

# Selenium Status of 12 Herds of Indiana Dairy Cattle

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## Summary

Ten of twelve herds of dairy cattle in Indiana that were surveyed were determined to have adequate selenium (Se) status (serum Se concentration  $>0.040 \mu\text{g/ml}$ ); two herds had marginal Se status (serum Se concentration between  $0.020$ - $0.040 \mu\text{g/ml}$ ). In 6 herds where Se supplementation was not given, mean serum Se concentration in lactating cows was  $0.051 \mu\text{g/ml}$  ( $n=25$ ) and in dry cows was  $0.043 \mu\text{g/ml}$  ( $n=5$ ). In 6 herds giving Se supplementation, mean serum Se concentration in lactating and dry cows were  $0.071 \mu\text{g/ml}$  ( $n=26$ ) and  $0.049 \mu\text{g/ml}$  ( $n=14$ ), respectively. Serum Se concentration had significant positive correlation to Se content of concentrate mixture but not to Se content of hay or corn silage. Two herds that were given no Se supplementation and had adequate Se status reported a high frequency ( $>20\%$ ) of placental retention but the incidence decreased to normal rates over the following year; one herd used no Se supplementation during this decline and a controlled field study of selenium-vitamin E prepartum injection in the other herd had similar decline in frequency of placental retention in cows either with or without selenium-vitamin E supplementation.

The need to supplement rations of dairy cattle with selenium (Se) has been advanced following publication of several reports<sup>1-6</sup> of beneficial use of prepartum Se and Se-vitamin E (Se-E) supplements to prevent placental retention in herds with high frequency of this important postpartum complication. However, the issue is not clear. Other published reports<sup>7-10</sup> have failed to demonstrate any benefit from Se or Se-E supplementation in preventing placental retention. Furthermore, the occurrence of herds with a high incidence of placental retention does not appear to follow the geographic patterns clearly established for known Se-E deficiency syndromes such as "white muscle disease" (WMD) in calves and lambs which occur with highest frequency in areas where low levels of Se are present in soil, plants, feeds and animal tissues.<sup>11-12</sup> As Se has been approved for addition to cattle rations at  $0.1 \text{ ppm}$ ,<sup>13</sup> the use of Se supplements has become widespread.

The present study was designed to: (1) determine the Se status in several Indiana dairy cattle herds either using or not

using Se supplements, (2) determine whether known Se-E deficiency syndromes (WMD) or suspected Se-responsive conditions (placental retention) were present in these Indiana herds shown to have low Se status and (3) to evaluate the efficacy of prepartum supplements of Se-E to control placental retention of those herds found to have a high frequency of this condition.

## Materials and Methods

Twelve dairy herds scattered throughout central Indiana that were serviced by the Purdue Ambulatory Clinic were evaluated in this study. Six herds were adding Se supplements as sodium selenite to their rations in the concentrate mixture and 6 herds were not. The history of each herd was evaluated initially to determine whether cases of WMD had occurred and if high frequency of placental retention existed. To establish the Se status of each herd, samples of blood were collected from 5 lactating cows and 5 dry cows (if available) and samples of concentrate mixture, hay and corn silage being fed to the lactating cows were collected. The sera were frozen and analyzed for Se concentration, as for the feed samples, by a modification of Watkinson's fluorometric procedure.<sup>14</sup>

Specific efforts were made to locate dairy herds with histories of high frequency of retained placenta to include in the study. However, only 2 such herds were found. In one of these herds, the owner was willing to cooperate in a prepartum injection trial using a commercial Se-E preparation.<sup>b</sup> Over the subsequent 6 month period, alternate cows were injected 2 weeks prior to calving with  $50 \text{ mg Se}$  and  $680 \text{ IU}$  of d-d-tocopherol acetate. Records were kept to determine whether the placenta was retained ( $>12$  hours) and if other conditions known to cause placental retention were present (twinning, premature birth, dystocia).

## Results

Table 1 summarizes the serum Se concentration in lactating and dry cows, feed Se concentration and history of retained placenta in 12 Indiana dairy herds. Mean serum Se concentration was lower in 6 herds feeding no Se supplements (4 herds in adequate range, 2 herds in marginal range) compared to 6 herds feeding Se supplements (all 6 herds in adequate range). Serum Se concentration was lower in dry cows than in lactating cows. The Se concentration of concentrate mixture, hay and corn silage varied greatly between herds but tended to be lower in the 6 herds using no

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TABLE 1. Serum Se Content, Feed Se Content and Frequency of Retained Placenta in 6 Herds of Indiana Dairy Cattle Using Se Supplementation and 6 Herds with No Supplementation.

