Seventh Symposium on Salt, Vol. II 421–426 (1993)
Elsevier Science Publishers B.V., Amsterdam

Salt Iodation in the Control of Iodine Deficiency: Increasing the Cooperation among Government, Industry and Science

Frits van der Haar

Senior Adviser in Nutrition and Food Technology, International Agricultural Centre, Wageningen, The Netherlands

ABSTRACT

Iodation of edible salt is the major long-term strategy for national programmes to control iodine deficiency disorders (IDD). Because of its self-financing character, salt iodation is the only sustainable policy option. In various countries where formerly there was a high incidence of goitre and cretinism, these disorders have been effectively prevented by salt iodation. The present global scale of IDD control programmes is not commensurate with the severity of the IDD problems in the world. There is therefore a need to enlarge, strengthen and re-enforce programmes for salt iodation in the world.

Experience with national programmes against IDD shows that the contribution by the salt industry is essential for achieving durable success. Public officials increasingly realize that the success of programmes depends critically on the competence and continuity in salt enterprises with the processing and profitability of salt iodation. The responsibility for effective salt iodation, after all, lies with the private salt companies. Salt is a consumer product in the market of every city and village. It is purchased and paid for by the consumer. The science of iodation is known, the technique works effectively, the costs are acceptable and the programme can be preserved over time.

What governments offer are national programmes that can eliminate a major problem in society. Due to financial tightness all over the world, the role of governments in IDD control programmes is nowadays being reduced to the indispensable functions of legislation and quality control.

Science offers adequate and professional communication of the essential knowledge about the problems of IDD, its magnitude and consequences, and the potential for eliminating IDD. At the global level, the International Council for Control of IDD (ICCIDD) has been playing that role. Scientists of ICCIDD can support industry to include sound and effective information in their communication through private channels. At the national level, science can help with legislation to assist the industry's and trader's ability with importing and exporting iodized salt; to strengthen the manufacturer's ability in fortification (not only with iodine), handling, packaging, storing, transporting, etc. of salt; and the trader's ability to market it as iodized salt.

An alliance between industry and science can offer technical expertise, advice and support to national programmes; and it can assist in the training of the various workers in the salt processing and distribution chain. As a follow-up to the 1990 World Summit for Children, an initiative for an Industry Alliance Against IDD (IAAIDD) is launched by ICCIDD. By becoming member of the Alliance, salt industry is being invited to contribute to the feasible goal of virtual elimination of IDD in the world by the Year 2000.

INTRODUCTION

Iodine is an essential chemical element that forms part of the common diet of humans and domestic animals. Iodine is required by the thyroid gland for making thyroid hormones of which thyroxine is the major component. Thyroxine regulates the normal function of body cells.

During evolution, thyroxine has been the first regulatory body fluid in the differentiation of species. Research has recently demonstrated that a lack of thyroxine can lead to injury of nervous cells in the body and, thereby, to abnormal development or function of the brain. If such injury occurs early in life, for instance when a fetus is still in the womb of the mother, a cretin may be born. If the injury takes place later in life because of a chronically inadequate iodine intake, loss of learning ability and low IQ may result.

It has been known for a long time that a person or domestic animal who lacks sufficient iodine in the diet develops a goitre. The term goitre means a thyroid gland that is bigger than normal. Goitre is a sign that the thyroid gland of the person affected makes an greater effort to use the little iodine that is available from the diet in a more efficient way. When the goitrous thyroid gland can maintain blood hormone levels in the normal range despite the

limited iodine from the diet, goitre is a successful physiological response. If, however, the iodine from the diet is too little for making sufficient thyroxine, the lack of iodine will lead to damage of nervous brain cells. When many members of a population have goitre, therefore, the members of that population run a high risk of brain damage due to iodine deficiency. Thus, the spotlight of attention in iodine deficiency has shifted away nowadays from the most apparent sign, goitre, towards an array of disorders that are related to the sensitivity of the brain due to lack of iodine. Collectively, these disorders are called Iodine Deficiency Disorders (IDD) (Hetzel, 1983). They seriously affect the health of the members of iodine deficient populations, and the socioeconomic status of that society is likewise affected.

