

Length of Estrous Cycle and Duration of Estrus following Natural and Induced Estrus in Korean Native Goats

Lee, J.S., D.J. Song, K.M. Choe* and C.S. Park
College of Agriculture, Gyeongsang National University

山羊의 自然 및 誘起發情時 發情週期 및 發情持續時間에 관한 研究

李枝三·宋又準·崔暎文*·朴忠生

慶尙大學校 農科大學

摘 要

在來山羊의 發情週期和 發情持續期間을 조사하고자 정관 절제 시술한 시정모 산양을 이용하여 90두의 암산양으로부터 3년간에 걸쳐 총 148회의 발정주기를 관찰하였다.

총 481회의 발정주기의 평균기간은 18.1 ± 0.5 일이고, 11일 이하의 短發情週期가 143회 (30%), 12일에서 16일의 中發情週期가 15회 (3%), 17일에서 24일의 正常發情週期가 268회 (56%) 및 25일 이상의 長發情週期가 55회 (11%)로 나타났다.

短發情週期の 발생율은 자연발정후(27%)보다 유기발정후(40%)에 유의적($P < 0.05$)으로 높았고, 그래서 전체적인 발정주기의 기간은 자연 발정후(19.0 ± 0.6 일) 보다 유기발정후(15.2 ± 0.8 일)에 유의적($P < 0.01$)으로 짧았다. 短發情週期에 있어서는 143회중 6일의 기간을 가지는 빈도가 54회 (38%)로 가장 많았으며, 正常發情週期에 있어서는 268회중 21일의 기간을 가지는 빈도가 92회 (34%)로 가장 많았다. 발정지속 시간의 평균은 34.0 ± 0.5 시간이었는데, 발정지속시간에 있어서는 자연발정과 유기발정간에 유의적인 차이가 없었다.

이상의 결과로 在來山羊의 發情週期는 自然發情後에 있어서 보다 誘起發情 後에 유의적으로 짧게 나타나며, 發情持續時間은 自然發情과 誘起發情間에 차이가 없음을 알 수 있다.

I . INTRODUCTION

The length of the estrous cycle of the goat was well reviewed and was found to be extremely varied from cycle as short as 3 days to cycle as long as 62 days (Riera, 1982). However, the majority of estrous cycles are 19 to 21 days in length. Many workers have observed cycles which differ significantly from this normal cycle but generally have considered these abnormal and explainable on some basis other than genetic variance in cycle length.

The length of the estrous cycle in multiparous goat is shorter than these of primiparous or biparous, and estrous cycles are significantly shorter during periods of the year with moderate climatic conditions compared to extreme cool-dry and hot wet periods (Prasad and Bhattacharyya, 1979b). In addition, abnormal short estrous cycles of less than 12 days, and often of only 5 to 7 days, are quite common (Smith, 1986). Prasad and Bhattacharyya (1979

*동아대학교 농과대학(College of Agriculture, Dong-A University)

a) categorized records of 1,099 estrous cycles of the Barbari breed into short, medium and long cycles.

The frequency of each category was 19.7% (6.4 days), 68.8% (19.8 days) and 11.5% (37.5 days), respectively, with an overall mean of 19.2 days. Simplicio et al. (1982) observed that from the 480 estrous cycles, 10.6%, 76.9% and 12.5% were considered as short (shorter than 15 days), medium (15 to 24 days) and long cycle (longer than 24 days), respectively and individual estrous cycle length varied from 5 to 69 days.

Gonzalez and Madrid (1982) reported that the cycle length averaged 20.6 ± 3.2 days but was significantly shorter in young kids than in adults, and short estrous cycles of 3 to 10 days occurred in 17.3% of 502 observations. Sah and Rigor (1985) observed 138 estrous cycles and the cycle length averaged 19.05 ± 0.65 days, with a range of 4 to 14 days. Eiamvitayakorn et al. (1988b) reported 22% of short (7.0 ± 0.7 days), 64.4% of normal (20.6 ± 0.4 days) and 13.3% of long (45.4 ± 0.5 days) cycles from 90 estrous cycles observed.

Duration of estrus also appears to be variable and is influenced by breed types, country, age, season and other factors (Riera, 1982; Jainudeen and Hafez, 1987). The most common duration of estrus reported in the goat was 36 hours with a variation from 3 hours (Sah and Rigor, 1985) to 192 hours (Simplicio et al., 1982) and many other with intermediate duration (Pretorius, 1973; Gonzalez and Madrid, 1982; Simplicio et al., 1986; Younis et al., 1988). The occurrence of estrus for long as 10 days was also reported by Jarosz et al. (1971).

