

IODINE DEFICIENCY

what it is and how to prevent it



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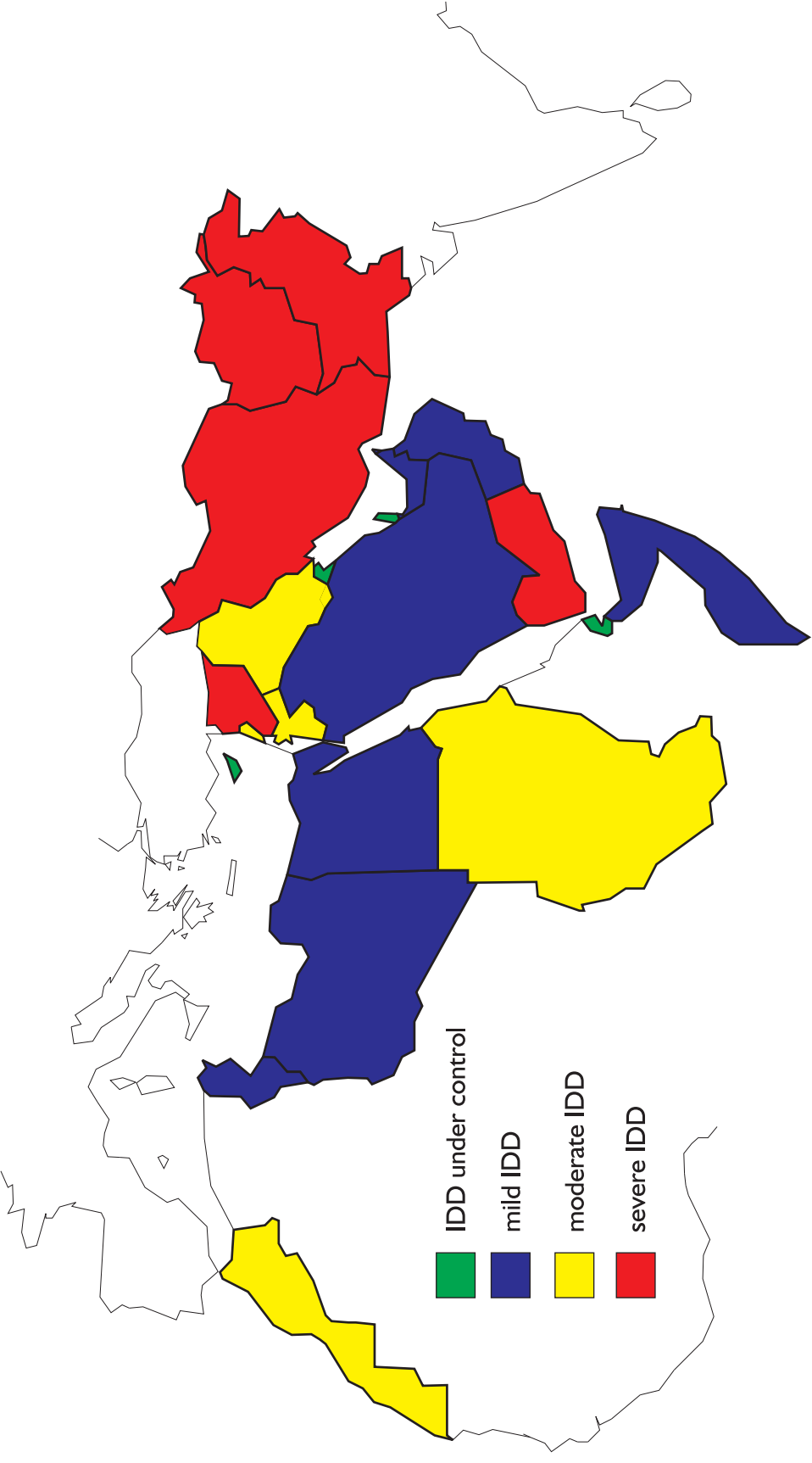
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The incidence of iodine deficiency disorders
in the Eastern Mediterranean Region
of the World Health Organization

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Introduction

Iodine is an essential element for human survival. It is needed for growth and development, even before birth. Insufficient iodine can cause abortion, stillbirth, mental retardation, growth retardation and also goitre, which is often the only visible manifestation of all the damage wrought by lack of iodine.