In populations with iodine deficiency, the health status of all the members are threatened: More infants and young children are found with irreversible mental abnormalities, more young children have depressed growth and development, more children are slow at learning in school, the work ability and stamina of adults is more often depressed, more adolescents and adults have reduced mental and physical energy, and pregnancies of fertile women end more often with abortion, miscarriage or stillbirth. Also, early death of newborn children occurs more frequently than in areas with adequate dietary iodine supply.

The socioeconomic development in areas affected by iodine deficiency is disabled in two ways: firstly, since the people are slower and less vigorous, they are harder to be educated, less motivated, and less productive in their work. Also, in areas with iodine deficiency there are more handicapped people who depend on others for their care, thus diverting scarce resources. Secondly, domestic animals in iodine deficient areas suffer in much the same way that people do. Thus, the animal husbandry will be less productive of meat, eggs, wool, and other products. Just like humans, domestic animals also have more abortions and are frequently sterile. Agriculture-based economies in iodine deficient areas are depressed.

Worldwide, the number of people living in iodine deficient areas as estimated by the World Health Organization (WHO) is about 1 billion. Of these, about 600 million live in Asia alone. China, India and Indonesia have the largest number of people affected, but the country prevalence in Buthan and Nepal are highest in this continent. More than 100 million people are affected in Africa; about 60 million in Latin America. Recent surveys in the newly formed states of the Commonwealth of Independent Countries (formerly U.S.S.R.) and in countries of Eastern Europe have added large numbers to the world population at risk (Gutekunst, personal communication). It is estimated at present that 20–200 million people in the world suffer demonstrably of brain damage due to iodine deficiency. All these effects are easily preventable by increasing the supply of dietary iodine.

IODIZED SALT IN THE CORRECTION OF IDD

Although goitre and cretinism have aroused much speculation and comment throughout history, it lasted until the early decades of the twentieth century before the technology of mass prevention and control became applied. Countries that pioneered with salt iodation were the USA, the Alpine countries Switzerland, Austria and Italy, and Australia and New Zealand. These countries are now virtually free from IDD.

The first large-scale trials with sodium iodide tablets was undertaken in 1916–1920 in Ohio, USA. The prophylactic and therapeutic effects were impressive (Kelly and Snedden, 1960). Following on this success, mass prophylaxis with iodized salt was introduced in Michigan. The addition of 200 ppm of potassium iodide to table salt reduced the prevalence of goitre among school children from 39% in 1924 to 9% in 1929. No toxic effects of iodine prophylaxis were observed. Iodized salt is now available throughout the USA and IDD is under control as evident by a goitre prevalence below 5% nationally. The daily urinary excretion of iodine found in various surveys in the USA is above 350 μg on average (Matovinovic, 1983).

As Switzerland is situated in the European Alps where the soil is depleted of iodine, goitre and cretinism has historically been highly prevalent. For instance in 1923, the Canton of Berne with a population of about 700,000 had to hospitalize 700 cretinous people incapable of self-care. After the introduction of iodized salt in the late 1920s, goitre fell steeply. Medical screening of army recruits showed that between the years 1925 and 1947, the number of exemptions for military service fell from 31 to less than 1 per thousand. Deaf and dumb institutions were closed or diverted to other purposes (Burgi et al., 1990). The iodine content of salt in Switzerland has been progressively increased over the last decades (European Thyroid Association, 1985). Austria and Italy are other countries in Alpine Europe where successes of salt iodation have been observed (Stanbury and Hetzel, 1980). Also Australia and New Zealand have successfully eliminated IDD by availability of iodized salt.

Although efforts at salt iodation are being undertaken in many countries, the present amounts of iodized salt available in markets is far too little to provide effective protection against IDD for the large numbers of people affected. Thus, national IDD control programmes require substantial expansion. Obviously, there are many managerial and administrative concerns involved. However, a decisive stimulus, addressed in this paper, is the better coordination of the respective contributions of industry, government and science in the application of national salt iodation strategies.

THE ROLES OF DIFFERENT SECTORS IN IDD PREVENTION

Governments have traditionally taken first responsibility for national programmes against iodine deficiency. Naturally, such programmes became located in Ministries of Health since the disorders of iodine deficiency were appreciated as primarily a health problem. In countries where prevention became effectively organized, the initiative of government took the form of a national IDD control programme for organizing the different strategic actions. Activities were implemented through different sectors which were represented as members in a National Coordination Council for IDD (Dunn and Van der Haar, 1991).

