IODINE DEFICIENCY IN ISRAEL

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ABSTRACT

Iodine is a very essential and critical trace element for proper health, in all stages of life, and is closely related to the quality of human body and intelligence quotient. Iodine is mainly related to the synthesis of thyroid hormone, and its physiological effect is also shown by the role of thyroid hormone. However, some studies discovered a high frequency of iodine deficiency in Israel. In this study, we focus on the iodine efficiency problem in Israel, learn from the experience and lessons of other countries, and explore feasible solutions to solve the problem of iodine efficiency. Ultimately, we hope to raise awareness of iodine deficiency in Israel, solve the iodine deficiency problem and improve public health through research on the issue.

Key words: iodine; thyroid hormone; iodized salt; public health;

INTRODUCTION

Iodine is a natural chemical element, just like oxygen, hydrogen and iron, which is naturally found in certain food products, supplemented to others, and is also available as a dietary supplement. Iodine is nutritious and critical for proper health, in all stages of life. It is critical for the proper function of the thyroid gland, especially before and during pregnancy and breastfeeding for the proper brain development of fetuses and new born (Ministry of Health, Israel).

For many years the common assumption was that due to the proximity to the Mediterranean Sea the consumption of iodine was sufficient and that iodine deficiency should not develop amongst Israelis. However, a countrywide survey that was recently carried out discovered a high frequency of iodine deficiency in children and pregnant women. It is possible that most Israelis, adults and children alike, do not consume enough iodine (Ministry of Health, Israel).

Israel clearly has a serious iodine deficiency problem an iodine supply problem. Ovadia et al. (2013) demonstrated a low dietary iodine intake (median 85 lg/day), compared to the recommended daily allowance (RDA) of 150 lg/day.

The recommended dietary allowances of iodine, endorsed by the International council for control of Iodine Deficiency Disorders and the World Health Organization, for the ideal intake should be 90µg/day for children, 150 µg/day for normal adults and 200 µg/day for pregnant and lactating women (Delange F., 2001). It was found that a high burden of iodine deficiency in the general population: 62% of school-age children and 85% of pregnant women fall below the WHO’s adequacy range (The Hebrew University of Jerusalem, Israel).

When iodine reaches the bloodstream, the thyroid gland absorbs it in the amounts that it needs in order to synthesize the thyroid hormones, which are then secreted into the bloodstream and are transported to different areas in the body. Every cell, tissue or organ requires the thyroid hormones, which help the body to utilize energy, maintain heat and normal activity of the brain, the heart, the muscles and other organs.

Iodine deficiency has long been recognized as a leading cause of goitre and impaired thyroid function, with development abnormalities being its more severe manifestation. For normal thyroid function to be sustained, an appropriate iodine intake is required (Delange F., 2000).

Because of the action of thyroid hormones in brain development from fetal life up to the third year of postnatal life (Bernal J eta al., 1995), and because the symptoms of hypothyroidism during this critical period are scanty and nonspecific (Delange F et al., 1995), congenital hypothyroidism (CH) used to be a frequent cause of irreversible mental retardation (Dussault JH et al., 1975).

A slight deficiency in iodine can bring about a subclinical (asymptomatic) disorder of the thyroid gland function and can minimize the formation of its hormones. Sometimes, these disorders occur during pregnancy and breastfeeding, when the woman's body needs a greater amount of iodine due to the need to share nutrients with the developing fetus and the nursing newborn. This is the sensitive stage during which issues can arise. Even a relatively slight decrease in the thyroid hormone levels can limit the development of the brain of the fetus.

A more serious iodine deficiency can increase the possibility of growth and developmental disorders in the child, and at a certain point even severe mental retardation, called “cretinism”. In cases of severe iodine deficiency, there is a high risk of deficient mental and intellectual development, which is expressed in a loss of around 10 IQ points in children. It can be assumed that in such cases, those children will experience difficulties at school, especially in mathematics and grammar, in which abstract thinking is very important. The commonly accepted thought and directives of the American Thyroid.

In Israel, as opposed to the vast majority of other countries in the world, the problem of iodine deficiency is significant. This is due to the fact that up until now there have been no legislation or regulations that require salt to be enriched with iodine, as is done in other countries. Therefore, only very low percentages of the salts that are marketed in Israel have been enriched with iodine (in other countries: 80%-90%) (Ministry of Health, Israel).

According to the Israeli Water Authority, 80% of the drinking water in Israel presently comes from iodine-depleted (nondetectable or 1 lg/L) desalinated sea water (Rejwan, 2011). Israel is presently the country with the largest proportion of desalinated water in the world. The usual supplementary sources for iodine in a population are (1) iodization of salt and (2) use of prenatal supplements containing 150 lg iodine. Israel lacks a USI program (only 3% of locallyproduced salt is iodized), and only 6% of pregnant women in Israel took iodine-containing prenatal supplements (Ovadia et al., 2017). A three-pronged attack to this problem is called for—(1) USI, (2) program to markedly increase the use of iodinecontaining prenatal supplements, and (3) a national surveillance system for both levels of iodine in the salt and levels of iodine in the population, including specifically pregnant women.

