Impact of Maternal Selenium Supplementation on Neonates

Selenium is an essential trace micronutrient that is known to play a role in immunocompetence through its incorporation into glutathione peroxidases and thioredoxin reductase. The selenium status has been reported to affect the function of all components of the immune system and influence the ability to respond to infections. Selenium-deficiency diseases have rarely been recognized beyond exceptional situations, such as severe malnutrition or prolonged parenteral nutrition, when selenium concentrations fall to <0.20 μmol/L (16 μg/L). Clinical features have included muscle pain and tenderness, macrocytosis and pigmentary changes in hair and nails, and fatal cardiomyopathy.

Pregnancy is a condition of oxidative stress due to an increase in the basal oxygen intake and consumption, as well as an elevated metabolic demand. Lower concentrations of selenium in the whole blood and plasma as well as lower glutathione peroxidase activities have been reported in pregnant women. An exposure to a high oxygen concentration at birth, an infection, inflammation, and a deficient antioxidant system make the newborn more susceptible to oxidative stress.

Reactive oxygen species are considered to have a role in the pathophysiology of various neonatal diseases such as bronchopulmonary dysplasia, retinopathy of prematurity, persistent ductus arteriosus, necrotizing enterocolitis, intracranial hemorrhage, and hypoxic ischemic encephalopathy, especially in extremely low-birth-weight infants. Concentrations of oxidation products were higher in the lowest-birth-weight, high-risk infants, and higher concentrations of oxidant markers have been proved to be associated with chronic lung disease and mortality. The risk of oxidative stress in neonates depends majorly on the maternal antioxidant status, which is important for the protection of the maternal–fetal unit against free radicals.

Neonates undergo rapid development of the immune system when the circulating concentrations of plasma selenium and glutathione peroxidase activities are low as compared with that of the mother. The immune system, which depends on selenium for differentiation and function, undergoes extensive maturation during infancy. Transplacental transfer is limited, so selenium concentration is relatively low in the fetus, corresponding in umbilical-cord blood to approximately 65% of the maternal serum level. Selenium in the umbilical-cord blood of newborns was found to have a significant association with gestational age and a remarkable increase in selenium concentrations after 36 weeks. Preterm infants are born with slightly lower selenium and glutathione peroxidase concentrations than term infants and have low hepatic stores of selenium, and, particularly if fed parenterally with solutions lacking selenium, these concentrations decline further in the first months of their life. Very low levels of selenium have been found in premature infants, potentially resulting in a risk of oxidative injury, which increased the risk of chronic neonatal lung disease and retinopathy of prematurity.

Maternal selenium deficiency is considered to be a contributory factor to the causation of oxidative stress in the neonate, which is characterized by increased lipid peroxidation and impaired development of the immune system in the neonate. The selenium content of human milk is influenced by maternal dietary intake. A study evaluating the impact of a maternal diet low in selenium on the development and function of a neonatal immune system has indicated that maternal selenium intake impacts neonatal selenium status, which in turn influences the development of the neonatal immune system. An extensive review of the relation between selenium deficiency and diseases of prematurity indicated uncertainty regarding whether selenium supplementation reduces the risk for chronic lung disease and retinopathy in preterm infants.

Serum selenium concentrations have been reported to be positively and significantly correlated with serum cholesterol. Observational studies have reported a positive association between serum selenium concentrations and lipid levels; intervention studies have indicated a reduction of total and low-density lipoprotein-cholesterol concentrations following selenium supplementation. Clinical trials investigating the effect of material selenium supplementation on cord-blood lipid profile are lacking. Interestingly, a recent intervention study of selenium supplementation in pregnant women found an increase in the cord-blood triglyceride level, although total cholesterol, and low- and high-density
lipoprotein-cholesterol levels did not change significantly. However, the clinical significance of the increased cord triglyceride concentration requires further evaluation.

Hsun-Chin Chao*
Division of Gastroenterology, Department of Pediatrics, Chang Gung Children’s Medical Center, Chang Gung Memorial Hospital, Chang Gung University, College of Medicine, Taoyuan, Taiwan

*Division of Gastroenterology, Department of Pediatrics, Chang Gung Children’s Medical Center, Chang Gung Memorial Hospital, Chang Gung University, College of Medicine, 5 Fu-Hsing Street, Kuei-Shan, Taoyuan 33305, Taiwan. E-mail address: chaohero@yahoo.com

Oct 9, 2012

References