Thus, the basic functional units for the global IDD control are national IDD control programmes, established with leadership of government. Because the technologies for correction of iodine deficiency are effective, it should be anticipated that such national programmes can be successful. The fact, however, is that until recently this has not often been the case. There are many countries in the world where national control has failed, even when initial success was impressive. For example, in Europe where successful national programmes can be found, there are still persistent IDD problems of national importance in Germany and the Eastern European states, as well as local areas in many other countries.

The reasons for such failures are important to analyze. Obviously, an effective national IDD control programme depends on more than the availability of technology only. As in other public health programmes, adequate assessment, planning, communication, policy support and resource supply are required for enabling a successful national IDD control programme. In addition, however, the implementation of national IDD control programmes has one more critical aspect which is of essential importance. This aspect results from the unique potential of salt iodation namely, that it provides the sustainable solution that can continue with minimal need for public resources. In order to arrive at such a durable state, the coordination between science, industry and government in applying the technology of salt iodation must be strengthened. The key to coordination is better collaboration.

Government

The disorders of iodine deficiency in the population are primarily perceived as a health problem. In many countries with severe IDD, the health sector undertakes campaigns for the supplementation of iodine with high doses of iodine-in-oil for some time already. Health officials in these countries have begun to realize, however, that the delivery of this expensive technology can not be maintained on the long term since it takes limited health resources away from other pressing medical problems.

The resources required for national IDD control have traditionally been allocated by government. The financial resources are obtained through taxing of salaries and profits (including those of salt industry), while government budgets in developing countries are often assisted by foreign agencies. Since all members of society will be equally interested in the successful and efficient expenditure of such funds, this represents an additional justification for coordinating the roles of different actors in national IDD control programmes. At the same time, the budgets of government are increasingly becoming limited and constrained: another, cheaper strategy is required.

What government offers are national programmes that, potentially, can eliminate a major problem in society. Government has authority for policy formulation of national IDD control. For effective action, it seeks agreement on the policy with the implementing partners. Government officers administer national IDD control programmes. They play a role in assessment, planning, communication, and in mobilizing and accounting for the resources that are required and expended for the successful application of policy. And, lastly but not less importantly, government represents the national interests in international fora on economic, health and other developmental conditions, including global IDD control.

In a national salt iodation strategy, the essential instruments of government are legislation and quality control. This affects the mining, processing, importation and exportation, packaging and labelling of edible salt. Efficiency of implementing the law means that government should adequately and effectively deal with the questions concerning iodine levels in salt, quality control procedures, and appropriate action if testing indicates that compliance with the law has failed.

Industry

In the context of a national IDD control programme, salt enterprises provide the single appropriate location where salt iodation can be effectively and self-financingly achieved. Only the salt producers, traders and retailers have the technical capacity and professional talent to accomplish the national availability of quality iodized salt. Public officials realize that the collaboration of these key actors in a salt iodation strategy is crucial. And together with scientists, public health officials also acknowledge that success in national programmes depends critically on the competence and continuity in the salt sector with the processing and profitability of salt iodation.

Salt is a consumer product in the market of every city and village. It is purchased and paid for by the consumer. The science of iodation is known, the technique works effectively, the costs are acceptable and the programme can be financially sustained over time. Mandatory salt iodation costs money. The practice of adding iodine to edible salt implies a change in manufacturing habits. Supplies, equipment, and training and supervision of staff leads to an increase in cost to the producer. Also the trader and retailer face costs since the transport and storage procedures of iodized salt are different. To these, the costs of changes in packaging and labelling must be added.

Government and salt business must find a way to recover these costs. As a worldwide average, iodation of salt is estimated to cost about 5 US cents per person per year. This cost is generally acceptable and it can be paid for eventually by the consumer. In the period that national salt iodation is becoming organized, however, initial solutions need negotiation between government and industry in order to avoid consumer price shocks and unfair practices in competition between producers that have iodized salt available and those who have not.

