



Ethiopia's salt iodization success story

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Ethiopia has made remarkable progress in iodized salt coverage, leading to sharply improved iodine intake across the country

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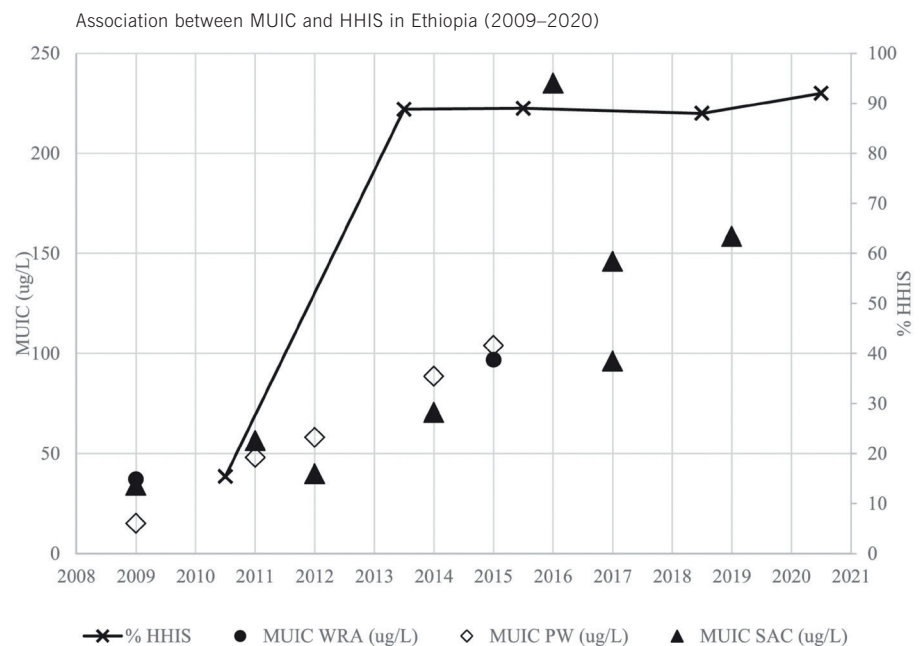
Ethiopia launched its iodized salt program in the 1990s. The Ethiopian Government was a signatory to the World Summit for Children held in 1990 and banned the production and sale of noniodized salt in 1996. Before the 1998–2000 Ethiopian–Eritrean conflict, nearly all edible salt in Ethiopia was produced in large, industrial scale plants in Eritrea along the Red Sea. Consolidated production and processing of salt across relatively sophisticated refineries enabled quick adoption of iodization policy and coverage of iodized salt of over 80% was achieved within 2 years.

The 1998–2000 Ethiopian–Eritrean war interrupted Ethiopia's salt supply from Eritrea, as a result, Ethiopia started importing salt from neighbouring countries, particularly Djibouti. Seeking to avoid dependence on importation, the Ethiopian government explored domestic sources of salt. Although a small amount of salt is available in underground water in Dobi (Tigray) and from rock deposits in Godcusbo (Somali) regions, the largest potential for salt production in Ethiopia is at Lake Afdera (Afar Region). More so, the Ethiopian Government decided to lift the ban on noniodized salt to ease the pressure on salt scarcity caused by the conflict between 1998 and 2000.

Consequently, between 2000 and 2011, iodized salt coverage in Ethiopia began to fall. According to the Demographic Health Surveys, the national average of households with iodized salt (HHIS) in 2000 was 28.4%, in 2005 was 54.3% and by 2011 it has reached its lowest point of 15.4%. Correspondingly, the iodine status of the population assessed through median urinary iodine concentration (MUIC) across several national and subnational surveys between 2009 and 2015 demonstrated alarming iodine insufficiency. The trends in MUIC values compared against household iodized salt coverage are shown in *Figure 1*.

The 2005 Ethiopian National Iodine Deficiency Disorders survey exposed widespread iodine inadequacy. It was estimated that over 6 million (40%) children aged 6–12 years and four million (36%) women aged 15–49 years were affected by goiter. As many as three quarters of the population

FIGURE 1 Association between median urinary iodine concentration (MUIC) and household iodized salt (HHIS) in Ethiopia.



suffering from varying degrees of deficiency. The data prompted the government to reassess its policy, which led to a renewed commitment and goal of achieving virtual elimination of IDD in 2005. In early 2011, and after several years of promotion and advocacy, the Government of Ethiopia reintroduced a comprehensive legislation that mandated for all salt produced or imported into the country to be iodized by 2015.

