

EFFECT OF SUPPLEMENTAL TRACE MINERAL LEVEL AND FORM ON PERIPUBERTAL BULLS

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Adequate dietary trace minerals are an essential component to growth and sexual development in males. Our objectives were to determine if different supplemental trace mineral levels and/or forms (sulfate and metal amino acid complexes) influence age at puberty, semen quality and scrotal circumference. Forty-three crossbred, prepubertal bulls were blocked by age ($258 \text{ d} \pm 8.9$) and scrotal circumference into five different treatment groups: 1) 1x sulfate form (1S); 2) 1x complexed form (1C); 3) 1S + 1C (2SC); 4) 1S + 2x1C (3SCC); and 5) 3x1S (3S). Each 1x supplementation level contained 360 mg Zn, 125 mg Cu, 200 mg Mn, and 12.5 mg Co. Bulls were assigned to Calan gate pens with one animal/treatment/pen. Supplements were individually fed daily in 0.45 kg of wheat middlings from day 0 to 100. The basal diet of 7% alfalfa hay, 10.5% corn, 75.5% corn silage, and 7% protein supplement was fed to all bulls and was formulated to achieve 1.2 kg ADG. Liver biopsies were collected on days -21 and 100 and were analyzed for Zn and Cu concentrations. Scrotal circumference, semen, and blood samples were collected on days -14, 14, 42, 70, and 98. Semen was collected by electroejaculation and spermatozoa evaluated for morphology and motility. Puberty was defined as the age at which an ejaculate contained a minimum of 50×10^6 total spermatozoa with at least 10% progressive motility. All bulls were deficient in Cu yet adequate in Zn on day -21 according to liver concentration. Following 100 d on treatment, liver Zn concentrations decreased ($P < 0.01$) and liver Cu concentrations increased ($P < 0.01$) in bulls regardless of treatment. Day 100 liver Zn concentrations were similar ($P = 0.59$) across treatments, but there was a tendency for liver Cu concentrations to be greater ($P = 0.07$) in 3SCC and 3S bulls compared to 1C and 1S bulls, whereas 2SC bulls were intermediate. Scrotal circumference did not differ ($P > 0.10$) among treatments throughout the trial. Two bulls did not reach puberty and were removed from the puberty data. On day 42, more ($P = 0.03$) bulls fed complexed trace minerals (1C, 2SC, 3SCC; 79%) were pubertal compared to those fed only sulfate trace mineral (1S, 3S; 47%). Bulls fed complexed supplement tended to reach puberty after fewer ($P = 0.11$) days on treatment ($43.9 \pm 5.7 \text{ d}$) than bulls fed only sulfate supplement ($58.5 \pm 6.7 \text{ d}$). Bulls fed 3SCC tended ($P = 0.07$) to reach puberty at a younger age ($315.2 \pm 7.9 \text{ d}$) than bulls fed 3S ($336.8 \pm 7.9 \text{ d}$). On day 42, 3S bulls had a larger ($P = 0.08$; 39.2%) percentage of proximal and distal droplets in ejaculates compared to all other treatments (1S, 1C 2SC, 3SCC; 15%, 20%, 25%, 21.6% respectively). Based on decreased final liver Zn concentrations regardless of treatments, we conclude that NRC recommendations for Zn may be inadequate for bulls during the peripubertal stage of

development. Supplementing Cu and Zn deficient prepubertal bulls a complexed form of trace minerals may lower the age at puberty, however, no apparent differences ($P > 0.41$) in semen characteristics existed at one year of age.

Keywords: Bull; Puberty; Trace Minerals