By collaborating with government and science in national salt iodation strategies, salt enterprises can contribute to the successful control of a major health problem in society. When successful, private enterprise supports an important social development goal, namely a healthy, vigourous population through less handicaps, better child survival, increased educability and greater ability for physical and mental work. Thus, the salt sector has now an unequalled opportunity to appropriate a justified corporate prestige and image.

Science

In national IDD control, scientists offer adequate and professional communication of the essential knowledge about iodine deficiency, the magnitude of the problems and their consequences, and the potential for eliminating IDD in a given country. Information of these aspects should be based on local studies and expertise. Scientists, from e.g. the national university, are usually member of a national IDD coordinating council. They can contribute to continuous assessment and analysis of the national situation. On basis of such studies, communication of the relevant results can take place to health professionals, government leaders, businessmen and the general public.

At the national level, science can help with legislation to assist the industry's and trader's ability with importing and exporting iodized salt. The improvement of quality control tests and procedures is an obvious example. By developing and testing of appropriate technologies, scientific can contribute to the manufacturer's ability in fortification (not only with iodine), handling, packaging, transport and storage of salt. Communication experts can assist the trader's ability to market iodized salt more profitably. Also, communication scientists can support industry to include sound and effective information in their communication through private channels. Finally, science can advocate for all these actors to join the national effort to eliminate IDD.

THE INDUSTRY ALLIANCE AGAINST IDD (IAAIDD)

Internationally, the International Council for Control of Iodine Deficiency Disorders (ICCIDD) has been actively and effectively playing the roles of scientists at the global level for some time. The ICCIDD was established at an inaugural meeting in Kathmandu, Nepal in March 1986, and it is registered as an international not-for-profit private organization based in Australia. The constitution of ICCIDD is based on the premise that the gap must be bridged between the available scientific knowledge about the potential for eliminating IDD and its application to the needs of the millions still suffering from IDD. ICCIDD has been very successful in mobilizing the attention and support of national governments and international agencies like Unicef, World Bank, WHO, etc. The governing Board of ICCIDD consists of a majority of members from developing countries. The Council itself has a total of around 300 members with a large and varied expertise, including amongst others, public health, nutrition, endocrinology, economics, communications, salt technology, and business administration.

At the opening of the United Nations Assembly in New York in September 1990, the largest gathering

of world leaders in history assembled at the World Summit for Children for adoption of a World Declaration on the Survival, Protection and Development of Children. The Plan of Action which accompanied this Declaration has, in the mean time, been signed or initialled by 150 heads of state or government. No other document in history bears the signature of so many world leaders, signifying their commitment for a specific action within a short period.

The presidents, prime ministers and monarchs attending the World Summit also gave prominence to the solution of malnutrition. They promised "measures to eradicate hunger, malnutrition and famine, and thus to relieve millions of children of tragic sufferings in a world that has the means to feed all its citizens and overcome the worst forms of malnutrition. With the right policies, appropriate institutional arrangements and political priority, the world is now in a position to virtually eliminate iodine deficiency disorders". This goal was indeed an endorsement of the priority for IDD elimination, adopted already by the governing bodies of Unicef and WHO in 1990.

The Declaration initiated a "War on Hidden Hunger", with special focus on "super-micronutrients" required for satisfying the minute amounts that are needed every day, at a genuinely "micro-cost." International and bilateral agencies, national governments and private organizations have reacted by formulating plans-of-action and other initiatives, and with programmes of cooperation to eliminate the tragic loss of life and human potential due to micronutrient malnutrition, particularly iodine deficiency disorders. The Plan of Action of the World Declaration specifically solicited "business and other institutions to actively support the goals of the Summit for Children."

As a follow-up to these global and national initiatives, ICCIDD therefore proposes the formation of an Industry Alliance Against IDD (IAAIDD). The Alliance is aimed at combining the unique expertise and talents that are available in industry and science for the elimination of IDD, principally through the expansion and strengthening of national salt iodation schemes. This ambitious goal can be achieved in many ways. The main examples are:

1. Support to the development and testing of new, appropriate technologies (e.g. innovations in machinery and equipment, manufacturing, refining and handling procedures, economic and financial analyses, imaginative packaging, communications and marketing, advertising, labelling, and quality control) for salt iodation enterprises in developing countries;

2. Support to the global and national development of quality standards for iodized salt, and for packaging, transport and storage, imports and exports, and control test procedures and standards;

3. Establishment of technical training courses for the various key officers engaged in salt enterprises in Third World countries where IDD is endemic;

4. Process development for multiple fortification of salt with other micronutrients like iron and possibly vitamin A;

5. Establishment of a global coordinating mechanism for the exchange of technical and scientific knowledge and information (e.g. by an international IAAIDD Newsletter), coordination of support to national programmes, and allocation and timing of assignments among members of the Alliance.