Salt production

Camel caravans have carried blocks of salt mined by hand from Ethiopia's Danakil Depression to markets since the sixth century, however, modern day salt production in Ethiopia is rapidly changing. Ethiopia started developing its domestic salt production capacity in response to a salt shortage as well as to move away from reliance on imports. At present, Ethiopia's primary salt production is concentrated at three zones, Lake Afdera, Dobi and Godcusbo. The requirement of salt for human consumption for Ethiopia's population is estimated at around 500,000 metric tonnes based on its current population and accounts for

about 4.5 kg of salt per capita requirement. This estimate includes salt used by the food industry. Ethiopia's salt production potential is much higher than its requirement and it is estimated that Lake Afdera alone has a potential for 2.5 million metric tons per annum of salt.

Around 70%–80% of the salt produced in Ethiopia comes from Lake Afdera. Lake Afdera is a natural saline lake located in the Danakil Depression. The salinity of the lake's water, high ambient temperatures, dry-arid climate, and flat topography along the south and south west corners of the lake create almost ideal conditions for salt production. Most salt production units in Lake Afdera employ a conventional triple stage solar evaporation technique. This technique produces high-quality salt with high sodium chloride content. Smaller artisanal producers in Lake Afdera apply a single-stage technique, pumping water straight into crystallizer pans and allowing the brine to completely evaporate, leaving a salt deposit which is harvested.



Iodine intakes in Ethiopian women and children have markedly improved

The single-stage technique is predominantly used in Dobi and Godcusbo salt production zones as well. Dobi is located near Lake Afdera within the Afar region while Godcusbo is in the Somali Region in the south eastern part of the country close to the border with Somalia. Dobi and Godcusbo produce salt from underground brine that is mechanically pumped or at times manually raised through pulleys and buckets from wells. The production methods in Dobi and Godcusbo are relatively primitive and artisanal resulting in low yields of inferior quality salt. These regions account for less than 30% of Ethiopia's salt production.

Salt iodization

Between 2000 and 2011, most of the salt iodization efforts targeted iodization of salt at the primary production level. The primary method for salt iodization was to dissolve potassium iodate in water and spray the solution onto salt. Since the approach was to iodize salt at the point of production which at the time was dominated by small operations located in areas with poor infrastructure, manual knapsack sprayers were used. This potassium iodate was sprayed directly onto mounds of salt, manually mixed and subsequently packaged. There were attempts to mechanize this process and several development partners provided mobile iodization machines. While these machines aided mixing and packaging of salt, they required additional labour to feed salt into the machines. These iodization machines

were not suited for the environment and the prevailing infrastructure. Most of these machines have been abandoned, went into disrepair or broke down.

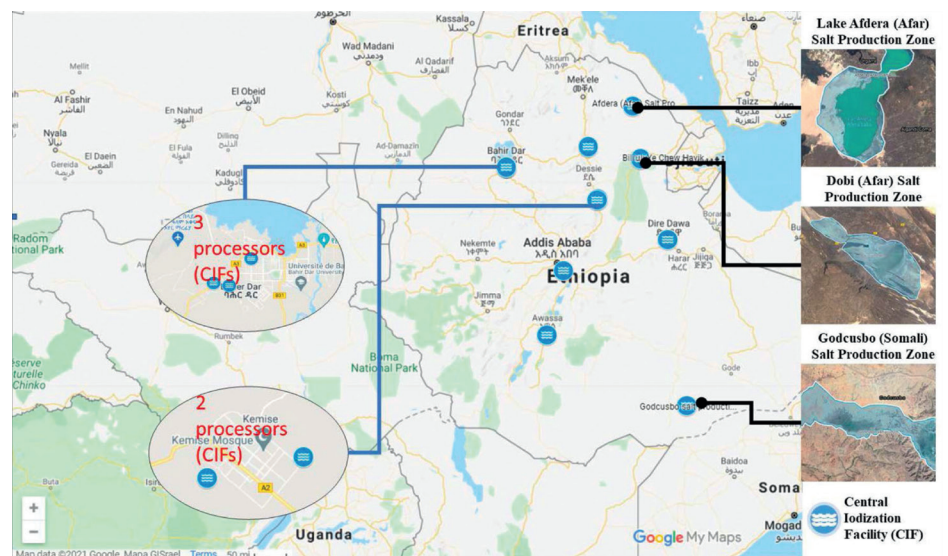
Between 2011 and 2015, the programmatic approach to salt iodization changed, central iodization facilities (CIFs) were considered. It was clear that iodization of salt at the primary production sites was not feasible and therefore the approach evolved to aggregating salt produced by smaller processors into central processing locations

