Effects of Parenteral Supply of Iron and Copper on Hematology, Performance, and Health in Neonatal Dairy Calves

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Introduction

Iron is an essential component of hemoglobin, myoglobin and several enzymes. The iron reserves of the calf, which are primarily in the liver, are generally sufficient to prevent serious anemia if calves are fed dry feeds beginning at a few weeks of age. Yet when calves are fed a milk diet exclusively for several weeks, then they may develop iron deficiency anemia, which can adversely affect growth and feed conversion. Iron deficiency is associated with numerous clinical signs, including anemia, reduced growth, and increased rates of disease. Copper has an important role in the metabolism and transition of iron in the body. Since copper absorption reduces with rumen activity, thus during the first month of life the deficiency of copper and impaired iron utilization could exist together. Consequently, administration of copper from the time of rumen activation could be useful in iron utilization. The objective of the present study was to examine the effects of parenteral administration of iron and copper on hematological parameters, growth, and health of dairy calves in the period when iron and copper deficiency could exist.

Materials and Methods

The study was conducted in a dairy herd with approximately 600 calves per year at Mashhad suburb (northeast of Iran).Twenty four Holstein calves were used for the experiment and randomly assigned to four different treatments. Treatments consisted of (1) control (no injections of Fe and Cu), (2) test 1 (1000 mg Fe as fe-dextran was injected to each calf at day 2 of age), (3) test 2 (160 mg Cu as methionine-copper complex was injected to each calf at day 14 of age), and (4)test 3 (Fe and Cu were injected to each calf as mentioned previously). Blood samples were collected from all of the calves within 24-48 hours after birth and at 7, 14, 21 and 28 days of age for measuring hematological parameters and within 24-48 hours after birth and at 14, 21 and 28 days of age for the determination of iron, copper, and TIBC concentrations. Anti-coagulated blood was analyzed shortly after collection for CBC. The amounts of iron, copper, and Total Iron Binding Capacity (TIBC) were measured by commercial kits using an autoanalyser. For evaluation of growth and health, body weight of all of the calves was measured weekly and days of treatment were recorded at the end of the study.

Results

Group had significant effect on the amounts of PCV, RBC, hemoglobin, MCV, neutrophil, weekly weight gain, and daily gain during each week ($p< 0.05$). Sampling time (age) had significant effects on the amounts of RBC, MCV, MCH, MCHC, WBC, neutrophil, lymphocyte, monocyte, platelet, fibrinogen, copper, TIBC, AST, weight, weekly gain and, daily gain during each week ($p< 0.05$). Significant interactions between sampling time and group were seen for PCV, RBC, hemoglobin, MCV, platelet, iron, and TIBC ($p< 0.05$). Significant differences were seen between trial groups for total weight gain and total daily weight gain ($p<0.05$). No significant difference was seen for the days of treatment between groups.

Significance

In the present study, administration of iron similarly provided an increase in RBC parameters. On the other hand RBC parameters were not affected by the administration of copper. RBC parameters in second, third, and fourth weeks of age were higher in the test 3 group than those in the control were and test 2 groups. Therefore, our results showed that by administration of iron and thereafter copper, greater increase in RBC parameters were resulted. In the present study, better performance was resulted in supplemented groups than control group was. Best performance was seen for Test 3 group than others. These results suggested better utilization of iron in the presence of adequate amount of copper. Administration of iron had no effect on the incidence of neonatal diseases and the frequency of treatments for them. Improved RBC parameters and performance were seen in calves of group 2 (test 1) and group 4 (test 3) in comparing with other trial groups