EFFECTS OF SOURCE OF TRACE MINERALS AND PLANE OF NUTRITION ON GROWTH AND HEALTH OF TRANSPORTED MALE DAIRY CALVES

TAKE HOME MESSAGES

• Organic trace minerals increased growth when supplemented to accelerated early nutrition programs but not in conventional programs. This improvement may be related to health benefits as well as the greater biological demand for the minerals in calves at a higher level of performance.

• Organic trace minerals tended to ameliorate the physiological adjustments to increased energy and solids intake (such as more fluid feces) on the accelerated plane of nutrition early in life.

• Growth rates and gain to feed (feed efficiency) were greater for calves fed the accelerated early nutrition program.

INTRODUCTION
Growth and health in newborn dairy calves are highly related, and can be impaired by several stressors such as transportation, colostrum deprivation, and poor maternal nutrition. However, these stressors can be mitigated by good management and adequate early nutrition. Quality of management may vary among dairies but adequate early nutrition might be able to be more consistently controlled. A common practice is to encourage early starter consumption by feeding limited amounts of milk replacer to lower feeding cost in conventional nutrition programs. In contrast, feeding increased amounts of milk replacer of higher protein content (accelerated, intensified, or enhanced nutrition) improves early growth performance. However, it has been suggested that these intensified nutrition programs might have a negative effect on health status and, consequently, on overall production cost, particularly in stressed calves.

Trace minerals are fundamental for structural development and function of many cellular systems, one of which is the immune system. Therefore, maintaining adequate trace minerals status is essential to improve health. Bioavailable (organic) trace minerals have been demonstrated to enhance health status in older cattle by improving absorption and storage of trace minerals. Increased energy and protein supply (intensified nutrition) might derive greater benefits from the biological value of bioavailable trace minerals.

MATERIALS AND METHODS
Ninety Holstein bull calves less than one week old were purchased in three groups of 30 to 35 calves from farms in southern Wisconsin and transported to the Nutrition Field Laboratory research site at the University of Illinois. Treatments for this study were a combination of either conventional (C) or accelerated (A) plane of nutrition (PN) with either inorganic (I) or organic
trace minerals (TM) sources. The randomized experimental design used a 2 × 2 factorial arrangement of PN and TM treatments. Calves remained at the Field Laboratory facility from arrival through week 12, and then were transported to the University of Illinois Beef Research Unit for housing through week 35. Milk replacer for conventional PN treatments was fed at 568 g/d and accelerated PN milk replacer at 810 g/d during week 1, and 1136 g/d during weeks 2 through 6. Fresh starter grain was provided daily from week 1 through 9. Calves were group-housed by treatment in super-hutches from weeks 9 through 12, and in groups on rubber-covered concrete slats from week 13 through 20. Grain mixes with either I or O TM plus chopped hay were provided at feeding rates corresponding to PN. After week 20, calves from all treatments were changed to a beef growing diet, with only BW and stature measurements made at week 35 to determine any residual effects of early nutrition. Measurements of body weight (BW), heart girth, body length, withers height, hip height, and hip width were performed upon arrival, weekly on the same day until week 10, and then at weeks 12, 15, 20, and 35. Health status were recorded daily from week 0 to 9 for fecal scores and respiratory scores, using classifications from firm to liquid and normal to dry cough for fecal and respiratory scores, respectively.

RESULTS AND DISCUSSION

Measurements for BW, heart girth, body length, withers height, hip height, and hip width did not differ by treatment at arrival (P > 0.05). The accelerated PN resulted in increased BW, heart girth, body length, hip height, and hip width during the milk feeding period (P < 0.05). Higher BW for the accelerated PN treatments was maintained throughout the experiment and differences became more marked during week 12 to week 35 (Figure 1). Treatment AO tended (P = 0.11) to have higher BW than other treatments. Similarly, calves fed AO showed greater withers height (P = 0.07) than calves fed other treatments (Figure 2). The organic TM source increased growth when supplemented to the accelerated diets but not in the conventional diets.

Efficiency of gain (Figure 3), water and starter intakes, and ADG were greater for calves fed the accelerated PN program (P < 0.05). Also, ADG was greater for the AO treatment (P < 0.05) in comparison to the other treatments. Total DMI (kg/d) during weeks 1 to 9 was 1.44, 1.35, 1.26, and 1.46 for CI, CO, AI, and AO treatments and where not different from each other (P > 0.05), which was a product of DMI compensation between higher milk replacer DMI for accelerated PN treatments and higher starter DMI for conventional PN treatments. Increased free water intakes by calves fed the accelerated treatments likely contributed to higher ADG, greater efficiency of gain, and lower morbidity.

During this study mortality 13%, 13%, 9.1%, and 5.4% for CI, CO, AI, and AO treatments respectively, although differences were not significant (P = 0.67). Mean fecal scores were higher (P < 0.05) for accelerated PN treatments (Figure 4). In addition, mean fecal scores were lower for AO than AI during the first four weeks. Increment in mean fecal score for accelerated PN treatments should be accepted as a physiological adjustment to increased energy and solids intake. Health status was actually improved, with less use of antibiotics and electrolytes.
Figure 1. Body weight by treatment

Figure 2. Withers height by treatment
Figure 3. Gain:feed rate by treatment

Figure 4. Fecal score by treatment