Important as iodine is, only very small quantities are needed to prevent deficiency. A person needs only 250 micrograms of iodine per day. A microgram is a thousandth of a milligram, so the daily need for iodine is around a quarter of a milligram. Over a lifetime, the total quantity of iodine needed is only one teaspoonful.

What causes iodine deficiency?

When the earth was formed, iodine was present in both land and water. Unfortunately, over the eons since the earth's formation, much of the available iodine was washed out of the soil, especially in mountainous areas through the action of glaciers, and in flood plains by regular flooding. This process of leaching away of iodine still continues, and due to ongoing erosion, iodine deficiency affects more and more countries in the world. The iodine which was washed away by glaciers, floods and erosion ultimately ended up in the sea, which is therefore rich in iodine. As a result, seafood contains iodine, especially seaweed, which accumulates iodine.

All crops grown on soils that are iodine deficient will be iodine deficient. Iodine deficiency is therefore a deficiency which can affect rich and poor countries alike, because it depends on the geophysical properties of the land, on the way in which the land is formed, the age of its mountains and on whether there are mountains or flood plains.

What are the effects of iodine deficiency?

Iodine is needed by the body for the production of hormones. These hormones are manufactured by the thyroid gland and are therefore

commonly known as thyroid hormones. Thyroid hormones have many functions in the body, all of which are essential for normal physical and mental development, including growth. When the diet contains insufficient iodine, the thyroid gland cannot make enough thyroid hormone to satisfy the body's need. The thyroid gland becomes enlarged due to its desperate efforts to produce the hormone; this enlargement is known as goitre, which is the outward sign of iodine deficiency.

While the goitre formed by the enlargement of the thyroid gland is unsightly and can, if too large, interfere with well-being and even cause problems in respiration, the real danger of iodine deficiency lies in the fact that there is not enough thyroid hormone for the body's multiple needs. The damage done by this lack of thyroid hormone varies in severity depending on the time in life at which the deficiency occurs. The brain is particularly sensitive to iodine deficiency during its formation in early fetal and postnatal life. Also, physical growth and psychomotor development are most severely affected in early life and youth.

It is therefore obvious that iodine is essential for women of child-bearing age, because the damage done to the brain in early pregnancy can occur before the woman is even aware that she is pregnant. Iodine deficiency can cause abortion, stillbirth, congenital anomalies, mental retardation and all forms of growth retardation.

All these together are called iodine deficiency disorders, or IDD. The manifestations of IDD are most severe during pregnancy and infancy. The effects however persist into later life. Table 1 shows the different disorders associated with iodine deficiency at different life stages. The most extreme form of iodine deficiency disorder is cretinism. Cretins

Table 1: Iodine deficiency disorders at various stages of life

Life stage	Major disorders
Fetal life and infancy	Abortion, stillbirth, congenital anomalies, increased infant mortality, psychomotor defects, cretinism in various degrees
Childhood and adolescence	Goitre, retarded physical development, impaired mental development, impaired intellectual performance
Adulthood	Goitre, hypothyroidism, impaired mental function



(Photo: G. Clugston)

Goitre is the outward sign of iodine deficiency, which causes brain damage, growth retardation and learning difficulties





Salt comes in many forms, including sea salt and rock salt

often suffer from growth retardation or dwarfism, are severely mentally retarded, and the majority are deaf–mute.

The effect of IDD on mental development does not however always lead to severe mental retardation or cretinism. The more common effect is a reduction in learning capacity. Studies have shown that iodine deficient children have intelligence quotients or IQs that are 10–15 points lower than those of children who do not suffer from IDD. This has grave consequences for their intellectual development, and for the development of their communities and their countries. An iodine deficient people cannot produce as much as they should, they cannot learn as well as they should, with disastrous effects on economic development.

