Selenium in Milk from Feeding Small Supplements

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ABSTRACT
Supplements of 0, 1, 2, or 5 mg of selenium from sodium selenite fed per cow daily from 90 days prepartum through approximately 6 mo of lactation had no significant effect on selenium in milk of Hereford cows. Selenium in milk was assayed 2 to 3 days postpartum (average of .014 to .023 ppm) and approximately 3 mo post parturition (average of .016 to .021 ppm). The basal diet consisted of medium quality grass-legume hay (.069 mg/kg), ad libitum liquid supplement (.152 mg/kg), and 1.36 kg shelled corn (.018 mg/kg) starting in early lactation. Treatments of selenium were administered via free-choice liquid supplement.

INTRODUCTION
Either orally or ruminally administered selenium has increased milk selenium of swine (4), sheep (2, 5). However, dosages administered to cattle were extremely high compared to those normally encountered in supplementary or natural feed. Grant and Wilson (2) administered once 50 mg orally during the 4th or 5th mo of lactation whereas Mathias et al. (5) administered 16 mg of selenium per head daily via rumen fistula during both 21 days pretreatment and collection period. This was approximately 2 ppm of the total diet. Perry et al. (7) reported a wide range in selenium for various samples of milk from a local dairy.

The objective of this research was to study the effect on selenium in milk of feeding several small amounts of selenium (0, 1, 2, or 5 mg per day which are comparable to approximately 0, .1, .2, or .5 ppm of the diet) to mature cows 90 days prepartum through approximately 7 mo postpartum.

EXPERIMENTAL PROCEDURE
Twelve mature pregnant Hereford cows (7 to 9 yr of age) at least 90 days preparturition were allotted to one of four drylots of three cows each. Each lot of three cows represented one treatment to receive daily 0, 1, 2, or 5 mg supplemental selenium from sodium selenite per cow daily in an ad libitum 64% high urea liquid supplement6. The cows were fed a medium quality grass-legume hay ad libitum and free choice mineral (two parts dicalcium phosphate to one part iodized salt). The hay contained .069 mg of selenium per kg dry hay, and the liquid supplement contained .152 mg of selenium per kg as fed. Hay consumption averaged between 10 and 11 kg per head daily irrespective of treatment. However, average ad libitum liquid supplement consumption varied among lots, Lot I 1.55 kg per head daily, Lot II 1.76 kg, Lot III 1.77 kg, and Lot IV 1.72 kg. No creep diet was available to the calves confined with their dams in earth lots. Therefore, starting June 23, 1.36 kg of dry shelled corn (corn, dent, grain gr 1 U.S. mn wt 721 g per liter, (4) Ref. No. 4-02-914) was fed per cow daily (selenium content of the corn was .018 mg per kg dry matter) to increase milk production by the cows.

Since the calves were penned with their dams and since there was no creep diet available, the cows were kept nursed dry most of the time. Therefore, except for the samples of

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5 Superintendent, Lynnwood Purdue Agricultural Center, Carmel, IN.
6 Composition of the supplement, sugarcane molasses, mn 48% invert sugar, mn 79.5 degrees brix (4) Ref. No. 4-04-696, 38.5%; liquid urea (32% N), 29%; ammoniated polyphosphate (10% N, 14.8% P) 9%; corn, distillers solubles (27% dry matter) (5) Ref. No. 5-02-844, 9.3%; NaCl, 2.5%; CaCl2, 1.2%; Na2SO4, 1% water, 2.6%; Vitamin A, 44 million IU/1000 kg. 9.6 kg/1000 kg; cobalt sulfate, 21 g/1000 kg.
TABLE 1. Effect of dietary selenium on selenium in milk.

