vided into 4 groups, utilizing a 2 x 2 x 3 factorial experiment with the following treatments for 3 years: control untreated, copper injection, selenium bolus/injection, and combination of copper and selenium treatments. Treated cows received copper by injection and selenium supplementation by bolus (MolyCu® and DuraSe® boluses; Schering-Plough) in January and June, 1992 and 1993. The second year, selenium was supplemented by injection (Mu-Se®; Schering-Plough) instead of the DuraSe® boluses. Dosage was according to field recommendations; 2 cc of MolyCu®/sq (400 mg of cupric glycinate) was the equivalent of 120 mg copper. The DuraSe®-120 bolus contained the equivalent of 360 mg selenium as sodium selenite. It delivered a controlled amount of 3 mg/day for 4 months. Mu-Se® (selenium; vitamin E) was injected at 1 ml/200 pounds body weight. Each ml contained 10.95 mg sodium selenite (equivalent to 5 mg selenium) 50 mg (68 USP units) vitamin E (as *d*-alpha tocopherol acetate). By staying within the commercial guidelines, we wanted to determine the economic benefits of this mode of trace mineral supplementation and its effect on the calves' immunity. All calves were weighed at birth and bled at 24 hours of age. The serum was analyzed for immunoglobulin (IgG) levels by single radial immunodiffusion (SRID). Ten head of cows per group were liver biopsied twice a year and the third year their calves were liver biopsied.

By combining the 1993-1994 calf numbers, the copper group SRID showed significant statistical but not clinical significant differences when compared to the control calves ($P=0.08$). No significant differences occurred in the SRID groups in 1995, or when the three years were combined.

In the 1995 calf liver biopsy groups, the treatment analysis indicated significantly elevated calcium ($P<0.08$) in the selenium injected group.

Liver biopsies of cows had higher concentrations of manganese, cadmium, and molybdenum than their calves ($P<0.01$). Liver biopsies of calves had higher concentrations of magnesium, zinc, potassium, calcium, and copper ($P<0.01$) than cows. Phosphorus, barium, nickel, sodium, sulfur, iron, chromium, and vanadium in liver biopsy samples were not different between cows and calves ($P>0.10$).

Case-control Study of Clinical Salmonellosis in Cattle Herds

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Veterinarians in Virginia's Shenandoah Valley noticed an increased number of cases of clinical salmonellosis in cattle during the Summer of 1994. Cases occurred sporadically in some herds, but many beef and dairy herds experienced outbreaks with high mortality in preweaned calves or adult cows. Data from the Virginia State Department of Agriculture showed there was an increase in the number of herds diagnosed with salmonellosis during July and August 1994. It was not known whether the apparent increase in clinical salmonellosis actually represented higher disease incidence or whether salmonellosis was diagnosed more often because of heightened awareness of the disease after outbreaks occurred in several herds. About 84% of the salmonella isolates from bovine samples submitted to the regional diagnostic laboratory were *S. typhimurium*.

A field study was conducted to identify potential risk factors for clinical salmonellosis in a sample of cattle herds near Harrisonburg, Virginia. Commercial herds with at least one laboratory-confirmed case of salmonellosis during 1994 were identified from diagnostic laboratory records. Of 27 herds identified, 14 dairy and 9 beef farms agreed to participate in the study. Herd veterinarians were contacted to select control herds matched with case herds by type of enterprise (beef vs. dairy), veterinary practice, and zip code zone. Twenty-five (4.7%) of 531 fecal, feed and environmental samples collected from 46 case and control herds were positive for salmonella. Lagoon and preweaned calf fecal samples had the highest percentages of positive samples (21% and 6%, respectively). *S. typhimurium* was the serotype most commonly isolated. Herds with a history of clinical salmonellosis were significantly more likely to have at least one positive culture from samples collected during the study than control herds ($p=0.04$). Positive samples were obtained from case farms up to seven months after the clinical cases occurred. Isolation of salmonella from fecal or environmental samples was more common for dairy herds than beef herds, but this may have been partly due to the accessibility of preweaned calves for collection of fecal samples. Case herds tended to be larger than control herds considering both the number of mature cows ($p=0.03$) and the total number of cattle on the farm ($p=0.08$).

Most factors related to manure handling, water

source, domestic and wild animals, housing, and nutrition were similar for case and control farms. There was no difference between case and matched control farms in the number of cattle moved to the farm or taken to a veterinary clinic and returned to the farm during 1993 and 1994 ($p > 0.5$). Many study farms reported spreading poultry manure or litter on crops or pasture (48%), spreading uncomposted litter (26%), feeding poultry litter (11%), or having a poultry operation on the farm (33%), but these factors were not different between case and control farms ($p>0.25$). There was a marginally significant association of clinical salmonellosis with exposure of cattle or feed to wild geese (odds ratio=7, 95% confidence interval; 0.9, 151).

We found that case and control farms were similar with respect to several potential risk factors for clinical salmonellosis. However, the small sample size for investigating herd-level factors, diversity of the herds in the study, and the probable complexity of factors that lead to clinical salmonellosis need to be considered in the interpretation of negative findings from this analysis. *S. typhimurium* was the serotype most often found in samples from clinical cases, environmental samples, and feces collected from asymptomatic animals during the study. This non host-adapted serotype of salmonella infects multiple species, is easily transmitted between species, can be shed by animals which are not showing clinical signs, and survives well in uncomposted manure[1]. These characteristics make it less probable that a single risk factor would account for most herd outbreaks. However, we did find that case farms were more likely to report having exposure of cattle or feed to wild geese. This finding is consistent with results from another report where wild birds were implicated as the source of salmonella infection in a dairy herd outbreak[2] and should be considered as a possible risk factor in future field investigations of clinical salmonellosis in cattle.

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Effects of a select direct-fed microbial gel effects of a select direct-fed microbial gel supplemented with different levels of vitamin E in neonatal Holstein calves

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The objective of this study was to determine if an oral microbial gel supplemented with a natural source of vitamin E increased plasma concentrations of vitamin E in neonatal Holstein calves . The study was conducted in two commercial dairy locations . Holstein female calves (n = 30) were assigned randomly at birth to one of five treatment groups: A) control with no direct-fed microbial B) direct-fed microbial C) direct-fed microbial with 300 IU vitamin E, D) direct-fed microbial with 600 IU vitamin E and E) direct-fed microbial with 900 IU vitamin E. An Apgar scheme was performed within the first hour of birth, calves were treated according to the treatment group and received 2 L of pooled colostrum. Blood was sampled at 0, 24, 48 h and 7 days. Sera were analyzed for IgG by radial immunodifussion. Plasma samples were analyzed for -tocopherol levels using a modification of the method of Kaplan et al. (1987). Diarrhea was assessed using a scoring system (1-4) for all calves for 21 days after birth. Compared to control group A and group B there was a significant difference (p-value < 0.01) for vitamin E levels in plasma for treatment group E at 24 and 48 h. No differences were detected for morbidity, weight and maturity indexes and hypoxia (Apgar score). Mean concentration of IgG at 48 h of age and plasma levels at 0 h were similar to all groups, hence all calves received similar and adequate amounts of colostrum. The results suggest that with a unique dose of a direct-fed microbial with high levels of vitamin E, -tocopherol levels peak at 24 hr. plasma remaining at significant amounts at 48 h post-treatment.