IDD in history

The oldest reports about iodine deficiency and more specifically goitre come from China. As much as 5000 years ago, Chinese authors described goitre, for which they prescribed seaweed. Nowadays it is known that people who eat a lot of seaweed do not suffer from iodine deficiency. For instance the Japanese, who consume a great deal of seaweed, as well as other seafood, do not suffer from IDD.

In the Middle Ages, iodine deficiency was very common in Europe. In the Alps, in Switzerland for instance, cretins were a common sight. IDD was in fact so common in Europe that painters depicted women with goitres as a sign of beauty. Not only were the mountainous regions of Europe affected by IDD, but so were countries like the Netherlands, much of which is located below sea level and thus can be considered as a flood plain.

Goitre and other manifestations of iodine deficiency must also have existed in the Eastern Mediterranean Region, and there are in fact suggestions that Cleopatra had a goitre.

How widespread is IDD?

The World Health Organization (WHO) has for the past few decades kept track of the spread of IDD through the world. While IDD is of course not a contagious disease, there are changes in the numbers of people affected as well as the countries where IDD is found, for two



*Using a hand-held
plant sprayer to
iodize salt*

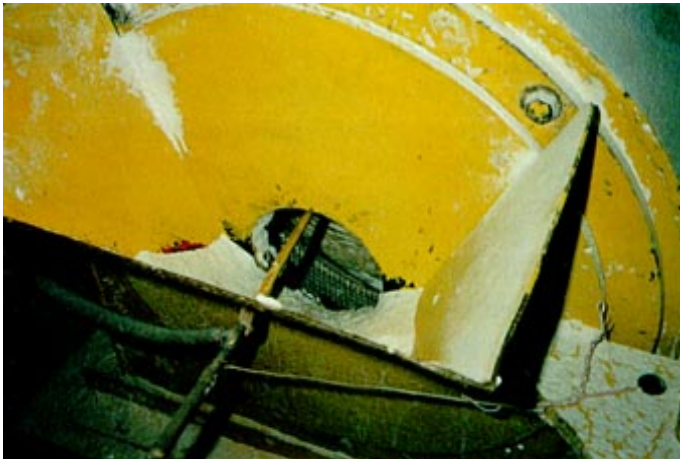
**Salt iodization does not
need sophisticated
techniques—even a
hand-held sprayer can
do the trick**



*Bringing salt to a
mobile iodization
plant*



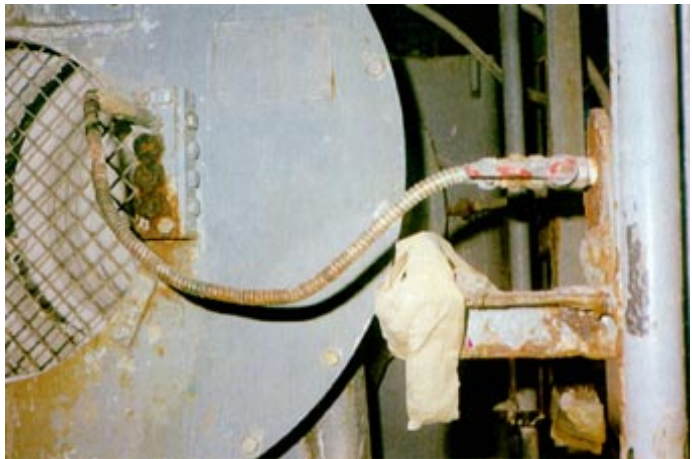
*Spraying chamber in
an iodization plant*



When iodizing rock salt, the iodate can be sprayed directly into the crusher

In a refinery, iodate can be sprayed into the centrifuge

The design of the salt iodization equipment should fit the process used for producing the salt



(Photo: F. Claassen)



Iodization equipment is becoming simpler and cheaper

main reasons. First, many countries have taken measures to prevent IDD from occurring, so their populations do not suffer any more from IDD; second, as a result of better techniques in detection and possibly related to rampant erosion, more and more countries are found to have populations suffering from IDD.

