Review Article

Programme for Global Elimination of Iodine Deficiency Disorders (IDD) with Emphasis on Bangladesh : An Overview

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Abstract

Iodine is an essential trace element for the body. It is required for production of hormones by the thyroid gland, which starts functioning in early fetal life. These hormones are intimately related with physical and mental growth from fetal life to infancy and childhood, and their maintenance throughout life. Average daily requirement of iodine is 150 microgram, which is higher in infancy and childhood, and in women at childbearing age; and is about 100 microgram in adults. This amount is usually obtained from food provided there is sufficient iodine in the environment, but if the environment, like soil, vegetables, water etc. is deficient in iodine, the daily requirement is not met, and this will result in iodine deficiency disorder. If the deficiency occurs in fetal life there will be stillbirth, neonatal goiter, cretinism, and at puberty it will lead to hypothyroidism and puberty goiter. In adults iodine deficiency will result in hypothyroidism and myxoedema. IDD is a global problem especially in hill areas. Southeast Asia including Bangladesh has a significant iodine deficiency. There are more people in Southeast Asia suffering and disabled by some forms of IDD than in any other region of the world. Also the world's highest recorded prevalence rates for cretinism have been measured in this region. For these reasons Southeast Asia is now widely recognized as perhaps the major global focus of iodine deficiency disorders (IDD). In an area with iodine deficiency in nature long term supply of iodine can be achieved by supplementation of iodine with an item of food universally taken by people. Common salt (NaCl) is universally consumed low cost material and has been found suitable for adding iodine. Soil iodination program is also an effort for IDD elimination. A collaborative effort among agriculturists, NGOs, IDD experts, salt industries, government salt regulators, policy makers, communicators, educators, heath care providers is the hall mark for the successful global IDD elimaination programme. CIDA, ICCIDD, MI, UNICEF, WHO and government of Bangladesh are working jointly to eradicate IDD from Bangladesh.

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Introduction

Iodine, a trace element first identified in 1815, was known to help the thyroid gland funcation properly. But how crucial it is for our mental and physical development was not understood until recent decades. New surveys and advances in understanding role of iodine reveal that even mild levels of iodine deficiency can do immense damage. But it appears from informal and random discussions with medical and scientific personnel, that outside a very limited circle, the true scale and severity of the consequences of iodine deficiency is yet to reach key professionals in Bangladesh. Iodine is present naturally in the environment, the soil and the sea whereby it enters the food chain of humans and animals. If for some reason this trace element is depleted, particularly in the soil, people consuming food grown on it do not get the minuscule, but vital supply. An adult needs only 150 micrograms of iodine a day the cost of a cup of tea-and only three grams in a lifetime. The far-reaching consequences of iodine deficiency on the physical and mental development of children and on human reproductive performance have fortunately triggered international agencies like WHO and UNICEF to initiate global programmers for the elimination of iodine deficiency disorders (IDD) by the turn of the last century[1-6]. More than 150 countries, including Bangladesh, have committed themselves to this end. Early biomedical research saw the problem of iodine deficiency (ID) too often as simply one of goiter, an enlargement of the thyroid gland, generally reversible with proper intake of iodine. It was taken to be not more than a problem of cosmetic significance[7].

Goiter of course is a common manifestation of iodine deficiency but the consequences of ID go far beyond goiter and are much more insidious[7-10]. Today, iodine deficiency is recognized worldwide as the single most common, preventable, cause of brain damage and mental retardation. The present and future quality of individual people and whole communities therefore depend on whether or not enough of this vital micronutrient is being consumed regularly. The International Council for the Control of Iodine deficiency Disorders (ICCIDD) in association with the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) presented a global summary of the prevalence of IDD in July 1993, based on the most recent information available. From detailed country by country counts the documents of birth weights of infant and young child mortality[1-14]. The 1990 WHO report

estimated that some 26 million people worldwide, including six million cretins, suffered from brain damage due to ID. In the past decade the world has been waking up to the magnitude of IDD and the realization that universal action must be taken to eliminate iodine deficiency[10-13].

