaries resulted in lower litter size (LS). Adult ewes tended to yield higher ($P < 0.01$) LS than ewe lambs (2.34 vs 1.41). While ewe lambs showed higher percentage of ova wastage (OW) than adult ewes (1.41 vs 0.93). Uterine efficiency (UE) was greater in adult than in ewe lambs (0.73 vs 0.35). Uterine efficiency declined as the imbalance of ovulations between ovaries increased.

This study showed that the reproductive performance of adult ewes was characterized by low OW and high UE when compared to ewe lambs.

Keywords: Sheep, ovulation rate, litter size, ova wastage, uterine efficiency

INTRODUCTION

Litter size is one of the most important economic traits to assess sheep production capacity. This trait is affected by genetic merit (Bromley *et al.*, 2000), age (AL-Mahdy, 1987), ovulation rate, embryo survival (Hanrahan and Quirke, 1985 and Maijala, 1996) and uterine efficiency (Meyer, 1985), thus litter size is considered mainly as a maternal trait.

Age was reported to influence ovarian function of sheep (Quirke *et al.*, 1983). Ewe lambs have poor reproductive performance as compared to adult ones (Quirke, 1981). This is attributed mostly either to their lower ovulation rate and / or their immature uterine efficiency. However, little published information are available on both traits (Maijala, 1996 and Fahmy, 1996).

Development of endoscopy technique provides an accurate procedure to determine ovulation rate. The difference between ovulation rate and litter size at

lambing is a reliable method to be applied for estimating rate of ova wastage as well as uterine efficiency.

The purpose of the present work is to investigate age effect on ova wastage and uterine efficiency and their contribution to litter size in sheep using endoscopy technique.

MATERIALS AND METHODS

Ninety-one Cambridge female sheep belong to University of Wales flock, Bangor were used in this study. Ewes were divided into two age groups: adult ewes >2 yr, (n = 59) and ewe lambs of eight month old (n = 32). Ewes were fed to cover their requirements according to NRC (1975). Throughout the mating season, ewes were detected for the onset of estrus twice daily (9 am and 4 pm) using vasectomized teaser ram and then mated to fertile rams. Ewes seen in estrus were examined for ovulation rate (OR, number of corpora lutea) by endoscopy 5-10 days after the onset of estrus according to the procedure of Oldham and Lindsay (1980). Dates of mating and lambing as well as litter size (LS) at lambing were recorded for each ewe.

Ova wastage (OW) was calculated as the difference between number of recognized corpora lutea (CLs) after fertile service and litter size at lambing. Uterine efficiency (UE) is defined as the marginal response in LS from one more egg and it is measured in ewes conceiving from multiple ovulations. The UE was calculated as the proportion of additional eggs (after the first) represented by additional lambs born, using the following formula: $UE = (LS - 1) / (OR - 1)$.

Effect of ovulation pattern (OP, number of shedded ova from one ovary to those from the other one) on litter size within the studied age groups was also investigated.

Data were analyzed using general linear model of SAS (1995). Differences among means between age groups were tested statistically with Multiple Range test method according to Duncan (1955).

RESULTS AND DISCUSSION

Table (1) gives the frequency distribution for ovulation rate, litter size and ova wastage as affected by age indicating better traits for adults ewes. Results showed that about 98% of adult ewes ovulated 2 ova vs. 90% in ewe lambs and the percentage of those ovulated >2 ova was nearly double of ewe lambs. Percentage of ewes which gave birth of 2 lambs was 88.6% in adult ewes, while the corresponding figure in ewe lambs was 34.4%. Meanwhile, percentage of adult ewes that showed ova wastage was less (52.2%) than ewe lambs (76%). This is consistent with the results of Gabr *et al.* (1989) who found that ewes ovulated 2 ova had higher OW than those ovulated single ovum. Moreover, ova wastage was found to be 26% and 18% in Finnsheep and Dorset-Leicester-Suffolk breeds, respectively (Fahmy and Dufour, 1988).

Average of ovulation rate and litter size were higher ($P < 0.01$) in adult ewes than ewe lambs (Table 2). The present results indicate that in Cambridge sheep advancement of age improved ovulation rate by 22%. This is similar in trend to the

results of Meyer (1985) reporting 20 % more in ovulation rate of mature ewes relative to young ones. This is most probably attributed either to the smaller ovaries which contain less recruited follicles per cycle or immature pituitary-ovarian axis which results in low concentration of circulating FSH and LH hormones in such age (Dyrmundsson, 1987, Ireland, 1987 and Bindon *et al.*, 1996). Litter size in adult ewes was higher than in ewe lambs by 72.3%. Results of more litter size in adult ewes is consistent with the results of AL-Mahdy (1987), Owen and Ap Dewi (1988) and Young and Dickerson (1988). This is because of higher OR and UE and lower OW in adults ewes than in younger ones (Table 2).