In Korean native goats, the length of estrous cycles and duration of estrus following the natural estrus were observed and compared with the results from induced estrus, although the data were based on the relatively few observations. Therefore, the present study was

undertaken to determine the length of estrous cycles and the duration of estrus from more observations in Korean native goats.

II. MATERIALS AND METHODS

The present work was carried out at Experimental Animal Farm of Gyeongsang National University, 35 °1' north latitude and 128 °1' east longitude for a three-year period. Ninety pluriparous Korean native goats that exhibited clinically normal estrous cycles before field observation were selected for the present experiment. Goats were kept in a pen and fed with grasses and commercially formulated concentrated. Goats were kept in a pen and fed with grasses and commercially formulated concentrates. Water and salt lick were available at all times.

Standing estrus was checked twice daily by vasectomized bucks at 07:00 and 18:00 for 30 to 60 minutes each time. A group of goats were treated with a single intramuscular injection of 3mg PGF₂α on Day 5 to Day 12 of the estrous cycle. Estrous cycles were classified into "short" (shorter than 12 days), "medium" (12 to 16 days), "normal" (17 to 24 days) and "long" (longer than 24 days). Estimation for duration of estrus was same as previously described (Song et al., 1984). Statistical analysis was performed using unpaired T-test and χ^2 -test (Zar, 1984).

III. RESULTS AND DISCUSSION

1. Length of Estrous Cycle

Of 481 estrous cycles observed, 143 were short (6.1 ± 0.1 days), 15 were medium (13.5 ± 0.4 days), 268 were normal (20.7 ± 0.1 days) and 55 were long (37.8 ± 1.7 days). The overall mean length of estrous cycles was 18.1 ± 0.5 days

(Table 1). The length of the estrous cycle was significantly ($P < 0.01$) shorter in the cycle following induced estrus (15.2 ± 0.8 days) than natural estrus (19.0 ± 0.6 days). Short estrous cycles occurred more ($P < 0.05$) frequently following induced estrus (40%) than natural estrus (27%).

The length of estrous cycles in goats varied greatly with range from 3 to 94 days in the present study. The relative frequency of the estrous cycle was 30, 3, 56 and 11% for short (shorter than 12 days), medium (12 to 16 days),

normal (17 to 24 days) and long cycle (longer than 24 days), respectively. Of 481 estrous cycles, 480 cycles fell within 70 days, and only one was recorded as long as 94 days. The short cycles of 6 days long were most common in the group of shorter than 12 days. The frequency distribution in estrous cycle length displayed a distinct model peak on Day 21 (Fig. 1).

The previous data on the estrous cycle of goats also showed a very wide variation (Pretorius, 1973). Riera (1982) reported an extreme variation in the cycle length from short

Table 1. Length of estrous cycle and incidence of short estrous cycle following natural or induced estrus in goats

Type of preceding estrus	No. and length of estrous cycle	Pattern of estrous cycle ¹⁾				Total
		Short (3-11 d)	Medium (12-16 d)	Normal (17-24 d)	Long (≥ 25 d)	
Natural estrus	No. of cycles observed	99	10	213	48	370
	Relative frequency (%)	27 ^a	2 ^a	58 ^a	13 ^a	100
	Length of cycles (days)	6.3 ± 0.2^a	14.2 ± 0.4^a	20.7 ± 0.1^a	38.8 ± 1.9^a	19.0 ± 0.6^A
Induced estrus ²⁾	No. of cycles observed	44	5	55	7	111
	Relative frequency (%)	40 ^b	4 ^a	50 ^a	6 ^a	100
	Length of cycles (days)	5.8 ± 0.2^a	12.1 ± 0.4^a	20.9 ± 0.2^a	31.0 ± 2.4^a	15.2 ± 0.8^B
Total or mean	No. of cycles observed	143	15	268	55	481
	Relative frequency (%)	30	3	56	11	100
	Length of cycles (days)	1.6 ± 0.1	13.5 ± 0.4	20.7 ± 0.1	37.8 ± 1.7	18.1 ± 0.5

1) Means \pm S.E. or percentages with different small ($P < 0.05$) or capital ($P < 0.01$) letters in the same column are significantly different.