That the desalination process for sea water removes many bio-essential micronutrients, including iodine, magnesium, and calcium, requires additional research both in Israel and elsewhere where desalinated sea water is a major source of drinking water (Koren et al., 2017). It is very likely that many more countries will adopt such new technologies in order to produce desalinated water to overcome the increasing shortage of fresh water for drinking and agriculture. In Israel, it appears that the mixing of desalinated sea water (0–1 lg/L) with groundwater (levels as high as 174 lg/L) has generally kept the drinking water iodine levels above 20 lg/L. That may not be true of other areas with less mixing or with mixing waters that contain lower levels of iodine. Increased reliance on desalination for the production of drinking water may lead to an increase in IDDs, a major nutritional and public health issue of global concern. So there is an urgent need to explore the effects of desalinated water on thyroid health in Israel and other countries. And iodine nutrition problems that may arise from desalination can be solved by salt iodization, which is simple and economical. Meanwhile, Water desalination is now a new potential contributory source for deficiencies not only in iodine but also in other micronutrients that should be followed up closely in order to determine its impact.

OBJECTIVE

It is to highlight the intensity of Iodine deficiency in Israel and the possible solutions adopted by other countries that can be implemented in order to curb iodine deficiency in the population of Israel.

PREVENTION AND CORRECTION

Fortification

Salt

Fortification of salt has a unique advantage among the micronutrient supplements—it requires no change in dietary habits, because everyone uses salt (Mannar, 1996). The one disadvantage it shares with any other program of micronutrient fortification is that the improved product costs slightly more than the original. This must be countered, either through subsidy by donor organizations or by intensive social marketing that makes the iodized salt more desirable and worth the additional cost. The experience is that cost has rarely been a major stumbling block. Importation of non-iodized salt across borders has occasionally been a problem, especially when the product has been labelled as iodized but actually contains no iodine. Small traders or local producers of salt near salt deposits have been a problem in rural Bolivia, Ecuador, and Argentina, for example. Demand for the iodized product has been created by professional social marketing techniques, as in Ecuador. Mass media campaigns that employed posters, press, pamphlet distribution, and radio were used in all regions. Universal salt iodization is the safest, most effective, least costly and most effective way to eliminate iodine deficiency globally, with about 70 per cent of households worldwide using iodized salt.

The goal in the prevention of iodine deficiency disorders (IDDs) is universal salt iodization (USI). USI is the safest, most effective, least costly and most effective way to eliminate iodine deficiency globally, with about 70 per cent of households worldwide using iodized salt. Iodized salt can prevent brain development lag caused by iodine deficiency, improve the quality of the people. Programs must take into account possible losses between point of manufacture or import and the consumer's table. Losses may vary among the forms of iodine used (iodide vs. iodate), heat, purity, humidity, packaging, shelf time, and losses in cooking. Programs should also be designed around salt consumption patterns in order to make the maximum effort to ensure an intake of iodine within the desired range. A mean consumption of 15 grams or more daily has been observed in some communities; in others as little as 2 grams have been consumed. Salt may be iodized in several ways, including dry mixing, drip, or spray techniques. Generally the iodine is sprayed or drip-fed on the salt as it flows down a mixing-screw conveyer; if the salt is finely ground, the iodine may be added dry (Dunn, 1995; Holman and McCartney, 1960). The long-term costs of producing iodized salt to supply the needs of an individual amounts to only three or four cents yearly. Unfortunately, in some instances a high, unwarranted premium is added to the cost of the salt to the consumer. Iodine is available principally from Chile and Japan.

The increasing use of plastic bagging has reduced iodine losses between manufacture and consumer, as has the sale of smaller packaging to effect more rapid turnover of the product.

A customary level of fortification is in the range of 25–50 mg of iodine per kg of salt. This level will require variation to accommodate local conditions. The cost—considering all factors of plant operation, cost of the iodate, and control—should add little to the cost to the consumer and is a trivial increment, considering the low cost of bulk salt. When the salt is imported it must be reprocessed at the portal of entry, or the supplier must be convinced to cooperate and ship only a properly iodated product.

A final determination of cost must include expenses of the iodine, processing costs (including labour and supervision), packing (including polyethylene lining of the containers), shipping, administration (including monitoring), and plant amortization. One estimate has placed the total cost, in addition to that of the basic salt, at US$0.02 to US$0.06 per person yearly. This represents somewhere between 2 and 20 percent of the retail price of the product.

Experience has shown that most manufacturers or suppliers of salt are quite willing to cooperate in iodinating their salt, once the importance of salt fortification has been explained. In some instances international agencies, particularly UNICEF, have been instrumental in introducing USI (universal salt iodization) and have assisted producers by supplying the machinery required for the iodization process.