that would enable iodization, and this would also make monitoring of quality easier and enable more consistent iodization. Primary salt producers and traders had to be convinced to sell their salt to these central processing units instead of directly into the market. At the same time investors had to be identified who were willing to offtake the salt from producers and process and distribute this to consumers.

Suspicion and doubt prevailed; however, these were eventually overcome through dialogue, assurances and producers eventually seeing the benefit of a consistent market. The location of CIFs must be strategically done with due consideration for the infrastructure, proximity to salt sources and markets and available road and utility infrastructure. Thus, 17 CIFs have been established in Ethiopia, 13 (76%) are located across three regions—Amhara, Afar and Tigray. Figure 2 provides an overview of the three main salt production zones—Lake Afdera, Dobi, and Godcusbo and 12 out of the 17 registered CIFs.

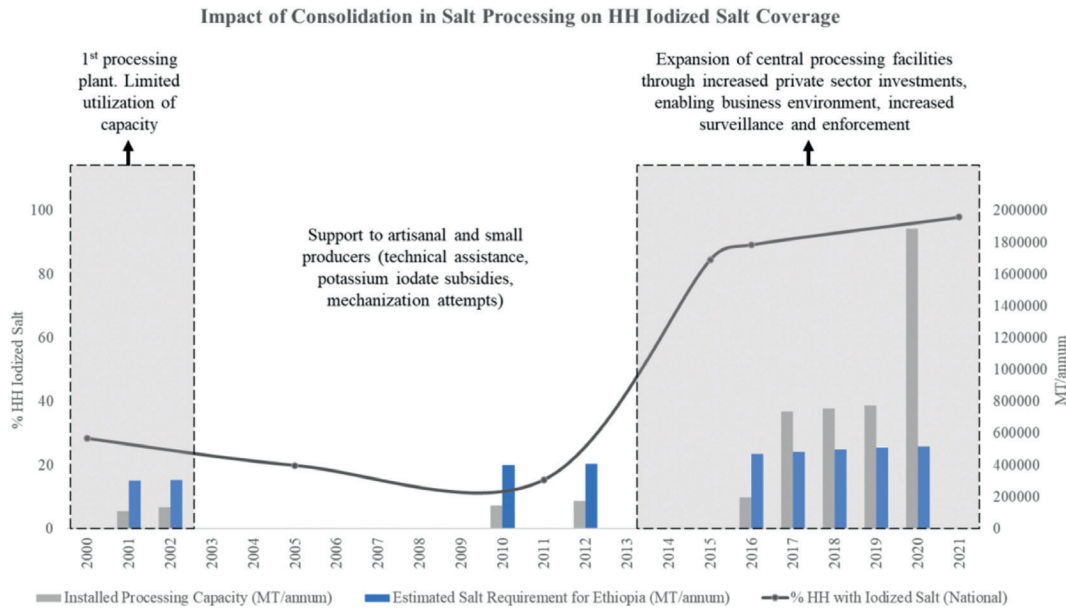
Out of the 17 registered CIFs, three companies SVS, TTR and Danakil Plc reported production that accounted for almost 90% of Ethiopia's salt requirement. The installed capacity of processing facilities exceeds the market for salt for human consumption resulting in underutilization of installed capacity which on average is below 30%.

FIGURE 2 Location of Ethiopia's main salt production zones and processing facilities



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the authors

FIGURE 3 Trends in iodized salt coverage salt requirements and processing capacity



Given that salt use in industrial applications is less than 20% of the overall salt demand in Ethiopia, the underutilization of the processing capacity of CIFs pose business sustainability challenges and carries a risk of a few companies going out of business unless new markets such as exports are created for salt.