The beginning of the nineties of the last century saw several conferences pledging to eradicate IDD by the turn of the century. The World Health Assembly (WHA), the World Summit for Children, the conference on Ending Hidden Hunger and the World Declaration and Plan of Action for Nutrition have all pledged the goal of IDD elimination[5-20]. The Bangladesh government for its part has passed the Iodine Deficiency Disease Prevention Act. 198921. The aim was to achieve universal iodination of edible salt by January 1994 with UNICEF as an active partner in realizing the goal. All 267 salt crushing plants were supplied with iodination machines. Their total capacity is said to be enough to meet not only domestic demand, but to export as well. The reality on the ground is that though iodizing salt is quite simple, and has been made easy by UNICEF support, we are still a long way from ensuring that only iodized salt is made available for all, and at affordable price[21-25].

Bangladesh share with other nations in South East Asia the largest rates of IDD. In the region 486 mend estimates that the total number of at risk population in the world exceeds 1,570 million (29% of the world population), and the global goiter prevalence rate is 12 percent. According to the latest national survey in Bangladesh, conducted jointly by ICCIDD, UNICEF and Dhaka University, total goiter prevalence rate (TGR) was 47.1 percent, while 69 percent were found biochemical deficient in iodine and 0.5 percent of the population suffered from cretinism. The percentage of women suffering from different degrees of iodine deficiency, in the age group 15-44, is as high as 55.6 percent while for males in the same age group it is 30.6[26-28]. This means that virtually the entire population is at risk. The implications of such widespread deficiency on this nation of 111.5 million are extremely disturbing considering that its effects on the quality of the human material what with the general poverty, protein-energy malnutrition and lack of education are as clear as day. The most severe consequences of ID are cretinism, mental retardation, deaf-mutes, squint, spastic paralysis of the lower limbs, coordination abnormalities, impaired learning capacities, and dwarfism. It also leads to

abortion, stillbirths, congenital anomalies, low million are at risk and 176 million are goitrous [26-31].

Iodine Deficiency Disorders in South East Asia

Eight countries of Southeast Asia have iodine deficiency disorders as a significant problem of health and indeed of national development. Since 1980 most have under taken nationwide IDD surveys. The major geographical focus of IDD are in the inland and mountainous zones particularly in the sub-Himalayan region. Goiter pevalences for these countries are : Bangladesh 10.5%, Bhutan 64.5%, Burma 14.3%, India 7.3%, Indonesia 6.1%, Nepal 46.1%, Sri Lanka 19.3% and Thailand 14.7%[31-33]. In larger countries IDD is not distributed evenly throughout, and certain regions have severe IDD, despite a low countrywide prevalence figure. For exemple India with its national goiter prevalence of 7.3%, is estimated to have 150 million with risk for IDD, 54 million with goiter, 22 million cretins, and 6.6 million neurological deficit making it one of the most important endemic in the world. These regional data information from studies in other iodine deficient communities in the world, have allowed the development of an epidemiological method relating the easily measurable goiter rates to the more important iodine deficiency disorders-cretinism, other mental and neurological deficits, stillbirth, and neonatal death. This methodology provides reasonable but probably conservative estimate of IDD. Clearly the problem is one of enormous magnitude, with an estimated 279 million people at risk, 99 million with goiter and at least 18 million affected mentally or neurologically to some measurable extent. Nevertheless, genuine progress is being made in IDD control in this region with measurable impact already having been achieved in some countries such as Indonesia, Nepal and Thailand and new or strengthened control programs being established in all IDD affected regional countries.

