The Use of Radioimmunoassay to Monitor Reproductive Status of Cheju Native Cattle and the Effect of Supplementary Feeding on Reproductive Performance*

2. Body Weight Changes, Reproductive Performance and Plasma Progesterone Concentrations Pre and Post Calving

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방사선 동위원소 면역기술을 이용한 제주한우 영양급여의 수준이 번식성적에 미치는 영향

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국 문 요 약

營養給與 水準에 따른 濟州韓牛의 分娩後 卵巢作用, 繁殖成績 및 血淸 Progesterone 水準에 關하여 調査하였다. 高營養給與區의 分娩 前後의 牝牛의 體重은 低營養給與區에 比하여 월등히 컸다. 高營養給與區의 分娩後 初排卵과 初發情은 19.5日과 37.8日이었으나 低營養給與區는 各各 73.4日과 111.8日로 현저히 지연되고 있었다. 高營養給與區의 血淸 Progesterone 수준은 分娩後 6주(0.5 ng/ml)에서부터 12주(3.3 ng/ml)까지 점차 증가되었으나 低營養給與區는 分娩後 10주(0.89 ng/ml)에 이르러서야 多少 증가되고 있었다.

Introduction

Nutrient supply pre and post calving is an important factor influencing breeding performance of beef cattle. It can be particularly important in mountainous area, like Cheju Island, where cattle are provided their nutrient requirements only by poor quality grassland. Kim et al. (1980), reported that average age at first estrus and at first calving of Cheju native cattle were 27.8 and 38.0 mo, which on average 10 mo later compared to the mainland Korean native cattle. On average, 174 days elapsed from calving to first

* The work was supported by IAEA. (Contract No.5780 RB, 1985)

estrus when biannual calving cows were included (Kim et al., 1980). This poor breeding performance is thought to be due to undernutrition or nutrient imbalance. Although there is lack of agreement among studies of the effect of nutrient supply on pituitary and ovarian function, some studies showed positive effects of increased nutrient level on reproduction potential, including enhanced pituitary and ovarian function (Rutter and Randel, 1984).

Our previous experiment (Choung et al., 1986) with Cheju native heifers also confirmed a positive effect of adequate nutrient supply on reproductive performance. The study reported here is a continuation of that experiment, designed to evaluate the effect of supplementary feeding on post-partum reproductive performance of Cheju native cows for improving breeding efficiency.

Materials and Method

Eight Cheju native cows were used in previous experiment (Choung et al., 1986). The trial was initiated in June 1984 and 8 Cheju native calves after weaning were randomly assigned in equal numbers on two supplementary feeding levels, these were designed to provide either 100% (standard group) or 70% (restricted group) NRC.

All animals in standard group were fed silage, hay and a balanced ration over the winter period, according to the NRC feeding standard. Animals in the restricted group were fed good quality hay but not balanced rations. Cows in both groups were grazed on improved pasture from May to October. All animals were weighed once per month at the same time during the experimental period. Rectal palpation was performed to monitor ovarian activity, such as the day of first postpartum ovulation, corpus luteum diameter, number of active follicles and ovarian size. Jugular blood was obtained by venipuncture from each cow every two weeks after parturition. The collected samples were kept at room temperature for 2 to 4 hrs and centrifuged at 5,000 r.p.m., after which serum was decanted and stored at -20℃ until radioimmunoassay. Progesterone was assayed using IAEA progesterone kits.

Results and Discussion

1. Body weights

Body weight changes from pre-partum to 6 months after calving related to the different feeding levels are shown in Table 1.