2) Estrus was induced by a single intramuscular injection of 3 mg $\text{PGF}_{2\alpha}$ on Day 5 to Day 12 of the estrous cycles.

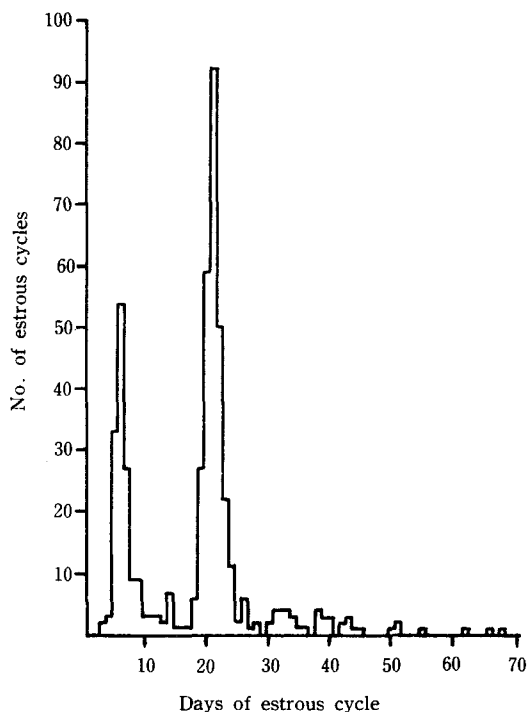


Fig. 1. Frequency distribution in estrous cycle length of a total of 480 estrous cycles observed in Korean native goats.

as 3 days to long as 62 days. Considerable variation in cycle length may be related to breed difference (Jarosz et al., 1971), nutrition (Simplicio et al., 1982), humidity (Simplicio et al., 1982), stage of the breeding season (Camp et al., 1982; Gonzalez and Madrid, 1982; Ramachandraiah et al., 1986; Simplicio et al., 1986), age (Gonzalez and Madrid, 1982) and environmental stress (Jainudeen and Hafez, 1987). Prasad and Bhattacharyya (1979a) using records of 1,099 estrous cycles from the Barbari breed categorized them into short, medium and long cycles and the cycle length was 6.4, 19.8 and 37.5 days, respectively. Song et al. (1984) reported that the length of estrous cycles in Korean native goats was 5.9 ± 0.2 , 21.0 ± 0.1

and 43.7 ± 3.3 days for short, normal and long cycle, respectively.

Sah and Rigor (1985) reported that the length of the estrous cycle was not consistent among individuals. However, the majority of the estrous cycles are 19 to 21 days in cycling goats (Pretorius, 1973; Prasad and Bhattacharyya, 1979a; Gonzalez and Madrid, 1982; Sah and Rigor, 1985; Ramachandraiah et al., 1986; Eiamvitayakorn et al., 1988a; Maria et al., 1988).

In addition to the length of the estrous cycle, Pretorius (1973) reported that 77% of the cycles fell within the range of 16 to 23 days, while 11% were shorter than 16 days and 12% exceeded a period of 23 days. Song et al. (1984) categorized 143 estrous cycles observed into short (shorter than 11 days), normal (18 to 24 days) and long (longer than 25 days), of which the relative frequency was found 31% (5.9 ± 0.2 days), 50% (21.0 ± 0.1 days) and 19% (43.7 ± 3.3 days), respectively. Several studies showed a higher proportion of normal estrous cycles ranging from 64.4% to 92.3% (Prasad and Bhattacharyya, 1979a; Simplicio et al., 1982; Eiamvitayakorn, 1988b; Setiadi et al., 1988). In the present study, the length and the type frequency of the estrous cycle fell, in general, within the previous data for other breeds.

Short estrous cycles were reported in goats (Ott et al., 1980; Camp et al., 1983; Simplicio et al., 1986; Bretzlaff et al., 1988; Park et al., 1989) and in cattle (Schams et al., 1978; Odde et al., 1980; Hinshelwood et al., 1982; Troxel and Kesler, 1984; Copelin et al., 1989). In the incidence of short estrous cycles in goats, Camp et al. (1982) observed that 21 of 48 estrous cycles observed were short with 6.6 days in length. Gonzalez and Madrid (1982) reported that short estrous cycles of 3 to 10 days occurred in 17.3% of 502 goats. We also observed 2 short estrous cycles with 3 days

in length.

