Repeated neonatal oral sucrose treatment affects growth and alters insulin-like growth factor-1 and liver choline metabolism in mice.

Cynthia Yamila Ramirez Contreras, Author, Department of Medicine, University of British Columbia, Vancouver, British Columbia, V5V 4M4
Presenting Author

Alejandra M. Wiedeman, Coauthor, Pediatrics, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Ei-xia Mussai, Coauthor, Obstetrics and Gynecology, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Nicha Boonpattrawong, Coauthor, Pathology and Laboratory Medicine, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Arya Mehran, Coauthor, Pediatrics, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Manon Ranger, Coauthor, Nursing, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Liisa Holsti, Coauthor, Occupational Science and Occupational Therapy, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Kiran K. Soma, Coauthor, Psychology, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Angela M. Devlin, Coauthor, Pediatrics, University of British Columbia, Vancouver, British Columbia, V5Z4H4

Premature infants (<37 weeks gestation) often require hospitalization in the neonatal intensive care unit, where they experience painful procedures due to medical care. Oral sucrose treatment for analgesia is the non-pharmacological standard of care for minor procedural pain relief. During hospitalization infants can be treated with several cumulative doses of sucrose raising concerns about the effects later in life. The objective of this study was to determine the long-term effects of repeated neonatal oral sucrose treatment on growth, adiposity, and glucose homeostasis using an animal model. Neonatal female and male mice (C57BL/6J) were randomly assigned to one of four treatments (n=7-10 mice/group/sex): sterile water, sucrose, fructose, or glucose. Pups were treated 10 times/day for the first six days of life with 0.2g/kg weight of the respective treatments (24% solution; 1-4 μl/dose) orally to mimic what is given to preterm babies. Mice were weaned onto a control diet and fed until age 16 weeks. Pups were weighed daily from birth to weaning and weekly thereafter. Glucose tolerance was assessed at weaning and in adults. Body composition, fat distribution and tissue were collected at age 16 weeks. Female sucrose-treated mice gained less weight during the suckling period and were smaller (p<0.001) at weaning compared to the water and glucose-treated mice (7.00 ±0.75g vs 8.13 ± 0.79g, 8.05 ±0.96g respectively). At age 16 weeks, female sucrose-treated mice had smaller (p<0.001) tibias and lower (p<0.05) serum insulin-like growth factor 1 concentrations. This was accompanied by lower liver free choline (p<0.01), phosphocholine (p<0.05), and glycerophosphocholine (p<0.05) concentrations, and higher (p<0.01) betaine concentrations in the sucrose-treated compared to the water-treated female mice. No differences in growth or liver choline metabolites were observed in male mice. Neonatal oral sucrose treatment had no effect on glucose tolerance at weaning or adulthood. Our findings suggest that repetitive neonatal sucrose treatment affects growth in female mice through an IGF-1-dependent pathway and alters liver choline metabolism. Further research is required to determine the mechanistic pathways of these findings. (Catalyst grant from the Healthy Starts Research Group at BC Children's Hospital Research Institute)