Tackling the next public health challenge—iodine deficiency and its detrimental effects on maternal and child populations in the United States

Policy Brief *June 2013*

Iodine Deficiency

Iodine deficiency affects more than 2.2 billion individuals (38% of the world's population) and remains the leading cause of preventable mental retardation worldwide (Leung, Pearce, & Braverman, 2011). Since the 1920s, dietary iodine in the United States has been considered adequate. However, according to recent data from the National Health and Nutrition Examination Survey (NHANES), the median urinary iodine concentration in adults has decreased by more than 50% from 1971 to 2008. Using the same measure of median urinary iodine concentration, a study of aggregate NHANES data from 2001-2006 found that pregnant women were marginally iodine sufficient, and both lactating women and non-pregnant non-lactating women were iodine deficient (Leung et al., 2011). Given the uncertainty of and changes in the iodine status of the most vulnerable populations in the US in recent decades, and the serious consequences of iodine deficiency, it is necessary to advance the assessment of iodine status and address the need for a national policy to mandate iodine fortification.

Scope of Problem

Iodine is essential for normal growth and development. It is required for normal brain myelination in utero and during the early postpartum period (Leung, Braverman, & Pearce, 2012). Adequate dietary iodine intake is required for thyroid hormone synthesis (Caldwell et al., 2011). During pregnancy, there is an increase in thyroid hormone production, renal iodine losses, and fetal iodine requirements. Therefore, dietary iodine requirements are higher in pregnant women than in non-pregnant adults (Leung et al., 2011). Because breastfed infants rely on maternal iodine intake, recommendations for dietary iodine intake during lactation are higher for lactating women than non-lactating adults (Leung et al., 2011)

The Food and Nutrition Board (FNB) at the Institute of Medicine (IOM) of the National Academies established reference intake levels for iodine (Table 1). The reference values, referred to as DRI, include the Estimated Average Requirement (EAR), Recommended Daily Allowance (RDA), and Tolerable Upper Intake Level (UL) (Swanson et al., 2012).

Table 1: Dietary Reference Intakes (DRI) for iodine in adult groups

(in mcg)	**EAR**	**RDA**	**UL**
Adults ≥19 y	95	150	1100
Pregnant women			
≤18 y	160	220	900
≥19 y	160	220	1100
Lactating women			
≤18 y	209	290	900
≥19 y	209	290	1100

NHANES data from 1971-2008 have shown that the prevalence of urinary iodine values less than 50 mcg/L among women of childbearing age has increased from 4% to 15%. The most recent NHANES survey (2005-2008) reveal that 35.3% of pregnant women had urinary iodine levels less than 100 mcg/L, which suggests mild iodine sufficiency (Leung, 770).

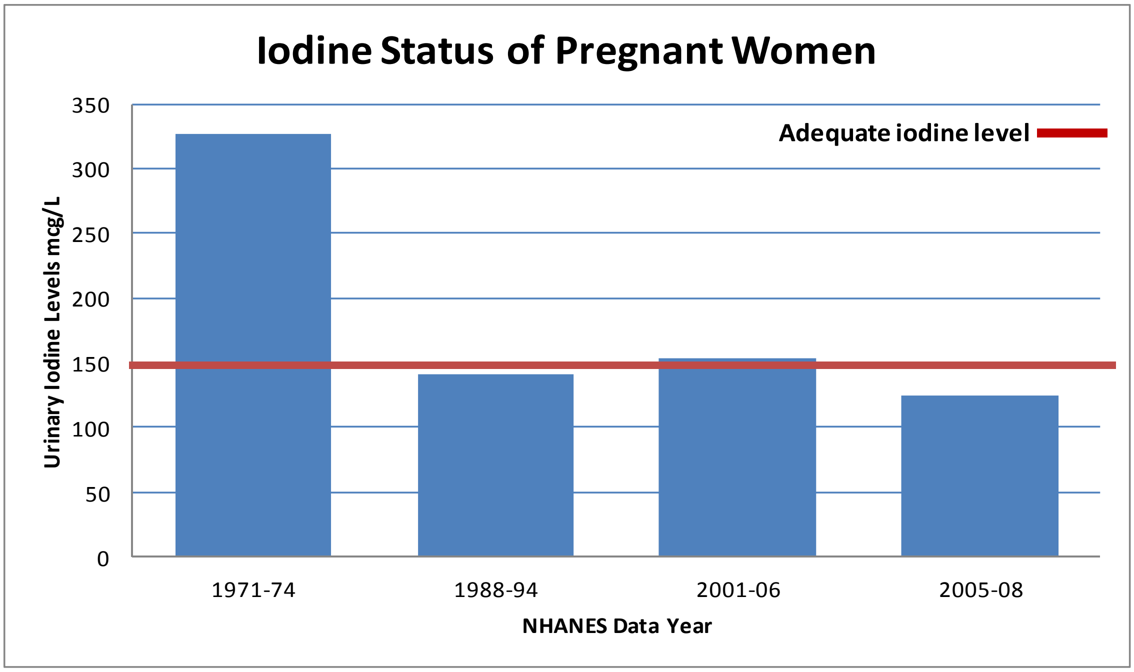

Figure 1: Iodine Status of Pregnant Women (Swanson et al., 2011)

Iodine Fortification and Supplementation in the US

The US does not mandate fortification of salt with iodine, unlike Canada and other industrialized countries. The Salt Institute estimates that approximately 79% of the table salt sold in the US is iodized. However, approximately 70% of the salt in the US diet comes from processed food and food eaten outside the home, neither of which is iodized (Swanson et al., 2012).