The establishment of CIFs, establishment of iodization capacity and actual production and corresponding trends on household coverage of iodized salt is presented in Figure 3. The cumulative installed capacity increased to meet the iodized salt requirement between 2016 to 2020 and correspondingly HHIS coverage has improved. This shows that the renewed CIF approach was more effective.

Iodized salt coverage

Overall, the proportion of households using iodized salt which was only 28% in 2000, and further fell to as low as 15% by 2011. Household coverage for iodized salt increased to 89% by 2016 and has remained steady as confirmed by the latest post market surveillance conducted by the Ethiopian Food and Drug Administration (EFDA) in 2021 (Figure 1). Furthermore, the post market surveillance conducted by the EFDA in 2021 which included quantitative analysis of iodine reported that iodine content of salt reported that 92% of salt samples collected from markets contained over 20 ppm I with the lowest coverage in Amhara Region where 13% of salt samples has iodine

levels below 20 ppm I. In the same survey, nationally only about 1% of salt samples did not contain any iodine (<5 ppm). These data represent a dramatic progress for the salt iodization programme in Ethiopia.

Iodine intake trends

Clearly, improvements in iodized salt coverage have contributed to improved iodine intake. There is a positive trend in iodine intake, as reflected by the MUIC of the population since 2009 documented through various national and subnational studies which are presented in Figure 1. The studies indicate a clear shift in iodine intake with a distinct rise in MUIC values between 2015 across all population subgroups which coincides with improved household coverage during the same period.

Adequate iodine improves school performance in Ethiopia

A recent meta-analysis of 10 studies identified the impact of malnutrition on the academic performance of children in Ethiopia. The pooled prevalence of good academic performance among elementary school students in Ethiopia was only 58%. Stunting (odds ratio = 0.48), underweight (odds ratio = 0.38), and iodine deficiency (odds ratio = 0.49) had a significant negative impact on academic performance of elementary school children in Ethiopia. (From: SAGE Open Medicine, Volume 10: 1–10, 2022)

Conclusions

Salt production in Ethiopia has increased to a point where the country is self-sufficient. While this production has improved, some aspects of salt production remain challenging, and the sector is still relatively fragmented and undermined by political, economic and social challenges which will need to be resolved.

These include:

- Harsh climatic conditions, remoteness and lack of infrastructure in the Afar region that makes salt production operationally challenging and it is costly to get this salt to the central processing facilities and eventually into the market.

- The Afdera region continues to experience conflict and persistent political friction between the Regional and Federal Government which manifests into poor adoption of socioeconomic policies.
- Price controls and production quotas to protect the livelihoods of small-scale salt producers frequently conflict with business dynamics and discourage investment into the salt sector and pose high business risk.
- The fragmented nature and small size of salt works restricts the potential for mechanization and adoption of modern salt production techniques.
- Surplus production and lack of markets for both food grade and industrial salt in the absence of export potential due to comparatively high production costs has led to a high turnover in salt production operations with many ceasing to operate.

Irrespective of these challenges, the Ethiopian Government has been successful with its vision to exploit the country's potential for salt production and establish independence from imports.

Poor cognitive function in iodine deficient Portuguese schoolchildren

From: Bailote, HB, et al. *Biology* 2022, 11, 1507 → <https://doi.org/10.3390/biology11101507>

Background

Intelligence in childhood, assessed by psychometric cognitive tests, is a strong predictor of several important life outcomes, including educational attainment, income, health, and lifespan. Iodine-deficiency has been linked to poorer intellectual function in studies in schoolchildren in Europe and New Zealand (1,2). In the Azores archipelago, schoolchildren are iodine deficient: 78.4% have a low urinary iodine concentration (UIC) (<100 µg/L) (3).

