

Questions and answers on iodine intake and the prevention of iodine deficiency

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Iodine is a trace element which the body needs to produce thyroid hormones. Based on the criteria of the World Health Organisation, iodine deficiency no longer exists in Germany. The iodine content in foods has gone up in recent years. One reason for this is that iodised salt is increasingly used in the production of food. The second reason is that more and more iodised feed is used for production animals, resulting in increased iodine contents in milk and dairy products. Measures for the prevention of iodine deficiency are still necessary, however, because the iodine intake of the population is still not optimal. This is shown, for example, by studies on the health of children and adolescents.

The Federal Institute for Risk Assessment (BfR) has answered and summarised the most frequent questions on the subject of iodine intake and the prevention of iodine deficiency below:

What is iodine and what is it used for in the body?

Iodine is an essential trace element which is notably indispensable for the production of thyroid hormones and which must be ingested with food. In the body, thyroid hormones have a central function in the control of a number of metabolic processes and are required, among other things, for normal growth, bone formation, the development of the brain, and energy metabolism. If iodine intake remains below the recommended daily allowance over extended periods of time, the thyroid gland will produce less thyroid hormones which can in turn lead to severe health problems.

How much iodine does the body need?

The main source of iodine intake is food, although the iodine contents of foods and overall diet varies considerably; it is influenced by geochemical and cultural conditions as well as by the use of iodised table salt.

The iodine requirements of a person depend on different factors. These include age, environmental influences such as smoking as well as high consumption of vegetables which contain substances that inhibit iodine uptake (various cabbage varieties, beans etc.). The recommendations of the German Nutrition Society for adequate iodine intake are age-dependent and increase from 40 to 80 µg / day for infants to 200 µg / day for adolescents and adults:

Age group		Recommended iodine intake
Infants	up to 4 months (estimate)	40 µg / day
	4 months to 12 months	80 µg / day
Kinder	1 to under 4 years	100 µg / day
	4 to under 7 years	120 µg / day
	7 to under 10 years	140 µg / day
	10 to under 13 years	180 µg / day
	13 to under 15 years	200 µg / day
Adolescents and adults	15 to under 51 years	200 µg / day
	51 years and older	180 µg / day
Pregnant women		230 µg / day
Breastfeeding mothers		260 µg / day

Since Germany has experienced a prolonged iodine shortage in the past, functional autonomy of the thyroid gland is still to be expected in the elderly in particular. This means that they are more sensitive to high doses of iodine and that excessive iodine intake can lead to hyperthyroidism in this group of the population. For this reason, iodine intake should not exceed 500 µg per day.

What should pregnant women and breastfeeding mothers watch out for?

Due to their particular metabolic condition, pregnant women and breastfeeding mothers have increased iodine requirements. In order to avoid the risk of iodine deficiency and any adverse health effects resulting from it for mother and child, pregnant and breastfeeding women should, following consultation of their gynaecologist, take 100 to 150 µg of iodine per day in the form of tablets in addition to their intake through food.

Hoch much iodine does an adult absorb from food, if they use iodised salt?

The German Nutrition Society recommends a daily iodine intake of 180 to 200 µg for adolescents and adults. Without the addition of iodine into the food chain via iodised salt, the daily intake for an adult would only amount to roughly 100 µg of iodine. On average, youths and adults reach the iodine recommendation, if about 50 to 80 percent of all food is processed with iodised salt and if similar use of iodised salt is made in the household. The frequency of iodine use in private households is about 80 percent. For industrially processed food including loose goods, the use of iodised salt is below 30 percent.

How can consumers ensure sufficient iodine intake through nutrition?

It is now easy to ensure sufficient iodine intake, provided that consumers make a conscious effort to eat foods containing iodine. This includes:

- daily consumption of milk and dairy products
- consumption of saltwater fish once or twice a week
- consistent use of iodised salt in the household and
- when shopping, giving preference to foods produced with iodised salt

Are there groups of persons for whom sufficient iodine intake is especially important?

Persons who refrain from eating some or all animal foods (meat, fish, milk, eggs) are at a

greater risk of iodine deficiency. Vegetarians, vegans and persons who must keep to a special diet must therefore be especially careful to ensure that they get enough iodine. Among them are consumers who, due to an allergy to cow's milk or fish or because they suffer from lactose intolerance, must avoid fish or dairy products.

Is the consumption of products from seaweed and kelp suitable to ensure adequate iodine intake?

The iodine contents in dried seaweed and kelp products can be especially high, because of the high concentration of iodine in seawater and because iodine is stored by some types of seaweeds. Depending on the type of seaweed, iodine contents fluctuate considerably and are between 5 and 11,000 micrograms per gram of dry weight. Brown seaweeds are especially rich in iodine, especially the varieties Arame, Kombu, Wakame and Hijiki.