In 1960, WHO estimated that 200 million people in the world were suffering from goitre. In 1992, this figure was raised to at least 655 million people worldwide who were suffering from goitre, in 110 countries. The number of people suffering from goitre is however only part of the problem. Many more are at risk. In 1987, WHO estimated that 800 million people worldwide were at risk of IDD, an estimate that has now gone up to more than 1000 million.

In the Eastern Mediterranean Region, which encompasses 22 countries, extending from Morocco in the west to Pakistan in the east, at least 16 countries have a problem with IDD. Over 42% of the total population of the region is considered at risk of IDD—that means 173 million people. The countries where IDD is most severe are the mountainous countries in the east, but surveys carried out in the past five years in most countries of the Region showed that IDD affects many more countries and many more people in those countries than previously thought.

What can be done to prevent and treat IDD?

All the frightening consequences of IDD, such as abortion, stillbirth and mental retardation can be prevented by ensuring that everyone, especially women of child-bearing age and young children, consumes an adequate amount of iodine.

Many ways have been tried to provide iodine, ranging from the prescription of seaweed, (as was done in ancient China), promotion of fish consumption, provision of Lugol (an iodine solution) or provision of iodine-containing tablets. All these increase iodine intake, but there are risks of getting too little or too much iodine. In addition, it is difficult to reach the people who live in mountainous areas, especially in regard to the provision of seafood. Also, it is not easy, on a sustained basis, to provide everyone with a medicine that must be taken daily.

In addition, not all fish contain significant amounts of iodine, and fish



Iodized salt should be packed in distinctive packages so that people can see that this salt protects them from goitre and brain damage



Titrating iodized salt to determine the iodine content



Quality control and monitoring of salt iodine levels at production, retail and consumption stages are essential to ensure that salt iodization is maintained for future generations



Using simple field-test kits to verify that the salt still contains sufficient iodine

is too costly for the average person to consume regularly.

In the 1950s in Papua New Guinea, scientists pioneered an approach using iodized oil, a substance commonly used in radiology for making contrast photographs. This oil, which was injected, was slowly absorbed from the injection site, and found to protect for about four years against IDD. This method has since been used in several countries, especially in inaccessible regions, such as in the Himalayas, in Nepal. In later years, an oral form of iodized oil was developed, which protects for about one year.

Although this method is effective, it has several drawbacks. Iodized oil is rather expensive, and it must be delivered to the target group by trained health workers, who have to reach each individual. Record-keeping is important to avoid treating the same person twice within a single treatment round, which may cause an overactive thyroid for a while, an unpleasant sensation which may dissuade an individual from coming again for a next protective dose one year later.

The ideal solution would of course be to add iodine to a food which everybody, be they rich or poor, consumes every day in limited quantities. Such a food is salt. Studies carried out all over the world have shown that salt is the most universally available food item, which everyone everywhere consumes daily in limited quantities. In fact, most people in the world consume between 5 and 10 grams of salt per day from all sources. The amount of iodine which has to be added to the salt is minute, 25 to 50 micrograms of iodine per gram of salt. These minute quantities of iodine do not in any way alter the taste or colour of the salt. Moreover, the technical process for adding iodine to salt is very simple, and has by now been perfected.

Iodized salt is now widely consumed in countries all over the world, from the USA to China. Most countries have issued legislation banning the production, importation and sale of non-iodized salt.

Action in countries of the Eastern Mediterranean Region

In 1987, the WHO Office for the Eastern Mediterranean Region (WHO/EMRO) alerted the countries in the Region to the dangers of IDD and to the fact that many countries had a much more severe IDD problem than previously thought. In particular the devastating effects of IDD on mental development and on intellectual capacity had

hitherto received little attention, and the governments of countries in the Region reacted with concern to the discovery that large segments of their populations were suffering from this problem, which prevented them from reaching their full intellectual and economic potential.