The group supplied adequate nutrition had a higher mean body weight through out the experiment than did the restricted group. Within the 100% NRC group,

Table 1. Body weight changes after parturition related to nutritional levels

(Unit : *kg*)

Nutritional level	Cow No.	Body weight							
		Pre-P	Post-P	1	2	3	4	5	6 mo.
NRC 100 %	1	360	331	305	300	292	298	302	306
	2	370	305	318	320	335	310	295	285
	3	555	518	510	516	528	532	558	553
	4	446	406	404	400	402	412	419	425
	Mean	433	390	384	384	388	388	393	392
	±SE	±90	±96	±95	±98	±102	±109	±123	±124
NRC 70 %	1	340	318	312	316	319	323	330	335
	2	263	228	235	245	259	250	256	265
	3	224	187	200	215	235	235	236	240
	4	301	272	280	293	300	300	299	315
	Mean	282	251	257	267	278	277	280	289
	±SE	±50	±56	±49	±46	±38	±41	±42	±44

* Pre-P : Pre-parturition, Post-P: Post parturition

mean body weight pre-partum, immediately post-partum and from the first through six months after calving were 432.8, 390, 384, 388 393 and 392.3 *kg*, respectively. Comparable weight of cattle in the restricted group (70 % NRC) were 282, 251.1, 256.8, 267.3, 278.3, 280.3 and 288.8 *kg*. However, it is difficult to compare the body weight changes after calving between the high and low nutrient group, because the age at first calving of the restricted group was 10 months later than that of standard group. Differences in body weight between animals in the 100 % and 70 % NRC feeding groups appeared to be the cumulative effect of nutrient supply from weaning up until first calving as shown in the previous experiment (Choung et al., 1986). Rutter and Randel's study, however, showed a negligible effect of nutrition on body weight changes. They reported that there was no difference in cow weight due to nutrient treatments when beef cattle were fed 90 %, 100 % and 110 % of the NRC maintenance leve (Rutter and Randel, 1984). This may be due to an inability to control nutrient intake in all cattle in a group feeding situation or to be the milder restrictive treatment in the experiment.

2. Ovarian activity

Changes of ovarian size up to the first oestrus postpartum are presented in Table 2.

In the 100% NRC group, average left ovary size was slightly smaller

Table 2. Changes of ovarian size after parturition until first oestrus (Unit : cm)

Nutritional level	No. of cows	2 weeks (10-20)				3 weeks (21-30)				4 weeks (31-40)	
		Left		Right		Left		Right		Left	
		L	W	L	W	L	W	L	W	L	W
NRC 100%	1	2.0	1.5	2.0	2.0	2.5	1.5	3.0	2.0	2.5	1.5
	2	2.6	1.5	3.0	2.0	2.5	2.0	3.0	2.5	2.5	2.0
	3	2.0	1.0	2.0	2.0	2.0	1.0	2.2	2.0	2.0	1.0
	4	2.5	1.5	3.0	2.0	2.5	1.5	2.5	1.5	3.0	1.5
	Mean	2.3	1.4	2.5	2.0	2.4	1.5	2.7	2.0	2.5	1.5
NRC 70%	1	2.0	1.0	2.0	1.2	2.0	1.0	2.0	1.5	2.0	1.5
	2	1.5	1.0	2.0	1.0	1.5	1.0	2.0	1.0	1.5	1.0
	3	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0
	4	1.5	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.5
	Mean	1.8	1.0	2.0	1.1	1.9	1.0	2.0	1.1	1.9	1.3

(31-40)		5 weeks (41-50)				6 weeks (51-60)			
Right		Left		Right		Left		Right	
L	W	L	W	L	W	L	W	L	W
3.0	2.0	3.0	2.7	3.0	3.0				
2.0	2.5	2.5	2.0	3.0	2.5				
3.0	2.0	2.0	2.0	3.0	2.5				
2.5	2.0	2.5	2.0	3.0	2.5				
2.9	2.1	2.5	2.2	3.0	2.6				
2.5	2.0	2.0	1.5	2.0	1.5	2.0	1.5	2.5	2.0
2.0	1.0	1.5	1.0	2.0	1.0	1.5	1.0	2.0	1.0
2.0	1.0	2.0	1.0	2.5	1.0	2.0	1.0	2.5	1.0
2.5	2.0	2.0	2.0	3.0	2.5	2.5	3.0	3.0	3.0
2.3	1.5	1.9	1.4	2.4	1.5	2.0	1.6	2.5	1.8