Even if only small amounts of 1 to 10 Grams of seaweeds are eaten, the maximum intake quantity of 500 micrograms per day (applies to adults) can be clearly exceeded. Due to the iodine surplus, detrimental health effects are, depending on the dose and the sensitivity of the consumer, possible. Given their non-standardised iodine content, therefore, regular use of seaweeds is not a good method for ensuring adequate iodine intake.

What factors influence iodine absorption in the body?

Various environmental influences, food components and some medications can interfere with the absorption of iodine or the production of thyroid hormones. However, these factors only pose a health risk, if the iodine intake through food is at the same time significantly below the daily allowance of 180 to 200 µg recommended by the German Nutrition Society.

As regards environmental factors, smoking is especially relevant. In terms of nutrition, selenium, zinc and iron deficiency in particular can influence iodine metabolism. In addition, high consumption of certain foods - such as cabbage and radish or corn and millet - can lead to decreased iodine absorption in the thyroid. The reason for the iodine uptake inhibition effect is the substance thiocyanate. In cabbage and radish it is contained as such, whereas corn and millet contain cyanogenic glycosides which are metabolised into thiocyanate.

What is the iodine intake situation like in Germany?

One way of determining the iodine intake status of the population is based on iodine excretion through urine. Data on iodine excretion in children and adolescents were collected as part of the representative "Study on the Health of Children and Youths in Germany" (KIGGS study) in the years 2003 to 2006. The data indicate that based on the general criteria of the World Health Organisation the average intake of children and youths is in the lower optimal range.

It must be taken into account that apart from the average iodine intake, a substantial proportion of children and youths fall into the category of deficiency or oversupply, the former category being significantly larger than the latter.

As part of the Study of Health in Pomerania (SHIP) conducted between 1997 and 2001, iodine excretion was measured in adults. This study too suggested that average iodine intake was in the lower optimal range.

The two studies clearly show that sustained compensation for the iodine shortfall in nutrition continues to be necessary. Generally, regular monitoring as part of health reporting is important in order to control the iodine intake status of the German population.

Is iodised salt prophylaxis still necessary in Germany?

As regards the iodine contents in the soil, Germany is an area of iodine shortage. This means that the natural iodine concentrations in food alone are not sufficient to achieve sufficient iodine intake. For this reason, iodised salt prophylaxis continues to be necessary in order to ensure adequate iodine intake in the population.

As a result of iodine prophylaxis, the iodine contents in food have increased markedly in Germany over the last 15 years. The use of iodised cooking salt in food production and the increasing use of iodised mineral nutrients for dairy cows account for the higher iodine contents in food, especially milk and dairy products. However, the use of iodised salt in industrially processed food is on the decrease.

How safe is iodised salt?

The iodine quantity which may legally be added to salt amounts to 15 to 25 mg / kg. This quantity is chosen in such a way that the salt poses health risks neither for healthy individuals nor for those suffering from thyroid disorders. Compliance with the legally prescribed maximum quantity for iodine contents in table salt is supervised by the Food Control Administration.

How prevalent is the use of iodised salt in the food industry?

In the individual EU member states, different iodine compounds and maximum quantities are permitted for the iodisation of table salt. This leads to trade restrictions for iodised products, meaning that many food producers generally dispense with iodisation altogether. An EU regulation has now opened up the possibility of marketing food produced with iodised salt Europe-wide. For industrially processed food, the use of iodised salt is still below 30 percent.

How can consumers determine whether or not food has been produced with iodised salt?

When purchasing packaged food, the consumer can glean from the list of ingredients on the label whether iodised or conventional salt was used in the production. When buying non-packaged goods from bakeries and butcher shops, consumers must ask whether or not they contain iodised salt.

What are the things that should be borne in mind by consumers who have to restrict their salt intake?

Patients with hypertension who have to restrict their salt intake should instead use iodised table salt substitutes. Under all circumstances, persons with special dietary needs should discuss with their doctor whether or not it is advisable for them to take an iodine supplement.

What health effects can iodine deficiency have?

Severe iodine deficiency can result in dwarfism, deaf-muteness and retarded mental development.

Iodine deficiency in pregnant women can lead to an increased rate of deformities or miscarriages. Mothers with iodine sufficiency in most cases give birth to babies with congenital hypothyroidism. In addition, such babies have an increased mortality rate.

In children and adolescents, iodine deficiency can lead to struma diffusa (goitre, enlargement of the thyroid) and hypothyroidism. Other possible consequences of iodine deficiency include lowered mental capacity and retarded physical development.

In adults, chronic iodine deficiency can result in the development of goitre either with or

without nodules.

Non-visible functional disorders of the thyroid are also common. Among those is hypothyroidism which is associated with reduced hormone production.

What are the reasons for excessive iodine intake?