Eiamvitayakorn et al. (1988b) observed 22% of short estrous cycles with 7.0 ± 0.7 days in 30 unspecified goats. However, Chemineau (1982) observed the higher percentage (39%) of short cycle, compared to normal (35%) or long cycle (26%). The length of the estrous cycle is closely related to the duration of the luteal phase. Short estrous cycles were associated with the premature luteal regression (Camp et al., 1982, 1983). It was suggested that the premature luteal regression may be related to premature release of endometrial $\text{PGF}_2\alpha$ (Battye et al., 1988; Copelin et al., 1989).

2. Duration of estrus

Duration of estrus was not significantly different between the last natural (33.8 ± 0.6

hours) and induced estrus (34.4 ± 1.1 hours). There was no significant difference in duration of estrus between the length of preceding estrous cycles. The duration of estrus was averaged 34.0 ± 0.5 hours with a range of 18 to 84 hours (Table 2).

Duration of estrus also appears to be highly variable. In goats, individual duration of estrus varied from 3 hours (Sah and Rigor, 1985) to 192 hours (Simplicio et al., 1982). However, the most common duration of estrus stated was 36 hours. Ramachandraiah et al. (1986) reported that the mean duration of estrus was 34.28 hours with a range of 24 to 72 hours. Simplicio et al. (1986) and Younis et al. (1988) observed that duration of estrus was significantly affected by season. Song et al. (1984) reported that dura-

Table 2. Duration of standing estrus at natural or induced estrus in goats

Type of last estrus	No. and duration of standing estrus observed	Preceding of estrous cycle ¹⁾				Total
		Short (3-11 d)	Medium (12-16 d)	Normal (17-24 d)	Long (≥ 25 d)	
Natural estrus	No. of estrus observed	99	10	213	48	370
	Duration of estrus (hours)	33.6 ± 1.3	33.6 ± 4.9	34.5 ± 0.8	31.6 ± 1.7	33.8 ± 0.6^a
Induced estrus ²⁾	No. of estrus observed	44	5	55	7	111
	Duration of estrus (hours)	32.7 ± 1.6	37.2 ± 7.7	35.8 ± 1.4	32.6 ± 4.9	34.4 ± 1.1^a
Total or mean	No. of estrus observed	143	15	268	55	481
	Duration of estrus (hours)	33.1 ± 1.0^a	34.8 ± 4.0^a	34.7 ± 0.7^a	31.7 ± 1.6^a	34.0 ± 0.5

1) Means \pm S.E. with same superscripts in the same row or column are not significantly ($P < 0.05$) different.

2) Estrus was induced by a single intramuscular injection of 3 mg $\text{PGF}_2\alpha$ on Day 5 to Day 12 of the estrous cycles.

tion of estrus was not related to the length of following cycle and the repeatability for duration of estrus was very low.

The present results on duration of estrus agreed with other previous reports (Pretorius, 1973; Gonzalez and Madrid, 1982; Simplicio et al., 1986; Ramachandraiah et al., 1986; Younis et al., 1988; Eiamvitayakorn et al., 1988b; Song et al., 1984). It is generally believed that duration of estrus might be influenced by internal and external factors such as breed, age, season and presence of the male (Janudeen and Hafez, 1987).

IV. SUMMARY

This study was carried out to investigate the length of the estrous cycle and duration of estrus in Korean native goats. The effects of the type of last estrus: induced or natural, and the length of preceeding estrous cycle on the subsequent cycle and duration of estrus in goats were also examined.

From 481 observations, the mean length of estrous cycles was 18.1 ± 0.5 days. The cycle length was significantly ($P < 0.01$) shorter following induced estrus (15.2 ± 0.8 d) than natural estrus (19.0 ± 0.6 d). Significantly higher ($P < 0.05$) incidence of short estrous cycle was observed following induced estrus (40%) than natural estrus (27%). The frequency distribution in the estrous cycle was 30%, 3%, 56% and 11% for short (3-11 d), medium (12-16 d), normal (17-24 d) and long (≥ 25 d), respectively. The most frequent type of short estrous cycle was 6 days in length.

Mean duration of estrus was 34.0 ± 0.5 h with a range of 18 to 84 h. Duration of estrus was not significantly different between the preceeding natural (33.8 ± 0.6 h) and induced estrus (34.4 ± 1.1 h), and was not significantly affected by

the last cycle length. These results suggest that the short estrous cycles are more frequent following induced estrus than natural one, and the duration of estrus are affected greatly by the various intrinsic and extrinsic factors.

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