* L : Ovarian length
W : Ovarian width

than that of right ovary at the 2 weeks after parturition, but it increased progressively between 3 weeks and 4 weeks. At 5 weeks postpartum, the left and right ovary were 2.5 cm (length) × 2.2 cm (width) and 3.0 cm × 2.6 cm, which was larger in size than 2 weeks after parturition. In the restricted group, the sizes of both left and right ovary at 2 weeks were, significantly smaller than those of the 100% NRC group, and at 6 weeks postpartum, right and left ovarian sizes did not exceed 2.0 × 1.5 and 2.5 × 1.8 cm, respectively, indicating that restricted feeding level was associated with impaired breeding performance and ovarian activity after parturition.

Few studies have been conducted to investigate ovarian activity after calving of beef cows. Oxenrider and Wagner (1971) reported no significant difference in follicle growth after calving in Holstein cows fed low versus high planes of nutrition. In a study of the postpartum corpus luteum, Collahar et al. (1970) noted that the growth of the corpus luteum had reached 1.0 cm by 20 days and 1.5 cm at 33 days after calving. This result showed similar value to the 100% NRC group, but was greater than corpus luteum growth of the 70% NRC group. In the study conducted by Nakahara (1975), ovarian activity of the Japanese cow after calving was influenced by age of dam, milk yield, post-partum cow condition and calving season, and the growth of follicles after calving was delayed in suckled cows (16 days), compared to that of milking cows (13 days). Also he reported that ovarian activity was detected at 10 days in high energy group but at 16 days after calving in a low energy fed group. The delay in ovarian activity in the present study may due to the age of dam and nursing of calves.

3. First oestrus and ovulation

Number of days post-partum to first oestrus, ovulation and insemination according to level of supplementary feeding is shown in Table 3.

Average first ovulation occurred 19.5 days and first oestrus at 37.8 days after calving in the standard feeding group. In the restricted group, first ovulation and oestrus were 73.4 days and 111.8 days after calving, respectively. These results indicated that there would be a longer calving interval when cows fed 70% NRC than in a standard feeding group. The number of insemination per conception was 1.2 in the standard group. In the restricted group, however, 3 cows conceived at first oestrus and one conceived on the second oestrus.

In a study of first ovulation, Oxenrider and Wagner (1971) reported that there was variation in number of days to first ovulation when Holstein cows fed different energy levels. Carruthers and Hafs (1980)

Table 3. First ovulation and estrus after parturition

(Unit : day)

Nutritional level	Cow No.	Post-parturition				
		First ovulation	First estrus	First insemi.	Repit. estrus	No. of insemi.
NRC 100 %	1	22	35	35	1	1
	2	16	37	37	1	1
	3	19	39	39	1	1
	4	21	40	40	1	2
	Mean	19.5	37.8	37.8	1.0	1.2
NRC 70 %	1	36	58	58	1	2
	2	Over 100	168	168	1	2
	3	Over 100	158	158	1	2
	4	61	60	81	2	5
	Mean	73.4	111.8	116.3	1.3	3.8

found that the number of days post-partum to first ovulation was 52 in suckled cow, 46 days in milked cows and 24 days in non-suckled or non-milked cows, indicating a delay in first ovulation due to suckling. Yoshimeki et al. (1986) also reported a delay in ovarian activity and first ovulation in high milk producing cows due to the imbalance of high milk output and low energy and protein intake. Sharp and King (1981) compared first ovulation post calving between beef and dairy cows. They noted that beef cows have a greater number of days to ovulation than did dairy cattle (28.7 days vs 19.8 days). Many studies have demonstrated that number of days post-partum to first oestrus of dairy cow is influenced by nutritional level, milk yield and suckling versus non-suckling (Zimmerman et al., 1961; Whitemore et al., 1974) Hashizume et al. (1983) reported that first oestrus occurred 59 days after calving in Japanese beef cows. But Whitemore et al. (1974) noted that delay in oestrus was found in Holstein cows (74 days).

4. Progesterone profile post-partum

Progesterone concentrations in plasma after calving is presented in Fig. 1.