An outstanding need in the salt iodization process is maintenance of the level of added iodine within safe and effective limits. This means, at the very least, that the concentration of the commercial product must be measured at frequent intervals. Fortunately, the technique required for this measurement is reasonably accurate. Unlike magnesium, iodized salt is relatively straightforward, provided that regular monitoring of iodine intake is legislated to ensure that salt iodization does not lead to excessive intake.

Iodinated Bread

Three programs—in the Netherlands, Russia, and Tasmania—have used bread as a vehicle for the distribution of iodine. Both the Dutch and the Australian programs were dropped for logistical reasons, because of an attendant rise in iodine-induced thyrotoxicosis, or because iodine became available from other sources. The Russian program is too recent to judge, but it appears promising in communities where bread is centrally prepared and iodized salt is unavailable.

Iodinated Water

Water has been successfully used as a vehicle for the prevention of IDDs. A silastic cylinder containing iodine has been used in bore holes in several African countries to achieve some success in raising community iodine intake, but the many associated difficulties have prevented its widespread use (Fisch et al., 1993). In selected rural regions of Thailand and Indonesia, iodine is added intermittently to cisterns that store water for drinking and cooking (Suwanik et al., 1989). The current program of USI in Thailand will doubtless eliminate use of this method in the near future. Iodine has been introduced into city water supplies in Sicily with a bypass through an iodine-containing canister. Reduction in IDDs was reported, but the method fell into disuse because of mechanical, legal, and monitoring problems.

An ambitious program to introduce iodine into irrigation water in the desert areas of western China (by DeLong and colleagues) has been hugely successful in increasing yields in sheep farming and in reducing infant death rates (G. R. DeLong, Division of Pediatric Neurology, Duke University Medical Center, 1997, personal communication).

Supplementation

Drops and Tablets of Iodine

The original study that proved iodine prevents goiter used sodium iodide, which was given to schoolchildren twice yearly (Marine and Kimball, 1921). Drops of Lugol's solution have also been used in schoolrooms. Tablets of salts of iodine, sometimes disguised with chocolate, have been dispensed intermittently. Recently there has been renewed interest in intermittent dosage in classrooms using tablets or drops containing iodine.

Iodinated Oil

Iodinated poppy seed oil has been widely and successfully used in the prevention of IDDs since its introduction in the late 1950s in New Guinea (Fierro-Benitez et al., 1969; Hetzel et al., 1980). Other unsaturated oils have also been used. Needs may be met for a year or more by a single dose, depending on its size and route of administration. These mixtures have been used both intramuscularly and orally in doses varying from .2 ml to several ml. Most programs have used either 1 or 2 ml in older children and adults, but success has been achieved with smaller doses (Benmiloud et al., 1994). Side effects have been virtually nonexistent, except for occasional instances of induced thyrotoxicosis. The technique is more expensive than USI. Depending on the logistical and administrative costs added to the cost of the iodinated oil, the cost totals approximately US$0.10 to $0.50 per person annually. A major expense will be determined by the costs of the team, which is often posted to remote regions. Iodinated oil has been accepted well by target groups. It is currently reserved for communities where it is unlikely that USI will be introduced within the foreseeable future (and such areas are disappearing) and areas where the need is urgent and USI is unlikely to reach the target population immediately.

Irrigation water has been successfully iodinated in western China (Cao et al., 1994). The water is derived from glacial streams, and never reaches the sea. All farms and households in the region subsisted on this water. Potassium iodide in 5 percent solution was slowly dripped into the water from tanks at a rate that provided approximately 10 to 80 µG iodide per liter for several weeks each season. There followed a sharp rise in iodine excretions among the population and a sustained rise in iodide in the soil. Improvements were noted in survival and weight gain among domestic animals, and growth of children also improved.

CONCLUSION

In general, IDDs are a widespread problem of public health throughout the world. There are two main strategies to solve this problem, namely fortification and supplementation. In each strategy, there are many specific ways to implement and they all have their own advantages and disadvantages.

In fact, the intake of iodine can only stay in the human body for 100 days, so in iodine deficiency areas, people as long as 100 days do not supplement iodine will reappear iodine deficiency. So, we have to insist on iodized diet as lifelong. Meanwhile, in recent years, the relationship between iodine excess and thyroid disease has attracted much attention, even some media reported that adding salt is the main culprit of thyroid disease. Hence, iodine intake has a U-shaped characteristic, we should be on guard against iodine excess.

Last but not least, depending on the geographic location, population characteristics, water resources and consumption habits in each country, they have chosen the most appropriate method for solving the problem of IDDs. In order to successfully applying in Israel, we suggest the policy considering many specific factors in Israel such as consumption habits, target groups, geographical and population characteristics to decide which the most optimal method is.

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