<table>
<thead>
<tr>
<th>Lot no.</th>
<th>Cow no.</th>
<th>Dietary Se (mg/day)</th>
<th>Milk selenium, µg selenium/ml milk</th>
<th>Parturition (Mar. 15 to Apr. 30)</th>
<th>June 23</th>
<th>October 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>704</td>
<td>0</td>
<td>0.018</td>
<td>0.007</td>
<td>0.014</td>
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<tr>
<td></td>
<td>790</td>
<td>0</td>
<td>0.014</td>
<td>0.008</td>
<td>0.020</td>
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<tr>
<td></td>
<td>1135</td>
<td>0</td>
<td>0.011</td>
<td>0.009</td>
<td>0.015</td>
<td></td>
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<tr>
<td>Avg.</td>
<td></td>
<td></td>
<td>0.014</td>
<td>0.008</td>
<td>0.016</td>
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</tr>
<tr>
<td>II</td>
<td>710</td>
<td>1</td>
<td>0.016</td>
<td>0.008</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td></td>
<td>087</td>
<td>1</td>
<td>0.017</td>
<td>0.009</td>
<td>0.019</td>
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<tr>
<td></td>
<td>116</td>
<td>1</td>
<td>0.021</td>
<td>0.012</td>
<td>0.021</td>
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</tr>
<tr>
<td>Avg.</td>
<td></td>
<td></td>
<td>0.018</td>
<td>0.010</td>
<td>0.019</td>
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<tr>
<td>III</td>
<td>797</td>
<td>2</td>
<td>0.012</td>
<td>0.009</td>
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<tr>
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<td>163</td>
<td>2</td>
<td>0.016</td>
<td>0.010</td>
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<tr>
<td></td>
<td>1126</td>
<td>2</td>
<td>0.013</td>
<td>0.010</td>
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<tr>
<td>Avg.</td>
<td></td>
<td></td>
<td>0.014</td>
<td>0.010</td>
<td>0.021</td>
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<tr>
<td>IV</td>
<td>716</td>
<td>5</td>
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<td>0.011</td>
<td>0.018</td>
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<tr>
<td></td>
<td>962</td>
<td>5</td>
<td>0.019</td>
<td>0.018</td>
<td>0.023</td>
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<tr>
<td></td>
<td>992</td>
<td>5</td>
<td>0.033</td>
<td>0.013</td>
<td>0.019</td>
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<tr>
<td>Avg</td>
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<td></td>
<td>0.023</td>
<td>0.014</td>
<td>0.020</td>
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<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>Sums of squares</th>
<th>Mean square</th>
<th>F</th>
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<td>Treatment/lot</td>
<td>3</td>
<td>1.871944E-04</td>
<td>6.2398148E-05</td>
<td>5.5602</td>
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<tr>
<td>Cows in treatment</td>
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<td>8.977778E-05</td>
<td>1.122222E-05</td>
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<tr>
<td>Time</td>
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<td>5.393889E-04</td>
<td>2.6969444E-04</td>
<td>20.5917</td>
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<td>Treatment × time</td>
<td>6</td>
<td>1.0572222E-04</td>
<td>1.7620370E-05</td>
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</tr>
<tr>
<td>Treatment × cows/treatment × time</td>
<td>16</td>
<td>2.0955556E-04</td>
<td>1.3097222E-05</td>
<td></td>
</tr>
</tbody>
</table>

The selenium assay was that described by Hoffman et al. (3) as modified by Olson (6). All selenium assays were in triplicate; therefore, each value listed represents three analyses.

RESULTS AND DISCUSSION

Statistical analysis of the milk selenium data indicates there were no significant differences in selenium in the milk from the two lower amounts of added dietary selenium (1 or 2 mg). However, the average for each treatment over time showed milk from cows fed 5 mg added selenium per day had more (P<.05) selenium in milk than did those fed no supplemental selenium. Only the data for cows fed the highest supplemental selenium agree with those of Mathias et al. (5) and of Grant and Wilson (2). The smaller amounts represent more nearly typical feeding conditions than did the much higher supplemental selenium in the references. Mathias et al. (5) introduced 16 mg selenium twice daily (32 mg per day) via a fistula directly into the rumen for 21 days presampling and during sampling. He reported a four fold increase (60 ppb vs. 280 ppb) in the dried skim milk as a result of the treatment. Grant and Wilson (2) administered a single dosage of 50 mg of selenium per animal to study its effect on milk selenium in subsequent production. Milk taken within 1 to 2 days after parturition, it was necessary to separate the cows from their calves for 12 h (overnight) prior to collecting milk samples. The cows were confined to a squeeze chute for obtaining the milk samples, and since the cows had never been milked before, it did not seem feasible to attempt to estimate total milk production.
from the control cows contained .003 or .004 
µg per ml whereas samples from the treated 
cows at the following days post-dosing—.5, 1, 2, 
3, 4, 8, or 23—contained the following respective 
µg of selenium per mg of milk: .034, .036, 
.019, .012, .011, .007, and .005.

Data in this paper from lower selenium 
feeding showing a nonsignificant relationship 
between dietary selenium and milk content 
agree with those reported by Waite et al. (8), 
who observed that although there appeared to 
be some increase in selenium of milk due to 
dietary selenium, there was no consistent effect 
(11 to 19 ppb).

No explanation is suggested as to why 
selenium in milk appeared to be lower on the 
June 23 milking as compared to milk drawn 
shortly after parturition or as compared to that 
drawn the last day of the experiment (October 
26). However, the analysis table shows a large F 
for time, perhaps indicating a buildup over 
time.

Total average daily selenium intakes were 
calculated for each of the four treatments (.99, 
2.02, 3.02, and 6.01 mg) and were plotted 
against average milk selenium (.0127, .0156, 
.0150, and .0190 ppm). The r² was .88 
indicating close correlation between increased 
total daily selenium intake and selenium in 
milk.

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