In the years that followed, many countries carried out surveys to assess the extent and magnitude of the problem. By mid 1995, 10 countries had carried out such surveys, which helped to plan effective control. In some countries the problem was so severe in some areas that the governments decided to start immediately with a programme to give iodized oil to women and children, to protect them and their offspring. In all the countries concerned, studies were undertaken to evaluate how best to embark on iodization of salt.

All countries in the world have pledged to eliminate iodine deficiency by the turn of the century, and in 1993, it was agreed that all countries would establish universal salt iodization by the mid decade, i.e. in 1995. WHO and UNICEF actively helped the countries in the Region in this important effort. By mid 1995, one country in the Region has almost reached the goal of universal salt iodization, while many others are well on the way.

Of course, it is not enough to iodize the salt at source. It is necessary to make sure that the salt contains enough iodine when it reaches the consumer. Iodine is volatile, and while the compounds used for salt iodization are reasonably stable, care should be taken to protect the salt from moisture and exposure to direct sunlight. Efforts are therefore under way to establish effective quality control and monitoring systems from the salt factories to the household, to ensure that adequately iodized salt reaches the consumer, now and in the future.

What can people themselves do to prevent IDD and its consequences?

IDD cannot be eliminated without the active participation of the people themselves. Everyone who lives in a country or area where the soil is deficient in iodine is at risk of IDD. Even in countries where the problem is not very severe, the risk of intellectual impairment is real. To prevent IDD and to have bright and intelligent children, every parent should ensure that only iodized salt is consumed by the family, every day.

There is no need to start eating more salt; in fact this is dangerous. Just eating iodized salt instead of non-iodized salt, in the same quantities as usual, is enough to prevent IDD.

It is important to remember that the salt producers and the government are doing their best to ensure that the salt contains adequate amounts of iodine. Therefore, the consumer has the responsibility to ensure that the salt, once purchased is kept in a tightly closed container, to protect it from humidity and sunlight which can destroy the iodine. Iodized salt should be used in cooking and at the table. There is no need to have any other salt in the house. Iodized salt tastes and looks the same as non-iodized salt. The only way in which the consumer can see the difference is by looking on the label of the salt packet when buying the salt.

Iodized salt is not harmful for people who already consume enough iodine. However, sea salt, believed by many to contain “natural” iodine, does not contain a sufficient quantity.

Conclusion

IDD has been called a scourge of humanity. It not only causes goitre, but may result in irreversible brain damage in the fetus and infant, and retarded psychomotor development in children.

Iodine deficiency is the most common cause of preventable mental retardation. The effects of iodine deficiency on a country's population have a negative impact on the entire economy of affected nations.

Fortunately, there is a simple and cheap way of preventing iodine deficiency and that is through the provision and consumption of adequately iodized salt.

Together, consumers, producers and governments can protect themselves and their children against the terrible consequences of iodine deficiency.

Further reading on iodine deficiency disorders

A practical guide to the correction of iodine deficiency (WHO/UNICEF/ICCIDD)

Global prevalence of iodine deficiency disorders (WHO/UNICEF/ICCIDD)

Guidelines for salt iodization to eliminate iodine deficiency disorders (WHO/UNICEF/ICCIDD) (in press)

Indicators for assessing iodine deficiency disorders and their control through salt iodization (WHO/UNICEF/ICCIDD)

Iodine and health: eliminating iodine deficiency disorders safely through salt iodization (WHO)

Iodine deficiency disorders: a strategy for control in the Eastern Mediterranean Region (WHO)

Methods for measuring iodine in urine (WHO/UNICEF/ICCIDD)

Monitoring universal salt iodization programmes (WHO/UNICEF/ICCIDD/PAMMI/MI)

Report on the WHO/UNICEF/ICCIDD regional meeting on the role of communication in support of IDD control programmes, EMRO, Alexandria, 25–26 April 1993 (WHO)

SOS for a billion: the conquest of iodine deficiency disorders (ICCIDD)

For more information on how to obtain these publications, contact the Office of Nutrition, Food Security and Safety, WHO Regional Office for the Eastern Mediterranean, P.O.Box 1517, Alexandria 21511, Egypt

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