The modern history of iodine and the near eradication of cretinism

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The eradication of intellectual disability from iodine deficiency in Western countries is one of the great public health triumphs of 20th-century child health care (1). Yet the problem persists today in many parts of the world (2). This article explores why a strategy so successful in the West has proven difficult to export to certain other contexts, and how new kinds of thinking may point the way forward.

As recently as the late 19th century, American pediatricians were familiar with the dwarfism and severe mental deficiency associated with the syndrome that had long been called “cretinism”. The 1920 edition of L. Emmett Holt’s (3) influential textbook The Diseases of Infancy and Childhood described these children as “dull, placid, and good-natured, rarely troublesome or excitable; and when fifteen or eighteen years old they appear like children of three or four years”. Pediatricians in those times were aware that the short stature and coarse facial features of cretinism could be lessened by the early administration of thyroid extract, with Holt describing a change in the entire appearance of the child and a loss of “the idiotic expression of the features.” However, treatment did not prevent children from developing mental deficiency.

Prenatal iodine deficiency, and the resulting fetal hypothyroidism that caused cretinism, vanished from the United States and Europe in the wake of iodization campaigns (4). To be sure, these campaigns were targeted at iodine-related goiter, but they had the effect of addressing the most common cause of cretinism as well (4, 5). Iodization in the United States was voluntary, primarily via the commercial championing of salt iodization by salt industry giants such as Morton. Other Western countries such as Switzerland attained success through government mandated prophylaxis using iodized salt. By the early 20th century, goiter and cretinism had all but disappeared from the Western world because of widespread iodine supplementation (6, 7).

Cretinism was rediscovered in resource-poor countries in the 1950s, sparking a wave of new interest that led to a different way of thinking about the disorder. Reports surfaced of endemic cretinism and goiter in a number of the more remote parts of the world, including Ecuador, China, and parts of Inner Mongolia. A large number of controlled studies were conducted during this period to elucidate the connection between cretinism and prenatal iodine deficiency. Most of the research done in the early 20th century had been focused on iodine supplementation with regard to endemic goiter and not specifically cretinism. Gradually, there was clear evidence connecting iodine deficiency to a spectrum of disorders (1, 6, 7).

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By the 1980s a developing awareness characterized cretinism at the extreme end of a continuum. In 1983, Australian endocrinologist Basil Hetzel (1) coined the more appropriate term iodine deficiency disorders (IDDs) to encompass all the effects of iodine deficiency, including brain damage, at a population level. Researchers recognized that iodine deficiency was a bigger public health problem than had previously been acknowledged, and they redirected policymakers to address the more demanding issue of preventing mental retardation with iodine supplementation.

For various reasons, the strategy that had worked earlier in the developed world, universal salt iodization (USI), did not readily apply in this new context. The cause of USI as the primary means of iodine delivery had been taken up by many international organizations, specifically ICCIDD and WHO. But although USI worked in areas with infrastructure, remote rural pockets were often overlooked when overall national data showed adequate consumption of iodized salt (8). Public health officers in these areas faced many challenges in supplying iodized salt, including excessive cost, lack of commercial outlets, and suspicion of interference by government authorities. These challenges were compounded by the cheap availability of non-iodized rock salt in many remote areas, such as the Xinjiang province in northwest China. Alternative emergency methods of supplying iodine, such as iodinated oil capsules or injections, were found to be expensive, labor-intensive, and difficult to sustain.
A pediatric neurologist from the United States, Dr Robert DeLong developed perhaps the most intriguing way to cheaply deliver iodine at a population level. During a period spanning approximately 20 years, Dr DeLong and his Chinese colleagues developed an environmental approach to iodine supplementation in primarily rural communities where iodized salt and oil had failed. For this project, carried out in southern China and Inner Mongolia, DeLong and colleagues achieved iodine supplementation by dripping an iodinated compound into the irrigation water. The intricate system of canals that was already being used by the local community became an effective means of delivering iodine to those who were otherwise hard to access. Through more than a decade of meticulous serial measurements of soluble iodine concentrations in soil, crops, livestock, and human urine specimens, DeLong demonstrated that iodine added to irrigation water persisted in the soil for >4 years and continued to provide iodine to the human population. Through evidence gathered during his years of work in China, Inner Mongolia, and subsequently Tuva, Dr DeLong became an advocate of the use of alternative cost-effective emergency methods of supplying iodine. Water has some of the advantages of salt as a vehicle for iodine fortification; as a daily necessity it reaches the most susceptible populations in isolated, far-flung areas. However, although water iodization programs are efficient and effective in controlling iodine deficiency, they are cost-effective only in smaller communities and require constant monitoring. Also, because these programs are generally more expensive than iodized salt in large-scale national programs, they are less likely to be self-sustaining in poor rural countries (10). Therefore, this method is meant to be used primarily as an interim solution while laying groundwork for the more long-term, more internationally accepted supplementation via iodized salt.

Cretinism still exists in remote rural areas of many countries (8) with an estimated 2 million children affected globally every year (2). Although USI is the primary tool being used for iodine supplementation internationally, it is important to think of alternative interim methods while the infrastructure needed to effectively deploy USI is put into place. More than a century after Holt described cretinism, the iodine movement has continued to gain worldwide momentum and has been perhaps one of the greatest developments in public health breakthroughs. The story of the 20th-century movement to eradicate cretinism illustrates a key point about global preventive health: Creative thinking is pivotal in bringing about change, and locally appropriate strategies are important.

References