	Herd No.	Mean serum Se content ( $\mu\text{g/ml} \pm \text{SE}$ )		Feed Se content (mg/kg, wet weight)			High frequency (>20%) of retained placenta
		Lactating	Dry	Concentrate mixture	Hay	Corn Silage	
No Se Supplementation	1	0.065 $\pm$ 0.003	ND	0.31	0.11	0.01	No
	2	0.044 $\pm$ 0.003	ND	0.21	0.04	0.01	No
	3	0.076 $\pm$ 0.003	0.043 $\pm$ 0.003	0.54	0.04	0.04	Yes
	4	0.020 $\pm$ 0.003	ND	0.07	0.06	0.01	No
	5	0.067 $\pm$ 0.003	ND	0.21	0.07	0.02	Yes
	6	0.034 $\pm$ 0.003	ND	0.08	0.05	ND	No
	Mean *	0.051 $\pm$ 0.001	0.043 $\pm$ 0.003	0.237 $\pm$ 0.065	0.062 $\pm$ 0.015	0.018 $\pm$ 0.011	2/6
Se Supplementation	7	0.088 $\pm$ 0.003	0.039 $\pm$ 0.003	0.56	0.06	0.02	No
	8	0.071 $\pm$ 0.003	ND	0.42	0.11	0.02	No
	9	0.077 $\pm$ 0.003	0.049 $\pm$ 0.005	0.22	0.12	0.09	No
	10	0.063 $\pm$ 0.003	0.060 $\pm$ 0.004	(Mixed feed - 0.09)			No
	11	0.066 $\pm$ 0.003	0.052 $\pm$ 0.004	0.31	0.12	0.02	No
	12	0.065 $\pm$ 0.003	ND	0.27	0.02	0.02	No
	Mean *	0.072 $\pm$ 0.001	0.050 $\pm$ 0.002	0.356 $\pm$ 0.071	0.086 $\pm$ 0.016	0.034 $\pm$ 0.011	0/6

ND — not determined;

\*No significant difference between means of unsupplemented and supplemented cows at  $P < 0.05$ .

Se supplements than in the feeds collected from the 6 farms feeding Se supplements. Correlation coefficients were determined for serum Se with feed Se and were as follows: concentrate mixture (+0.82,  $P < 0.01$ ), corn silage (+0.48, not significant) and hay (+0.29, not significant). Only 2 herds were found to have histories indicating high frequency (>20%) of retained placenta. In both of these herds (herds 3 and 5 in Table 1), the serum Se concentration was in the adequate range. None of the 12 herds reported occurrences of WMD in the past.

In Table 2, the results of a field trial using prepartum injection of Se-E in Herd No. 5 that reported 20% frequency of retained placenta over the previous year are inconclusive as only 1 of 27 calvings was followed by placental retention that was unrelated to other known causes of this condition such as dystocia, premature parturition and twinning. The other herd (No. 3 of Table 1), that reported high frequency of retained placenta at the time blood samples were collected, when evaluated one year later was not experiencing abnormally high rates of placental retention and no supple-

mental Se had been provided to the cows during this time.

### Discussion

The cows in 10 of the 12 herds in the present study had serum Se concentrations that were considered to be adequate (>0.40  $\mu\text{g/ml}$ ) and in 2 herds had marginal status (0.020-0.040  $\mu\text{g/ml}$ ). Considerable variation existed in the serum Se concentration of our various herds, whether supplementing Se or not, and was related to marked variation in Se content of the concentrate mixtures fed on the various farms. Numerous reports<sup>15-19</sup> established that determinations of Se concentration of serum, plasma or whole blood will accurately reflect the Se status of cattle. In general, higher Se status was present in our 6 herds using Se supplementation but the lower range of values of the supplemented group overlapped those seen in cows of the 6 unsupplemented herds. Also, the Se status of our dry cows was lower than lactating cows, reflecting the lower Se intake from dry cow rations.

Data from 2 herds in the present study did not support the suggested role of Se responsiveness of placental retention in dairy cows. Only 2 herds with previous high rates of retained placenta, and also showing adequate Se status, were detected for inclusion into our study and both herds had no significant problem (<10% incidence) over the year of our observation whether or not Se-E supplementation was utilized. Schingoethe *et al*<sup>9</sup> have suggested that cattle with adequate Se status will not show a Se-responsive decrease in frequency of placental retention following prepartum treatment. It has been frequently observed that rates of placental retention within herds will fluctuate greatly from year to year but the etiologic factors responsible for these variations are still unclear.

TABLE 2. Effect of Prepartum Injection of Se-E on Frequency of Retained Placenta in an Indiana Dairy Herd (Herd 5 of Table 1).

Number of calvings	Prepartum Se-E Injection	Frequency of retained placenta
13	Yes	0/13*
14	No	1/14**

\* Deleted 1 case of placenta that followed dystocia.

\*\* Deleted 3 cases of retained placenta that followed premature parturition (2 cows) and twinning (1 cow).