In the US, pregnant women are encouraged to take a prenatal supplement. However, in a brief report of NHANES data collected between 2001 and 2006, about 70% of pregnant women in the US reported supplement use (Swanson, 1179S). However, only 20.3% of pregnant and 14.5% of lactating women in the US takes a supplement containing iodine (Leung et al., 2011).

Comprehensive information on the iodine content of food is not readily available in the US. The Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) conduct studies to estimate the iodine content of foods. However, because it is variable among foods, exposure cannot be directly measured (Swanson et al., 2012). A recent survey found that only half of prenatal vitamins have iodine listed on the label and many of vitamins which contain iodine do not list the labeled amount (Leung et al., 2011).

Sources of Iodine and Factors Affecting Iodine Intake

Iodine can be naturally found in the soil and marine life. As noted previously, iodine in food sources can be highly variable but in general iodized salt, seafood, dairy products, and some grain products are the major contributors of iodine for the US (National Institutes of Health Office of Dietary Supplements [NIH ODS], 2011). Several factors have affected the intake of iodine from food sources in recent years in the US:

- Decreased intake of iodized salt, fewer meals being prepared at home and increased consumption of non-iodized salt from processed foods (Swanson et al., 2011)
- Decreased use of iodorphor to sanitize udders in milking/production process (Swanson et al., 2011)
- Specialty forms of salt, such as Kosher salt and sea salt, are not usually iodized (Swanson et al., 2011)
- Decreased use of iodate as a bread conditioner (replaced by bromate) (Zimmerman et al., 2011)
- Increased environmental exposure to perchlorate which competes with iodine absorption (Leung, Pearce, & Braverman, 2009)

For infants, human milk and formula also contribute to iodine intake. Human milk iodine amount will vary depending on maternal iodine status prior and during lactation (Leung et al., 2011). Therefore, ensuring adequate iodine intake during the pre/perinatal period is crucial to the health of both mother and infant.

Table 2: Common Sources of Dietary Iodine (ATA, 2012)

Food	**Serving Size**	**% DV (mcg)**
Cod	3 oz	66% (99)
Yogurt	1 cup	50% (75)
Iodized salt	1.5g (1/4 tsp)	47% (71)
Milk	1 cup	37% (56)
Fish sticks	3 oz	36% (54)
Bread (enriched white)	2 slices	30% (45)
Egg	1 large	16% (24)

Challenges

There is clear evidence to support the need for adequate iodine supplementation, and consuming adequate amounts of iodine is challenging without this mandate. Compounding the problem is that the iodine content of foods is not required to be listed on food packaging labels in the US, making it difficult to identify good iodine sources or assess one's intake from foods (American Thyroid Association [ATA], 2012). Unlike folic acid, there is no consistent mandate that even requires iodine to be in prenatal vitamins.

A Call to Action

The following steps are important in addressing the issue of iodine deficiency in the US:

1. Identify further trends amongst a larger sample size of the vulnerable population in the US (pregnant and lactating women) by monitoring urinary iodine levels in future national nutrition surveys.

2. Conduct studies to evaluate and understand the effects of mild iodine deficiency that occurs in the US and other industrialized countries.

3. Research reliable and valid biomarkers to assess nutrient exposure, status, function, and effect. (Iodine is one of six nutrients currently being developed under the Biomarkers of Nutrition for Development initiative [Swanson, 2011]).

4. Mandate the fortification of prenatal supplements and salt with iodine to prevent iodine deficiency disorders in the US.

5. Conduct studies on the effectiveness of proposed interventions on iodine supplementation of pregnant women and the subsequent health effects on their children (Swanson, 2011).

References:

1. American Thyroid Association. Iodine Deficiency. (2012) Retrieved February 19, 2013, from American Thyroid Association website: http://www.thyroid.org/iodine-deficiency/

2. Caldwell, K.L., Makhmudov, A., Ely, E., Jones, R.L., Wang, R.Y. (2011) Iodine Status of the U.S. Population, National Health and Nutrition Examination Survey, 2005-2006 and 2007-2008. *Thyroid,* 21, 419-427.

3. Leung, A.M., Braverman, L.E., and Pearce, E.N. (2009) Perchlorate, Iodine, and the Thyroid. *Clinical Endocrinology & Metabolism*, 24, 133-141.

4. Leung, A.M., Pearce, E.N., and Braverman, L.E. (2011) Iodine Nutrition in Pregnancy and Lactation. *Endocrinology Metabolism Clinics of North America,* 40, 765-777.

5. National Institute of Health Dietary Supplement Iodine Fact Sheet. (2011). Retrieved February 19, 2013, from National Institute of Health, Office of Dietary Supplements website: http://ods.od.nih.gov/factsheets/Iodine-HealthProfessional/

6. Swanson, C.A., Zimmerman, M.B., Skeaf, S., Pearce, E.N., Dwyer, J.T., Trumbo, P.R., Zehaluk, C., Andrews, K.W., Carriquiry, A., Caldwell, K.L., Egan, S.K., Long, S.E., Bailey, R.L., Sullivan, K.M., Holden, J.M., Betz, J.M., Phinney, K.W., Brooks, S.P., Johnson, C.L., and Haggans, C.J. (2012). Summary of an NIH Workshop to Identify Research Needs to Improve the Monitoring of Iodine Status in the United States and to Inform the DRI. *Journal of Nutrition*, *111*(Supplement).

7. Yarington, C., and Pearce, E.N. (2011) Review Article: Iodine and Pregnancy. *Journal of Thyroid Research*, 2011, 1-8.

Authors:
Margaret Eng, MS, RD, LDN, CLC, Nutrition Specialist, Maryland WIC Program
Lynn Beattie, MPH, LDN, CLC, Nutrition Education Specialist, Massachusetts WIC Nutrition Program