A randomized cluster trial to evaluate the effect of iodized salt exposure on birth outcome and infant development in Ethiopia

October 18th, 2016
3:15 pm

Raymond Building, Room R4-046
McGill University, Macdonald Campus

COMMITTEE:
Dr. Ian Strachan (Pro-Dean) (Department of Natural Resource Sciences)
Dr. Timothy Johns (Chair) (Dietetics and Human Nutrition)
Dr. Grace Marquis (Supervisor) (Dietetics and Human Nutrition)
Dr. Hugo Ramiro Melgar-Quiñonez (Internal Examiner) (Dietetics and Human Nutrition)
Dr. Frances Aboud (External member) (Psychology department)
Dr. Humberto Monardes (External Member) (Animal Science Department)

Dr. Josephine Nalbantoglu, Dean of Graduate and Postdoctoral Studies
Members of the Faculty and Graduate Students are invited to attend
ABSTRACT
Iodine deficiency disorders (IDD) can result in physical and mental disabilities at all stages of human life. The main objectives of this thesis were to examine the effects of iodized salt introduced in a moderately iodine-deficient population of Ethiopia (1) on pregnancy and birth outcomes, (2) on the growth and mental development of young children, and (3) on thyroid function and hormonal mediation of children’s cognitive development.

Sixty villages in 60 districts across six zones in the Amhara region of Ethiopia were randomly assigned to intervention (early access to iodized salt) or control (later access through normal market forces) arms. Out of the 30 intervention and 30 control districts, 22 of each were randomly selected for data collection. A total of 1220 pregnant women who conceived after the intervention began were assessed for their iodine and iron status, and their household salt was tested for iodine. When their children were 2 to 13 months old, additional data were collected once on socio-demographic characteristics, gestational history, pregnancy and birth outcomes, infant mortality, child psycho-social stimulation in the home, and household food insecurity (HFI). Child’s diet, anthropometry, urinary iodine, hemoglobin, motor milestones, and mental development (Bayley III scales: cognitive, expressive language, receptive language, and fine motor) were also assessed. Children’s serum samples were tested for thyroid hormones, ferritin, and inflammation markers. An intention-to-treat analysis of covariance controlling for clusters, logistic regression analysis, and mediation analysis were conducted. The study was part of a randomized clinical trial to evaluate the effect of iodized salt on child development, registered at clinicaltrials.gov No: NCT01349634.

A total of 1035 children were followed up, of which 1024 were included in the analysis. Even though fewer intervention than control households used iodized salt (92% vs 95%, p=0.01), the maternal urinary iodine levels were adequate and significantly higher in the intervention than in the control villages (median 163 vs 121 µg/L, p<0.0001). Additionally, fewer mothers (28% vs 41%, p<0.05) and children (13% vs 20%, p<0.05) were iodine deficient at less than 50 µg/L in the intervention compared to the control group.
The mothers were on the average 28 y of age with low education (77% illiteracy) and low assets (2.4 out of 10); most had livestock (94%). Their water and sanitation practices (61% scored <2 out of 3) were poor. The intervention did not significantly reduce adverse pregnancy outcomes (miscarriage aOR (95% CI): 2.5 (0.9, 6.9), birth outcome (stillbirth aOR (95% CI): 1.0 (0.4, 2.8)) or infant mortality (aOR (95% CI): 0.9 (0.5, 1.6)). The intervention children had a higher cognitive score (33.3 ± 0.3 vs 32.6 ± 0.3; effect size \(d\) =0.17; IQ points 103 vs 99; p=0.01) but other Bayley scores and child growth indicators did not differ from control children. There were significant interactions between the intervention effect and levels of psychosocial stimulation, maternal depression, and child iron stores on cognition. Intervention children compared to control children had lower serum thyroid stimulating hormone (TSH) (2.4 ± 1.0 vs 2.7 ± 1.0, effect size=0.18, p<0.01) and thyroglobulin (Tg) (41.6 ± 1.0 vs 45.1 ± 1.0, effect size=0.14, p<0.05) levels. Mediation analysis showed that TSH was a partial mediator of the effect of the intervention on children's cognitive development (Sobel z-score= 2.1 ± 0.06, p<0.05).

Early exposure to iodized salt during pregnancy did not reduce adverse pregnancy and birth outcomes but improved pregnant women’s iodine status and their children’s iodine status, cognition, and thyroid hormone levels.
CURRICULUM VITAE

UNIVERSITY EDUCATION
• PhD Human Nutrition
  McGill University (Jan. 2012 – Present)
• MPhil Dietetics
• Post-graduate diploma in food and nutrition security
• BSc Biochemistry and Nutrition

EMPLOYMENT
Jul. 2006 – Mar. 2011 Research Assistant at the Department of Nutrition and Food Science of the University of Ghana, Legon, Ghana

AWARDS
IMMANA post-doctoral fellowship. Tufts University, USA 2016
Heart and Stroke best poster award. University of Concordia, Canada 2015
Graduate Research Enhancement and Travel Award 2013
Graduate Excellence Award 2013
Graduate Travel Award 2012
Graduate Excellence Award 2012
Ghana Education Trust Fund Award 2012
International Nutrition Foundation/Ellison Medical Foundation (INF/EMF) Travel Fellowship 2009
Netherlands Fellowship Program 2009
International Nutrition Foundation Travel Grant 2008
INF/EMF Travel Fellowship 2007

PUBLICATIONS
1. Mohammed H, Ghosh S, Smriga M, Vuvor F, , Armah SM, Steiner-Asiedu M. Dietary intake and the dynamics of stress,