Table 1. Frequency distribution (%) of ovulation rate, litter size and ova wastage in adult ewes and ewe lambs of Cambridge sheep breed

Trait	Adult ewes		Ewe lambs	
	N	%	N	%
No. of ewes	59		32	
Ovulation rate				
1	1	1.7	3	10.0
2	11	18.6	17	53.0
>2	47	79.7	12	37.0
Litter size				
1	7	11.8	21	65.6
2	25	42.4	9	28.1
>2	27	45.8	2	6.3
Ovulation wastage				
0	27	45.8	8	25.0
1	18	30.5	11	34.4
2	5	8.4	5	16.6
>2	9	15.3	8	25.0

Table 2. Least squares mean (\pm SE) of ovulation rate, litter size, ova wastage and uterine efficiency in adult ewes and ewe lambs of Cambridge sheep breed

Trait	Mean ($X \pm$ SE)		Significance
	Adult ewes	Ewe lambs	
Ovulation rate	2.78 \pm 0.06 ^a	2.28 \pm 0.11 ^b	**
Litter size	2.34 \pm 0.09 ^a	1.41 \pm 0.11 ^b	**
Ova wastage	0.93 \pm 0.14 ^a	1.41 \pm 0.20 ^a	NS
Uterine efficiency	0.73 \pm 0.05 ^a	0.35 \pm 0.09 ^a	NS

Means with different superscripts in the same rows differ significantly ($P < 0.05$)

** $p < 0.01$, NS: Not significant

The OW was greater in ewe lambs than in adult ewes by 52%. High OW in ewe lambs may be attributed to low quality of shed ova (Quirke and Hanrahan, 1977) and/or unfavourable uterine condition (blood circulation, endometrium development,

uterine glands secretion and level of progesterone, (Meyer and Clarke, 1982; Quirke and Hanrahan, 1983 and Kelly, 1984).

Table 3. Least squares mean (X) of litter size of adult ewes and ewe lambs in relation to multiple ovulations of different ovulation patterns in Cambridge sheep breed

Ovulation rate	Ovulation Pattern	Litter size			
		Adult ewes		Ewe lambs	
		N	X	N	X
Twin	1-1	6	1.83	11	1.18
	2-0	1	1.00	1	2.00
Triple	2-1	7	3.00	2	2.00
	3-0	3	2.00	0	-----
Quadruple	2-2	7	2.86	1	2.00
	3-1	2	3.50	2	1.00
	4-0	1	3.00	0	-----

Effect of ovulation pattern (OP) on LS was obviously observed (Table 3). Adult ewes with twin ovulations, with OP of 1-1 had higher LS than those had 2-0 pattern. The same trend was observed in other categories of OR (i.e, the greater the OR, the higher the LS) indicating higher UE in bilateral than unilateral ovulations. Results of ovulation pattern agree with those reported by White *et al.* (1981) and Meyer (1985) who reported that ewes with bilateral ovulations produced more lambs than unilateral ovulations. Bilateral ovulations result in better uterine efficiency due to the pre-implantation distribution of embryos between the two uterine horns, leading to less embryonic crowd, large space for pre-natal growth and efficient blood circulation (Meyer *et al.*, 1983).

In conclusion, adult ewes are more prolific than ewe lambs due to their high ovulation rate, less ova wastage and efficient uterine function. However, further investigations are needed to clarify the factors that may influence or control ova wastage

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تأثير العمر على فقد البويضات وكفاءة الرحم و حجم الخلفة فى اغنام الكمبردج

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استخدم فى هذه الدراسه عدد ٥٩ نعجة بالغه، ٣٢ حويله من سلالة الأغنام الكمبردج . تم كشف الشياح عن طريق الكيش الكشاف ثم لفتحت الاناث بالكباش المخصبه وفحصت لمعرفة معدل التبويض باستخدام المنظار خلال ٥-١٠ يوم من ظهور الشبق والتأقيح .

كان لعمر النعاج تأثير معنوى (١%) على معدل التبويض حيث أنتجت النعاج البالغة عدداً أكبر من البويضات مقارنة بالحوليات (٢,٧٨ مقابل ٢,٢٨) (وقد ادى اختلال معدل التبويض بين المبيضين الى انخفاض عدد المواليد. حيث أنتجت النعاج البالغه عدد مواليد أكبر من الحوليات (٣,٣٤ مقابل ١,٤١) وأظهرت الحوليات نسبة أعلى من فقد البويضات مقارنة بمثلثها النعاج البالغة (١,٤١مقابل ٠,٩٣) وكانت قيمة كفاءة الرحم فى النعاج البالغة أعلى منها فى الحوليات (٠,٣٧ مقابل ٠,٣٥) . وقد انخفضت كفاءة الرحم مع زيادة الخلل فى التوازن فى معدلات التبويض بين المبيضين .

وتشير الدراسه إلى أفضلية الأداء التناسلى فى النعاج البالغة والتي تميزت بنقص فى فقد البويضات وزيادة كفاءة الرحم مقارنة بتلك للحوليات .