Iodine Deficiency in Bangladesh

Goiter is found throughout all 64 districts of the contry. A survey undertaken in the mid 1960s confirmed the prevalence of endemic goiter in the north and northeastern districts[26]. In 1975-76, a survey conducted by the Institute of Nutrition and Food Science of the University of Dhaka, with WHO and

UNICEF collaboration covered 2,14,608 persons in 417 Upazillas in all 64 districts of the country. It clearly indicated that goiter occurs throughout the country with a mean severely affected districts (Rangpur 27.5% and Jamalpur 29.2%), there were pockets of some Upazillas with high goiter prevalence between 50% and 70%.

Although on nationwide IDD control program has yet been implemented several pilot projects using iodized oil and iodinated salt have been undertaken and a national iodinated salt programs is being developed. In 1977, the Institute of Nutrition and Food Science carried out an iodized oil injection program covering 95,000 people, largely in Rangpur and Japalpur while in 1983 the Department of Health injected a further 80,000 persons in Rangpur with iodized oil. A small pilot project using iodinated salt was implemented in 1981 in Tangail District[28].

In 1981, the National Nutrition Council of Bangladesh organized the first National Workshop for the Control of IDD and decided to develop a national IDD control program based on iodinated salt as the long term measure and iodized oil injections as an immediate measure in the highly prevalent goiter areas[29].

Iodine deficiency is endemic in Bangladesh. Average incidence of goiter is 10.5%. In northern districts the incidence of goiter is as high as 30%. Only in a few southern districts incidence of goiter is less than 5%. These facts were revealed by a nationwide survey by the Institute of Public Health Nutrition in 1981-82 under the supervision of the World Health Organization. This deficiency is perhaps mainly due to frequent flood, heavy rainfall and eating habits. In addition Sub-Himalayan region is practically devoid of iodine. Although seawater is the main source of iodine, sea salt does not contain it in significant amount. Sea fish are sparsely consumed by the people except in a few coastal areas[30-31].

The 1993 survey in Bangladesh shows total goiter prevalence (TGR) to be 47.1 percent. Nearly 69 percent were said to have lower than expected median urinary iodine excretion (UIE), indicating that virtually the whole nation is at risk of iodine deficiency. Prevalence of cretinism is 0.5 percent. The implications of such widespread deficiency are clear enough. As a long-term permanent measure to prevent the iodine deficiency disorders from the

country it was decided in early 1985 that universal salt iodination would be undertaken as early as possible in Bangladesh.

The Global Impact of IDD

Iodine Deficiency Disorder (IDD) is a significant public health problem in 130 countries, affecting a total of 740 million people. While remarkable measurable progress is being made through universal salt iodination, there are nearly 50 million people who are estimated to still be affected by some degrees of IDD-related brain damage.

One-third of the world's population is estimated to be at risk of IDD. Over the last decade, extraordinary progress has been achieved by increasing the number of people with access to iodized salt. From 1990 to 1998, the number of countries with salt iodination programs increased from 46 to 93. Two-thirds of households living in IDD-affected countries now have access to iodized salt. Twenty countries have 90% of their households with access to iodized salt[1-3]

The tragedy is that such a huge global burden of brain damage is still occurring, much of it irreversible, yet less than a single teaspoonful of iodine is all a person requires during an entire life time, and the cost amounts to only about 5 US cents per person per year[3].

Iodized Salt Program in Bangladesh

When iodine is added to salt is called iodized salt. This can be done either by using KI having molecular weight of 166 and iodine content of 76%, or by using KIO_3 having molecular weight 214 and iodine content of 59%. Iodine is cheaper than iodide but impurity in the salt, like Iron, Aluminum, Calcium, Nitrite, etc. may cause iodide to be oxidized and free Iodine is lost by evaporation. The iodate is not easily oxidized and therefore, is more suitable for iodination of salt. Since Potassium iodate is added to salt the iodized salt is sometime called iodinated salt and the process is known as iodation[26].

Iodide and iodate cannot be incorporated into the salt crystal but are dissolved in a molecular film of water surrounding its crystal. Where iodate is added and mixed homogeneously, the iodine concentration remains uniform if the salt is kept dry. However, in humid condition this move down slowly by

gravity and iodate concentration decreases at the top and settles at the bottom of the container. This can also happen if the iodinated salt is kept for a long time in the storage. Loss of iodine is negligible after cooking[17].