## References

1. Eger S, Drori D, Kadoori I, *et al*: Effects of Selenium and vitamin E on incidence of retained placenta. *J Dairy Sci* 68:2119-2122, 1985.
2. Harrison JH, Hancock DD, Conrad HR: Vitamin E and selenium for reproduction of the dairy cow. *J Dairy Sci* 67:123-132, 1984.
3. Julien WE, Conrad HR, Jones JE, *et al*: Selenium and vitamin E and incidence of retained placenta in parturient dairy cows. *J Dairy Sci* 59:1954-1959, 1976.
4. Julien WE, Conrad HR, Moxon AL: Selenium and vitamin E and incidence of retained placenta in parturient dairy cows. II. Prevention in commercial herds with prepartum treatment. *J Dairy Sci* 59:1960-1962, 1976.
5. Trinder N, Woodhouse CD, Renton CP: The effect of vitamin E and selenium on the incidence of retained placenta in dairy cows. *Vet Rec* 85:550-553, 1969.
6. Trinder N, Hall RJ, Renton CP: The relationship between the intake of selenium and vitamin E on the incidence of retained placenta in dairy cows. *Vet Rec* 93:641-643, 1973.
7. Gwazdauskas FC, Bibb TL, McGillard ML, *et al*: Effect of prepartum selenium-vitamin E injection on time for placenta to pass on productive functions. *J Dairy Sci* 62:978-981, 1979.
8. Ishak MA, Larson LL, Owen FG, *et al*: Effects of Selenium, vitamins, and ration fiber on placental retention and performance of dairy cattle. *J Dairy Sci* 66:99-106, 1983.
9. Schingoethe DJ, Kirkbride CA, Palmer IS, *et al*: Response of cows consuming adequate selenium to vitamin E and selenium supplementation prepartum. *J Dairy Sci* 65:2338-2344, 1982.
10. Segerson EC, Riviere GJ, Dalton HL, *et al*: Retained placenta of Holstein cows treated with selenium and vitamin E. *J Dairy Sci* 64:1833-1836, 1981.
11. Kubota J, Allaway WH, Carter DL, *et al*: Selenium in crops in the United States in relation to selenium-responsive diseases of animals. *J Agric Food Chem* 15:448-453, 1967.
12. Muth OH, Allaway WH: The relationship of white muscle disease to the distribution of naturally occurring selenium. *J Am Vet Med Assoc* 142:1379-1384, 1963.
13. Food additives permitted in feeds and drinking water of animals. Selenium. *Fed Regist* 44:5392, 1979.
14. Olson OE, Palmer IS, Cary EE: Modification of the official fluorometric method for selenium in plants. *J Assoc Off Anal Chem* 58:117-121, 1975.
15. Perry TW, Peterson RC, Griffin DD, *et al*: Relationship of blood serum selenium levels of pregnant cows to low dietary intake, and effect on tissue selenium levels of their calves. *J Animal Sci* 46:562-565, 1978.
16. Ammerman CB, Chapman HL, Bouwman GW, *et al*: Effect of supplemental selenium for beef cows on the performance and tissue selenium concentrations of cows and suckling calves. *J Anim Sci* 51:1381-1386, 1980.
17. Perry TW, Beeson WM, Smith WH, *et al*: Effect of supplemental selenium on performance and deposit of selenium in blood and hair of finishing beef cattle. *J Anim Sci* 42:192-195, 1976.
18. Ullrey DE, Brady PS, Whetter PA, *et al*: Selenium supplementation of diets for sheep and beef cattle. *J Anim Sci* 46:559-565, 1977.
19. Thompson KG, Fraser AJ, Harrop BM, *et al*: Glutathione peroxidase activity in bovine serum and erythrocytes in relation to selenium concentrations of blood, serum and liver. *Res Vet Sci* 28:321-324, 1980.

<sup>a</sup> Selenium analyses were done by Dr. Ivan S. Palmer, Experiment Station Biochemistry Department, South Dakota State University, Brookings, South Dakota.

<sup>b</sup> Mu-Se. Shering Corporation, Animal Health Products Division, Kenilworth, New Jersey.

## Simple Surgical Repair for Urine Pooling in the Cow

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## Summary

A simple surgical procedure for extension of the urethral orifice in the cow with urine pooling is described. Accurate diagnosis is essential as is careful patient selection and meticulous suture placement.

This procedure can be accomplished by most practicing veterinarians with the patient standing, using minimal restraint and epidural anesthesia.

Complications and post-surgical care are minimal, resulting in a practical method of extending the reproductive life for selected cases of urine poolers in the cow.

## A Computerized Analysis of the Incidence of Reproductive Disorders and Their Impact on Fertility Indices

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## Summary

A computerized analysis of the incidence of reproductive disorders and their impact on fertility indices was introduced in 115 Kibutz dairy herds with above 30,000 cows. This scheme was very useful in monitoring fertility on the herd level, but in addition it provided valuable data for comparative research studies. Some of the results discussed supply evidence on the very high repeatability of the data on the incidence of reproductive disorders. The importance of early diagnosis and treatment of uterine disorders as well as the connection of the diagnosis of unobserved oestrus with serious impairment of the fertility is documented.

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