Progesterone concentrations of standard group gradually increased from 6 weeks to 12 weeks post-partum with overall mean of 2.19 ng/ml. All animals in 100 % NRC group were conceived on 37.8 days after calving which reflected to increase progesterone concentrations of pregnant cows. This results are

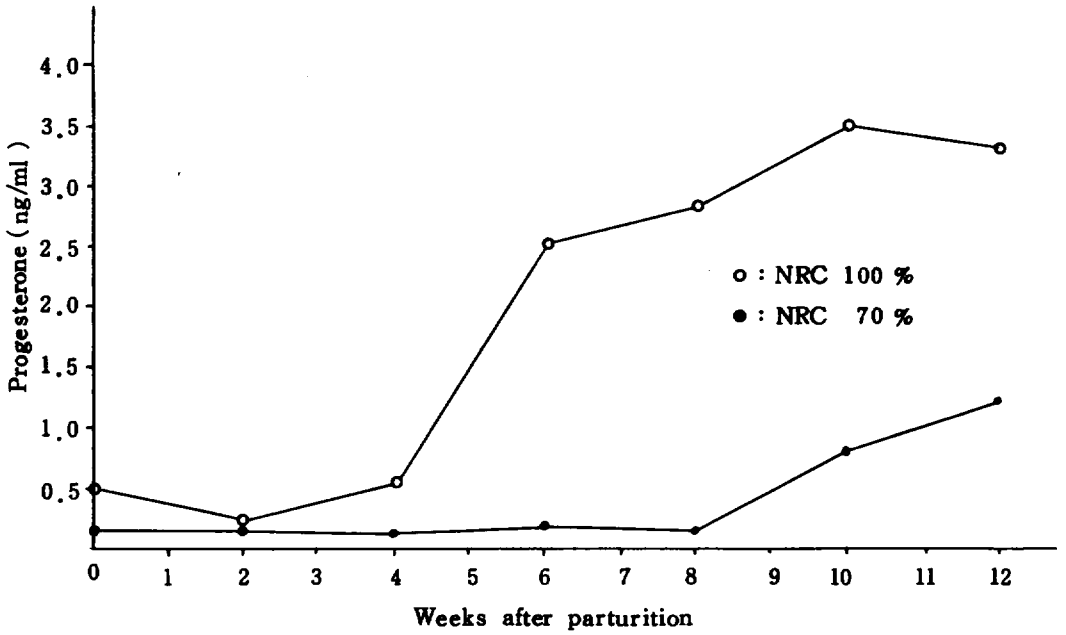

Fig. 1. Changes in plasma progesterone concentrations postpartum on different feeding levels.

inagreement with previous study on progesterone concentrations during pregnancy of Cheju native cows (Choung et al. 1986). However, animals in restricted group had not start to cycle within 110 days of calving. Progesterone concentrations of restricted group showed slight increase in 10 weeks after calving with overall mean of 0.45 ng/ml due to two animals inseminated on 58 days (cow No.1) and 81 day (cow No.4) after calving but only cow No.1 had conceived. High plan of nutrition effect on post-partum first oestrus (Zimmerman et al., 1986; Whitemore et al. 1974) but present results are in conflict with these Junesa and Arona (1986) who reported the level of nutrition did not affected progesterone concentrations of crossbred cows.

Based on the results of present experiment, it could be concluded that supplementation to Cheju native cows could improve post-partum breeding performance and efficiency and reduce calving interval.

Summary

The effect of supplementary feeding on postpartum ovarian activity, reproductive performance and plasma progesterone concentrations in Cheju native cows was studied. The group with adquate nutrition had greater mean body weight than did the underfed group before and after calving. First ovulation occurred 19.5 days and first oestrus at 37.8 days postpartum in the standard group, however, there was delay in first ovulation and oestrus in the restricted group (73.4 days and 111.8 days). Progesterone concentrations of full fed animals gradually increased from 6 weeks (0.5 ng/ml) to 12 weeks (3.3 ng/ml) after calving. However, progesterone concentrations of underfed animals had a slight increase in 10 weeks after calving (0.89 ng/ml).

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