Repeated Neonatal Oral Sucrose Treatment Affects Growth and Alters Insulin-Like Growth Factor-1 and Liver Choline Metabolism in Female Mice

Cynthia Yamila Ramírez-Contreras 1, Alejandra M. Wiedeman 2, Ei-xia Mussai 3, Nicha Boonpattawong 4, Arya Mehran 2, Manon Ranger 5, Kiran Soma 6 Liisa Holsti 7, Angela M. Devlin 2.

Departments of Medicine 1, Pediatrics 2, Obstetrics and Gynecology 3, Pathology 4, Nursing 5, Psychology 6, and Occupational Science and Occupational Therapy 7; University of British Columbia and British Columbia Children’s Hospital Research Institute.

Background

• Premature infants (<37 weeks of gestation) often require hospitalization in the neonatal intensive care unit, where they experience painful procedures due to medical care.
• Oral sucrose is the non-pharmacological standard of care for minor procedural pain relief.  
• Approximately 0.5-2mL of a 24% sucrose solution is administered orally prior to each painful procedure.
• Infants can be exposed to high and cumulative volumes of sucrose.  

Concerns about neonatal sucrose treatment

• Adult mice treated with neonatal sucrose have reduced white and grey matter.  
• Very preterm infants that received multiple doses of sucrose have poorer attention and motor function.  

Objective

To determine the long-term effects of repeated neonatal oral sucrose treatment on growth, glucose homeostasis and liver choline metabolites using an animal model.

Methods

• Neonatal female and male mice (C57BL/6J) were randomly assigned to one of four treatment groups (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 respective treatments (1-4 μl/dose; 24% solutions) orally to mimic what is given to preterm babies.
• Mice were weaned at 3 weeks onto a control diet (D12450K Research Diets ©) and fed until age 16 weeks.
• Nose to anus length was measured on the day of euthanasia before cervical dislocation. Tibia length was treated in 2% KOH and measured using a digital caliper.
• Serum IGF-1 was measured using a commercial ELISA kit (ALPCO ©).
• Liver water-soluble choline metabolites were quantified by LC-MS/MS.

Results

Data presented as mean ± SD. One-way ANOVA (Tukey post hoc analysis)

Figure 1. Body weight

Figure 2. Body size and serum IGF-1 at 16 weeks

Figure 3. Liver water-soluble choline metabolites at 16 weeks

Conclusions

• Neonatal sucrose treatment affects growth in female, but not in male mice and may involve an IGF-1 and choline-dependent pathways.