ABSTRACT

Low perinatal and infantile vitamin B-12 (B-12) status have been associated with health complications. South Asians and residents of low- and middle-income countries may be at increased risk for low B-12 status.

The overall goal was to facilitate and screen for perinatal, neonatal, and infantile B-12 status. First, a reliable (recovery: 93–98%; CV: <7%) tool for B-12 status assessment in vulnerable populations was developed, using dried blood spot methylmalonic acid (DBS MMA) concentrations. MMA is the most specific functional B-12 biomarker. Given the minimal invasiveness and ease of DBS collection, DBS MMA may be convenient to use in newborns and populations in remote settings to estimate B-12 status. As such, a reference value of elevated neonatal DBS MMA concentration of >29.3 pmol/8-mm punch was computed per clinical guidelines (CLSI EP18-A3c). Further, B-12 status of South Asian and European pregnant women and their newborns living in Vancouver were compared. B-12 status was assessed in 751 healthy Vancouver women (50% South Asian, 50% European) during their 1st and 2nd trimester of pregnancy using multiple B-12 biomarkers, and in their newborns using DBS MMA concentration. South Asian pregnant women had a significantly lower B-12 status than European women, e.g. comparing 1st trimester mean (95% CI) serum total B-12 concentrations [189 (180; 199) pmol/L versus 246 (236; 257) pmol/L; P<0.0001]. This difference in B-12 status was not reflected in the DBS MMA concentrations of their newborns. Last, the prevalence of B-12 deficiency in mothers and their infants living in rural Indonesia was determined. The prevalence of infants (n=221) living in rural Indonesia with serum total B-12 concentrations <191pmol/L followed at age 6-, 9-, and 12-months was 27%. Maternal DBS MMA concentrations at 6 months postpartum were weakly, but statistically significantly (P=0.004), associated with infant serum MMA concentrations.

This research suggests DBS MMA is a convenient screening tool with use in vulnerable populations, including newborns. Pregnant South Asian women living in Vancouver and infants living in rural Indonesian were identified as populations at risk for low B-12 status. Future research evaluating outcomes and determinants of B-12 status is warranted to allow for targeted interventions.

BIOGRAPHICAL NOTES

Academic Studies: Vordiplom, University of Konstanz, 2007
Diplom, University of Hohenheim, 2011

GRADUATE STUDIES

Field of Study: Nutritional Biochemistry

Courses

		Instructors
HUNU 500	Research Methods	Dr. Chapman
SPPH 400	Statistics for Health Research	Dr. Guhn
HUNU 631	Food, Nutrition and Health Seminar	Various

SELECTED AWARDS

Killam Graduate Teaching Award, University of British Columbia, 2016
Graduate Student Service Award, Faculty of Land and Food Systems, 2016
Four Year Fellowship for PhD Students, University of British Columbia, 2012
Doctoral Scholarship for Outstanding Women in Science, Simons Foundation, 2012

SELECTED PUBLICATIONS

Schroder TH *et al*. Reference interval of methylmalonic acid concentrations in dried blood spots of healthy, term newborns to facilitate neonatal screening of vitamin B12 deficiency. *Clin Biochem* 2016; 49:973-8.

Schroder TH *et al*. Methylmalonic acid quantified in dried blood spots provides a precise, valid, and stable measure of functional vitamin B-12 status in healthy women. *J Nutr.* 2014; 144:1658-63.

Schroder TH *et al*. Oxalate content in commercially produced cocoa and dark chocolate. *J Food Compost Anal*. 2011; 24:916-22.

SELECTED PRESENTATIONS

“Performance of total vitamin B-12 and holotranscobalamin concentrations during pregnancy in screening for maternal and predicting neonatal functional vitamin B12 deficiency.” *FASEB SRC: Folic Acid, Vitamin B12, and One Carbon Metabolism*, Steamboat Springs, Colorado. Aug 7-12, 2016.

“Predictors and prevalence of vitamin B-12 deficiency in infants living in rural Indonesia during the introduction of complementary foods.” *FASEB SRC: Folic Acid, Vitamin B12, and One Carbon Metabolism*, Steamboat Springs, Colorado. Aug 7-12, 2016.

"Functional vitamin B-12 status in lactating women living in rural Indonesia assessed by using dried blood spot methylmalonic acid analysis." *Experimental Biology*, San Diego, California. Apr 2-6, 2016.

"Methylmalonic acid concentration quantified in newborn screening cards for vitamin B-12 status assessment at birth." *One Carbon Metabolism, Vitamins B and Homocysteine Conference*, Nancy, France. Jul 7-11, 2015.

"Methylmalonic acid concentration in dried blood spots – validation of a novel method for vitamin B-12 status assessment." *Experimental Biology*, Boston, Massachusetts. Apr 20-24, 2013.

"Simple and non-invasive method for vitamin B-12 status assessment: functional biomarker quantification in dried blood spots." *CNS-SCN Annual Meeting*, Vancouver, Canada. May 24-26, 2012.

"Quantitative analysis of dried blood spots for assessment of vitamin B-12 status using liquid chromatography – tandem mass spectrometry." *Annual Meeting of the American Society of Mass Spectrometry*, Vancouver, Canada. May 20-24, 2012.

SUPERVISORY COMMITTEE

Dr. Yvonne Lamers, Research Supervisor (Human Nutrition)
Dr. Susan Barr (Human Nutrition)
Dr. Jehannine Austin (Medical Genetics)
Dr. Joshua Miller (Nutritional Sciences, Rutgers University)

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Graduate and Postdoctoral Studies

PROGRAMME

The Final Oral Examination
For the Degree of

DOCTOR OF PHILOSOPHY
(Human Nutrition)

THERESA H SCHRODER

Vordiplom, Chemistry, University of Konstanz, Germany
Diplom, Food Chemistry, University of Hohenheim, Germany

Friday, February 24, 2017, 9:00 am
Room 200, Graduate Student Centre
Latecomers will not be admitted

"Vitamin B-12 Status During Pregnancy and Infancy: Screening Tools and Assessment of Populations at Risk for Deficiency"

EXAMINING COMMITTEE

Chair:
Dr. Margot Van Allen (Medical Genetics)

Supervisory Committee:
Dr. Yvonne Lamers, Research Supervisor (Human Nutrition)
Dr. Susan Barr (Human Nutrition)
Dr. Joshua Miller (Nutritional Sciences, Rutgers University)

University Examiners:
Dr. Rajavel Elango (Experimental Medicine)
Dr. Hélène Coté (Pathology & Laboratory Medicine)

External Examiner:
Dr. Anne Molloy
School of Medicine
Trinity College Dublin
Dublin, Ireland