Controlled field study comparing organic and inorganic trace elements supplementation in hypermuscled Belgian Blue Breed: biochemical aspects

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Selenium (Se), copper (Cu), zinc (Zn) and Iodine (I) deficiencies are frequently observed in cattle in Europe. The hypermuscled Belgian Blue (BB) breed is particularly prone to these deficiencies because of the higher dietary requirements. Inorganic and organic supplements of Se, Cu and Zn are commercially available feed sources. The aim of this study was to validate the alleged greater efficacy of organic minerals to prevent deficiencies in BB farms.

A double-blinded controlled field trial was organized in 13 BB farms as a split-plot dividing the animals in each farm in 2 groups and randomly assigning to them the 2 dietary treatments. Mineral supplements of 100 grams were fed daily to each pregnant dam for at least 2 months before calving. Group A received 4 mg Se, as 2 mg Optimin SeY (63% seleno-methionine Se enriched yeast, Nutreco), and 2 mg Na_2SeO_3, 140 mg Cu as 70 mg $CuSO_4$ and 70 mg Optimin Cu (Nutreco), and 500 mg Zn as 250 mg $ZnSO_4$ and 250 mg Optimin Zn (Nutreco). Group B received the same amounts of Se, Cu, and Zn, but only in their inorganic form. Supplements also contained 15 mg I, 6 mg Co and vitamins A, D3, E. Farms were visited monthly to record zootechnical and health data from dams and calves. Blood samples were taken from dams at T0 (before supplementation), T1 (2 weeks before calving), T4 (2 weeks after calving by caesarian-section) and T5 (at the end of the study, approximately 2 months after calving). Colostrum samples were also taken. Regarding calves, blood was taken at birth, during the first week of life, and 2 weeks after birth. Plasmatic Se, Cu, Zn, I, thyroid hormones and haptoglobin were measured. Total proteins in plasma and serum were analyzed. Colostrum was analyzed for total protein, IgG and Se content. Calf growth, blood parameters and colostrum characteristics were studied as continuous variables with PROC MIXED SAS using farm as a random effect. Plasma minerals, haptoglobin and thyroid hormones, clustered in 3 subgroup levels of status per farm, were analyzed as multinomial cumulative parameters with GENMODE, using MULTINOMIAL and CUMLOGIT. This paper focuses on biochemical results of the dams.

No differences between the treatments were found at T0 for any of the variables ($p>0.1$). Se status was higher at all times in group A ($p<0.01$), and Zn showed a trend ($p=0.08$) in favor of group A at T4. No difference was found at any time point for Cu or total proteins ($p>0.1$). Thyroid hormones and their ratio were also not different ($p>0.1$). Haptoglobin was lower at T4 for group A ($p<0.05$).

Colostrum density, total protein and IgG were not significantly different between groups ($p>0.1$) but Se content was higher for group A ($p<0.01$).

Supplying half of Se, Zn and Cu in organic forms in well managed and only marginally deficient BB farms leads to a better Se status in dams and a greater supply to their progeny *via* the colostrum. This effect persisted even 2 months after the discontinuation of the supply of Se in organic form. A trend for fewer cases of Zn deficiency was also found in T4. The organic supplement resulted in less inflammation 2 weeks after calving, which in BB is always by caesarean section. A partial formulation of the mineral supplement with organic trace minerals (50% organic + 50% inorganic) resulted in greater nutritional efficacy to sustain Se and Zn status, and additional health benefits reducing inflammation in transition BB cows.