ICCIDD proposes to initially serve as convener of the Alliance. The Alliance is the tangible mechanism for Salt Industry to work together with scientists, and contribute their unique expertise for the global elimination of IDD. Subscription to this Alliance by salt industry is invited by ICCIDD. With the cooperation and support from the Salt Industry for the effort required, ICCIDD feels confident of success.

CONCLUSIONS

Iodine deficiency is a serious, widespread nutritional problem throughout the world. Iodine deficiency disorders (IDD) range from the more common, but less serious affliction goitre to serious, irreversible mental and intellectual retardation due to insufficient thyroid hormone availability that damages the developing brain in infancy and childhood. In addition, more pregnancies end with stillbirths and abortions in iodine deficient areas. These areas are characterized by depressed socio-economic development. An estimated 1 billion people in the world are living in iodine deficient areas.

Experience in Western countries, including the USA, Switzerland and Australia, demonstrates that national iodized salt availability is effective in eliminating endemic iodine deficiency disorders. National programmes for salt iodation are usually initiated by government Ministries of Health. The essential instruments of government in directing national salt iodation strategies are legislation and quality control. For effective implementation of national iodized salt availability, government requires the collaboration of salt industry. The salt enterprising business is the single, appropriate institution where the technical capacity and professional talent is available for realizing national salt iodation sustainably. Science can contribute to the national effort by assessment, research and by widespread, effective communication of successful actions.

The 1990 World Declaration on the Survival, Protection and Development of Children signifies a global commitment to timely, specific action against the worst forms of hunger and malnutrition in the world. One of the major goals of the Action Plan is to virtually eliminate iodine deficiency disorders. International and bilateral agencies, national governments and private organizations have started to eliminate the tragic loss of life and human potential due to micronutrient malnutrition, particularly iodine deficiency disorders. In the Declaration, active support of the business and other institutions is solicited particularly.

The International Council for Control of Iodine Deficiency Disorders ICCIDD) proposes to complement the international and national action by an association with salt industry through the formation of an "Industry Alliance Against Iodine Deficiency Disorders" (IAAIDD). The Alliance can contribute to the goal of virtual elimination of iodine deficiency disorders before the year 200 by assistance to the transfer of various technologies, by training and by information dissemination. With the collaboration of salt industry through IAAIDD, the international community feels confident of success.

REFERENCES

Burgi, H., Supersaxo, Z. and Schurch, B., 1990. Iodine deficiency diseases in Switzerland one hundred years after Theodor Kocher's survey: A historical review with some new goitre prevalence data. Acta Endocrinol., 123: 577–590.

Dunn, J.T. and Van der Haar, F., 1991. A Practical Guide for the Correction of Iodine Deficiency. ICCIDD/WHO/Unicef, 64 pp.

European Thyroid Association, 1985. Goitre and iodine deficiency in Europe. Lancet, i: 1289–1293.

Hetzel, B.S., 1983. Iodine deficiency disorders (IDD) and their eradication. Lancet, ii: 1126–1129.

Hetzel, B.S., 1989. The Story of Iodine Deficiency. An international challenge in nutrition. Oxford University Press, New York, 236 pp.

Kelly, F.C. and Snedden, W.W., 1960. The prevalence and geographical distribution of endemic goitre. In: Endemic Goitre. WHO, Geneva, pp. 27–234.

Matovinovic, J., 1983. Endemic goitre and cretinism at the dawn of the third millennium. Ann. Rev. Nutr., 3: 341–412.

Stanbury, J.B. and Hetzel, B.S., 1980. Endemic Goitre and Endemic Cretinism. Wiley, New York, 606 pp.