About 700,000 tons of common salt produced in Bangladesh per year, which is sufficient for national requirements. There is an occasional import when there is shortfall. In normal condition only crude salt is imported. All salt obtained from seawater and import has to go through 210 refineries situated in southern districts of the country. Iodination in the refinery stage is very convenient and accepted by the authority[28].

Salt iodination is already in progress in Bangladesh, the financial assistance of UNICEF, which as agreed to bear about 90% of the initial cost by supplying iodination equipment and Potassium iodiate to all refiners. The equipment is being produced in the country to make their maintenance easy[19].

The Government has appreciated the problems of iodine deficiency disorders and importance of salt iodination. The National Assembly passed a law for universal salt iodiration on February 28, 1989. It was expected that the end of 1991 would iodize all salt available in Bangladesh. The law is modified later and according to it all marketed salt will be iodized. Selling and production of non iodized salt will be punishable offence[10]. The government and ICCIDD have jointly conducted a survey with financial assistance from UNICEF to evaluate the impact of the salt iodination program on the IDD situation in Bangladesh[12].

Experience in Other Countries

In North America and many countries in Western Europe, salt iodination was adopted long before 1950 and there has been successful prevention of iodine deficiency disorders in these countries to such as extent that diseases of the thyroid due to iodine deficiency is practically unknown today[1-16].

Quality Control and Evaluation of Impact

An easy and low cost effective technique has been developed by the BCSIR and can be used even by a lay man at home. There is an education campaign for domestic users to teach them how to store and use iodized salt. It is advisable

to use the iodized salt to the end of cooking procedures to prevent the degradation of iodate[11].

Evaluation of the impact of salt iodination on the incidence of iodine deficiency disorders will be done from time to time and will be compared with the base line figures of the first national IDD survey in 1993. A national committee to give the guideline of the salt iodination program along with two technical committees responsible for quality control and monitoring has been set up by the Government.

Conclusions

About one crore people of our country are suffering from "Goiter" which is locally named as "Galogando" or "Ghag". It is found all over the country but mainly in greater Rangpur, Dinajpur, Jamalpur and Mymensingh districts. Besides, thousands of people also suffer from other diseases caused by lack of iodine.

Seafood like marine fish, seaweed etc, are the richest source of Iodine. Besides bread, milk, vegetable and even drinking water can supply iodine in diet. For various reasons, as discussed in the foregoing our diet lacks iodine needed for optimal health. So, to get enough iodine in diet we must consider alternative way and this can be achieved by using iodized salt. A very small quantity of Na or K iodide (1:45000) is mixed with common salt. As a result normal taste, color and flavor of salt remain constant. This small amount of iodine in iodized salt is quite enough to fulfil our requirement[22]. It is hopeful news to us that Bangladesh government passed a bill in 1993 to make all salt iodized to be taken in diet. Consequently iodized salt of different companies are now available in market[3]. The bill become a law in 1994 and became effective from February 1, 1995[12].

Legislation, needless to say, is not enough to ensure daily intake of iodized salt. As long as the non-iodized variety is available, and cheaper, the poor would prefer to save a few taka when buying salt for family members and farm animals. The authorities would do well to eliminate the manufacture and marketing of non-iodized salt, as well as monitor the finished product for the right mix and right price[30]. Without such a foolprooff mechanism in place we

cannot reduce the huge gap between the client's intent and the reality on the ground[31].

In the absence of any check by the concerned authorities, the rural markets of the conutry have now been flooded with noniodized salt coming from the bordering country. And most of the rural people buy the smuggled salt, as this variety is relatively cheaper than the local products[10]. Some experts on pubic health observed that this salt is nonrefined and contains sulfur, which is usually used for processing of wet-blue leather[30].

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