

# 新生子牛における血漿1,25 dihydroxyvitamin D濃度の推移

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NOTE

**Plasma Level of 1,25-Dihydroxyvitamin D in Neonatal Calves**

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In pregnant women [2, 8] and rats [9], the serum concentration of 1,25-dihydroxyvitamin D ( $1,25(\text{OH})_2\text{D}$ ) in the placental venous blood is significantly lower than that in the maternal venous blood. The plasma concentration of  $1,25(\text{OH})_2\text{D}$  in a pregnant cow, however, is not significantly different from that in her fetus, and fetal  $1,25(\text{OH})_2\text{D}$  concentration correlates positively with maternal one [1]. But, little is known about the plasma  $1,25(\text{OH})_2\text{D}$  level in the early stage after birth. The purpose of the present study is to determine plasma  $1,25(\text{OH})_2\text{D}$  levels in calves immediately after birth.

Six Holstein-Friesian calves of both sexes were used. They were born normally and isolated from their dams immediately after birth. Each calf was fed about 2 liters of colostrum 4 hours after birth and then 1 liter of milk per 10 kg of body weight per day. Blood samples were taken at birth and 4, 8, 12, 24, 48, 72, and 168 hours (1 week) after birth from the jugular vein into tubes containing heparin. Blood plasma was immediately separated by centrifugation. The concentrations of  $1,25(\text{OH})_2\text{D}$ , calcium, and inorganic phosphorus (i-P) were determined. The  $1,25(\text{OH})_2\text{D}$  concentration was estimated the method by Lambert *et al.* [5], and the purity of cytosol, by

Shimura and Tamura [7]. Plasma calcium was measured by atomic absorption spectrophotometry, and plasma i-P by Goldenberg's method [3].

The plasma level of  $1,25(\text{OH})_2\text{D}$  in the newborn calves is shown in Table 1 and Fig. 1. There were no significant changes until 12 hours after birth, but the level rose after 12 hr and then decreased. The value at 48 hour was significantly higher than that at birth ( $p < 0.05$ ).

Barlet *et al.* [1] observed an increase in plasma level of  $1,25(\text{OH})_2\text{D}$  48 hours after birth in one calf. In human, Steichen *et al.* [8] noticed that the infant serum concentration of  $1,25(\text{OH})_2\text{D}$  at 24 hours of life was significantly higher than that at birth.

The present study showed that the plasma level of  $1,25(\text{OH})_2\text{D}$  increased rapidly in neonatal calves for the first 48 hours of life. This increase may be due to synthesis of  $1,25(\text{OH})_2\text{D}$  as a prerequisite for the intestinal absorption of calcium and i-P [8]. The production of  $1,25(\text{OH})_2\text{D}$  may be stimulated by the feeding of milk.

The plasma  $1,25(\text{OH})_2\text{D}$  level in this study ( $109 \pm 20$  pg/ml) is close to that in cows at delivery reported by Barlet *et al.* ( $134 \pm 35$  pg/ml) [1]. This result confirms that there are no significant differences in the plasma  $1,25(\text{OH})_2\text{D}$  level between

Table 1. Plasma 1,25(OH)<sub>2</sub>D level in 6 calves from birth to 1 week after birth

Calf no.	Plasma 1,25(OH) <sub>2</sub> D level (pg/ml) after birth							
	0	4 hr	8 hr	12 hr	24 hr	48 hr	72 hr	1 week
1	163	173	184	154	194	326	133	94
2	49	54	—	132	421	94	272	411
3	46	56	—	27	43	229	128	87
4	143	152	122	179	137	207	171	86
5	136	302	199	162	143	258	379	122
6	116	100	122	96	243	621	437	372
Mean±S.E.	109±20	140±38	157±20	126±22	197±52	290±73	254±54	196±62

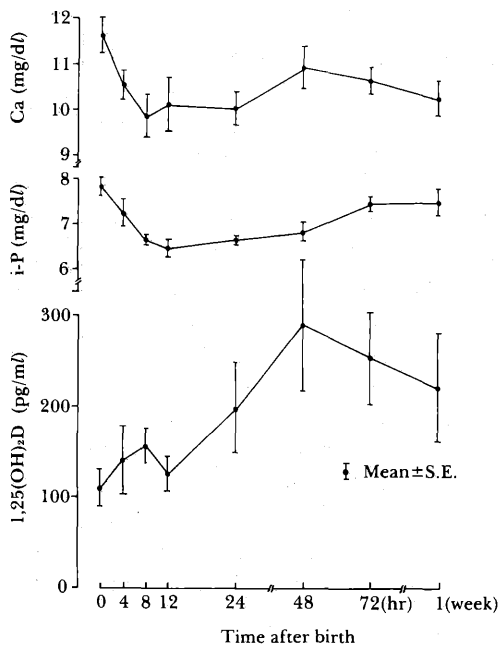


Fig. 1. Plasma levels of 1,25(OH)<sub>2</sub>D, calcium (Ca), and inorganic phosphorus (i-P) in 6 calves from birth to 1 week after birth.

the dam and the fetus as reported by Barlet *et al.* [1]. Further studies are required to elucidate the precise mechanism of maternal-fetal transfer of 1,25(OH)<sub>2</sub>D in cows.

The plasma calcium and i-P levels of calves at birth and in the postnatal stage are shown in Fig. 1. At birth, they were much higher than in any postnatal stage. Plasma calcium level decreased gradually by 8 hours after birth. Since then it

remained within the same range as in the adult cow. Plasma i-P level decreased gradually by 12 hours and increased slightly after 72 hours. The high plasma calcium and i-P levels at birth seem to reflect the high levels in the fetal stage. They were judged as normal levels according to the values observed by other investigators [4, 6].

The plasma 1,25(OH)<sub>2</sub>D level was fairly constant over a period from birth to 12 hours after birth during which period rapid decreases were occurred in plasma calcium and i-P levels. Then it increased rapidly in the subsequent stage when the plasma calcium level was constant. Therefore, the rapid increase of plasma 1,25(OH)<sub>2</sub>D level after birth may be attributed to either the intestinal nutrition or the stimulus due to decreases in calcium and i-P levels. Further studies are required to elucidate the dynamic mechanism and regulation of the postnatal 1,25(OH)<sub>2</sub>D metabolism in calves.

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#### 要 約

新生子牛における血漿 1,25-dihydroxyvitamin D 濃度の推移 (短報): 内藤善久・渡辺栄次・押部明德・佐藤れえ子・村上大蔵 (岩手大学農学部家畜内科学教室)——ホルスタイン種の新生子牛 6 頭について、出生時から1週間までの血漿 1,25(OH)<sub>2</sub>D 濃度を血漿カルシウムおよび無機リン濃度とともに調べた。その結果、血漿 1,25(OH)<sub>2</sub>D 濃度は出生時から12時間までは一定で推移し、48時間では平均 290 pg/ml とピークに達し、その値は出生時の値に比較して有意に高かった。