Breed effects on bovine fetal and maternal hepatic mineral concentrations

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A number of factors have been identified as influencing trace mineral status of the dam and its fetus. Previously, breed (dairy vs. beef) was identified as a significant factor affecting hepatic mineral status. Aim of this study was to better characterize breed effects on maternal and fetal hepatic mineral concentrations.

Liver samples were collected from 181 pairs of pregnant cows and their fetuses at an abattoir over a period of 13 months. Breed, sex, fetal numbers and measured crown-rump length were recorded at time of collection. Inductively coupled plasma atomic emission spectroscopy (ICP/MS) was used to assay 9 minerals (calcium, copper, cobalt, iron, magnesium, manganese, molybdenum, selenium, zinc) in all samples. Mineral concentrations were determined on a wet weight (WW) and converted to a dry weight (DW) basis. Liver dry matter (DM) content was determined by drying an aliquot sample in a convection oven. Fetal gestational age was estimated from measured crown-rump length. Regression and ANOVA were used to evaluate interrelationships and breed effects between fetal and maternal hepatic mineral concentrations.

A total of 181 fetal-maternal paired samples were collected from 142 dairy and 39 beef cows, including 11 sets of twins (10 dairy; 1 beef). Dairy cows were predominately Holstein breed, while beef cows were Hereford, Angus or crossbreds. Mean (range) fetal age was 6.4 (3.8-9.4 months). Breed (dairy vs. beef) was found to influence fetal and maternal values and their interrelationships. Within all fetuses, both WW and DW concentrations of magnesium decreased ($P<.0001$) and manganese and molybdenum increased ($P<.0001$) with gestational age. Dairy fetuses had increasing calcium WW and decreasing iron DW concentrations, while beef fetuses showed increasing ($P<.001$) zinc (WW, DW) and decreasing ($P<.03$) cobalt and selenium DW concentrations. Dairy fetuses had greater WW and DW iron ($P<.02$) and selenium ($P<.001$) and lower ($P<.02$) WW magnesium, calcium and manganese content compared to beef fetuses. In general, maternal hepatic mineral concentrations were not influenced by gestational stage; however, some differences between breeds were identified. In dairy cows, manganese ($P<.0005$) and molybdenum ($P<.04$) content (WW, DW) declined with gestational age. Magnesium (DW) content declined ($P<.05$) over gestation in beef cows. Beef cows had higher hepatic manganese ($P<.03$) and lower copper ($P<.0001$), zinc ($P<.05$) and selenium ($P<.0004$) content compared to dairy cows.

In the current study, beef cattle showed lower hepatic copper, zinc and selenium content, possibly reflecting lower rates of mineral supplementation. Fetuses were capable of assimilating mineral similarly across gestation, but hepatic content reflected maternal status.