Iodine Deficiency Disorders and Their Elimination

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Preface

Iodine is an essential micronutrient and an integral component of the thyroid hormones, which are required for normal growth and development. The term “iodine deficiency disorders” (IDD), first coined by Basil Hetzel, encompasses a spectrum of adverse health effects including goiter, cretinism, hypothyroidism, growth retardation, and increased pregnancy loss and infant mortality. Thyroid hormone is particularly crucial for neurodevelopment in early life. Insufficient maternal iodine intake during pregnancy may result in neurological and cognitive deficits in children. Despite substantial public health efforts, IDD is currently considered the leading preventable cause of intellectual impairment worldwide.

In ancient geologic times, iodine was distributed evenly over the earth's crust, but in many regions processes such as glaciation and repeated flooding have stripped iodine from the soil. The iodine content of foods depends on the iodine content of the soil in which they are grown, and, therefore, may vary considerably from region to region. The ocean is a rich source of iodine, and seafood, particularly saltwater seafood, is a good iodine source of iodine nutrition. However, there is very substantial variation in the iodine content of fish and seafood across species and locations. Seaweed concentrates iodine from seawater and is, therefore, a good natural source of iodine nutrition although, as for fish, there is considerable variation in seaweed iodine content. The iodine content of meat and milk is increased when livestock feed is fortified with iodine. Iodine may be added to foods as a public health measure, as is the case for iodized salt. It may also be added to the food supply simply to facilitate food processing as in, for example, the use of iodate dough conditioners by some commercial bread bakers in the United States, or the use of iodophor cleansers by the dairy industry. This inadvertent food fortification has been referred to as “silent prophylaxis.”

IDD can never be eradicated, in the way that infectious diseases such as smallpox have been completely and permanently wiped out. However, global IDD elimination – ongoing public health efforts to abolish IDD combined with continuous monitoring to sustain IDD prevention – is an important international public health goal.

This volume is intended to summarize the current understanding of the effects of iodine deficiency as well as iodine excess, and state-of the art methods for IDD

elimination. The history of the discovery of iodine and its effects on human health is fascinating, and is described by Drs. J. Woody Sistrunk and Frits van der Haar in Chap. 1. The accurate assessment of population iodine status is essential for designing IDD prevention efforts. Biomarkers for iodine nutrition and the use of other metrics such iodine intake assessments are discussed by Drs. Zheng Feei Ma and Sheila Skeaff in Chap. 2. Chapter 3 is an up-to-date discussion of the current global status of iodine nutrition, compiled by Gosia Gizak and Dr. Maria Andersson.

Salt iodization and other preventive strategies have substantially improved iodine nutrition worldwide. Consequently, severely iodine-deficient regions are, happily, uncommon at present. The manifestations of severe iodine deficiency are described by Drs. Eduardo Pretell and Chandra Pandav in Chap. 4. In Chap. 5, Drs. Creswell Eastman and Mu Li discuss the milder end of the IDD spectrum, and current data gaps related to how we define and identify mild-to-moderate iodine deficiency. Excessive iodine intake can cause alterations in thyroid function in susceptible individuals; defining safe upper levels for chronic iodine intake has been challenging, as described by Dr. Angela Leung in Chap. 6. The evolution of modern methods for salt iodization, the mainstay of global IDD prevention efforts, is discussed by Dr. Frits van Der Haar in Chap. 7. Optimal methods for the intentional iodine fortification of foods other than table salt, such as the mandated use of iodized salt in bread sold in Denmark, is explored by Drs. Lone Banke Rasmussen and Peter Laurberg in Chap. 8.

Iodine supplementation has been advocated in regions where adequate iodine intakes cannot be assured by dietary intake alone. Both risks and benefits of iodine supplementation, particularly for vulnerable populations such as pregnant and lactating women, are outlined by Drs. Peter Taylor and Onyebuchi Okosieme in Chap. 9. Finally, low-level environmental exposure to chemicals such as perchlorate and thiocyanate, which competitively block thyroidal iodine uptake, appears to be ubiquitous worldwide. There has been recent concern that such environmental exposures might pose a health hazard by inducing or aggravating underlying thyroid dysfunction. This is discussed by myself and Dr. Lewis Braverman in Chap. 10.

The authors of this volume include international experts on iodine nutrition and metabolism and leaders in IDD eradication efforts. I am grateful to my colleagues for their outstanding contributions to this book. It is with both thanks and deep sadness that I would like to particularly acknowledge the contribution of Dr. Peter Laurberg, who died during the preparation of this volume.

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