“Excessive iodine intake” usually denotes an intake of more than 1000 µg of iodine per day. Such a high intake is not possible purely through a normal diet. Calculations on the basis of consumption studies have shown that iodine intake even in the 95th percentile is still well under this level, even if 100 % iodised table salt was used both in the household and in the food processing industry.

The reasons for excessive iodine intake are often the use of contrast agents and medications containing iodine or the consumption of seaweeds rich in iodine.

What health effects can excessive iodine intake have?

Depending on the dose and the sensitivity of the person, excessive iodine intake can lead to the following symptoms:

- hyperthyroidism with functional autonomy,
- Graves` disease (autoimmune hyperthyroidism)
- Hashimoto`s thyroiditis (autoimmune inflammation of the thyroid resulting in either hyperthyroidism or hypothyroidism)
- acute blockage of iodine uptake in the thyroid (Wolff-Chaikoff effect) with or without hypothyroidism or
- rare over-sensitivity reactions (for example in patients with Dermatitis herpetiformis Duhring).

One-off higher doses under 1000 µg/ day are usually tolerated without any side effects by people who do not suffer from any thyroid disorders. Excess iodine is excreted with the urine.

Are there groups of persons who are especially sensitive to excessive iodine intake?

Elderly people who were raised in times of iodine shortages and who have therefore developed functional autonomy are generally seen as a risk group that is especially sensitive to excessive iodine intake. As a matter of precaution to protect sensitive consumers, the German Nutrition Society therefore recommends that iodine intake through diet be restricted to 500 µg / day for adults.

Can iodine deficiency prophylaxis lead to hyperthyroidism?

An increase of usually only temporary iodine-induced hyperthyroidism was observed as part of programmes for iodine enrichment in countries in which the introduction of iodine deficiency prevention measures was implemented in a relatively short period of time. Those affected are mainly the elderly who have been exposed to iodine shortages for long periods of time and who have therefore developed autonomous nodules which react to slight increases of iodine intake with an increase in the production of thyroid hormones. This means that if the applicable maximum value of 500 µg iodine per day is exceeded on a permanent basis, this could pose a problem for older persons suffering from thyroid disorders. Calculations have shown, however, that this maximum value is not exceeded in Germany even in case of maximum use of iodised table salt.

The current medium iodine intake does not pose a problem even for patients who are receiving treatment for hyperthyroidism due to Graves` or Hashimoto`s disease.

What is Hashimoto's thyroiditis?

Hashimoto's thyroiditis denotes an inflammation of the thyroid which in its early stages could lead to hyperthyroidism and later to hypothyroidism due to scarring of the thyroid tissue. This disease is the consequence of an autoimmune reaction and is facilitated by genetic factors. In the course of the disease, antibodies against thyroid tissue first cause an infiltration of the thyroid with defence cells and an inflammatory reaction and finally scarring with hypothyroidism.

Progression of this disease is very slow, meaning that hypothyroidism only occurs years or decades after the first detection of thyroid autoantibodies. However, a positive autoantibody titre does not always lead to Hashimoto's disease and hypothyroidism, for it is equally possible that the function of the thyroid is preserved for life.

Is a diet low in iodine required for patients suffering from Hashimoto's thyroiditis?

The medical institutes specialising in the field neither recommend that patients suffering from Hashimoto's thyroiditis refrain from all iodine intake nor that they keep to a diet low in iodine. They should refrain from taking additional higher-content iodine such as food supplements that contain iodine and vitamin supplements. However, it is not necessary to refrain from consuming iodised table salt.

Can the iodine intake as part of iodine deficiency prophylaxis cause cardiovascular disease?

Normal iodine intake as part of iodine deficiency prevention does not lead to cardiovascular diseases, but on the contrary increases cardiovascular capacity. However, an already existing thyroid illness with a deficiency or excess of thyroid hormones can have negative effects on the cardiovascular system. In case of a hormone deficiency caused by hypothyroidism, the heart rate is slowed down and the diastolic blood pressure is increased; in contrast, hyperthyroidism with increased thyroid hormone levels can lead to cardiac dysrhythmia (tachycardia) and an increase in the systolic blood pressure.

Can iodised salt trigger allergies?

Allergy is an oversensitivity reaction which is based on stimulation of the immune system by an allergen. The iodates used in iodised salt are molecules that are too small to act as allergens. For this reason, there is no such thing as an iodine allergy. That said, patients may develop allergies to products containing iodine such as x-ray contrast agents. In that case, it is the carrier to which the iodine is attached that acts as an allergen.

Can iodised salt cause "iodine acne"?

"Iodine acne" is an intolerance reaction which is caused by halogens to which iodine belongs. Such skin changes only occur, if iodine quantities in the range of milligrams and grams are consumed on a daily basis and thus by far exceed iodine intake in connection with the current iodine deficiency prevention programme. However, iodine intake in this quantity can occur, for example, when medications containing iodine are taken.