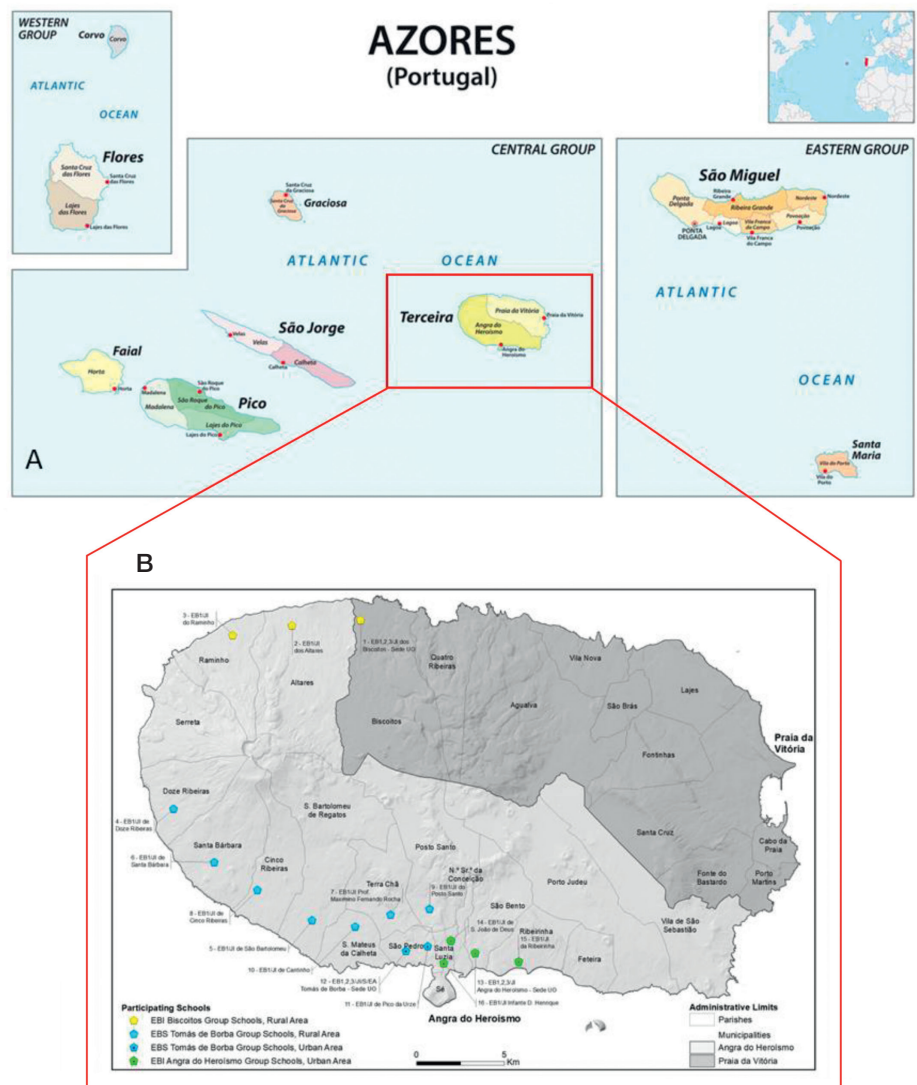
The association between iodine deficiency and cognitive impairments, using the Raven’s Colored Progressive Matrices (CPM) and the Wechsler Intelligence Scale for Children (WISC) as instruments for intelligence measure, have been reported previously (1,2). However, not all the IQ subtests for WISC were used in these studies, leaving some questions, including what cognitive functions could be compromised in iodine-deficient schoolchildren and what is the magnitude of the effect of iodine deficiency on IQ.

Study design

The study was done on Terceira Island in the Azores Islands of Portugal (Figure 1). Its aim was to ascertain whether moderate iodine deficiency would affect the cognitive function of schoolchildren (7–11 years old; 3rd and 4th grades). Sixteen elementary schools from Terceira Island were selected. Clarification meetings were carried with each school coordinator, and a random sample of children from the 3rd and 4th grades were recruited after a brief presentation of the project in their classrooms.

Iodine intake data was recorded using a modified validated iodine-specific food frequency questionnaire. Iodine status was assessed by measuring UIC. From each participant, one spot-urine sample (first urine in the morning) was collected. UIC was measured by a colorimetric method in the

FIGURE 1 Location of the Azores archipelago (A) and Terceira Island (B). The participating schools are represented by dots (green, blue, and yellow).



Laboratory of Endocrinology of Portuguese Institute of Oncology in Lisbon.

This study examined the effects of iodine deficiency in the schoolchildren using both CPM and the complete form of the

WISC-III. CPM were used for measuring the intelligence quotient (IQ) of the total population (n = 256), and the WISC-III was used to study two selected subgroups:



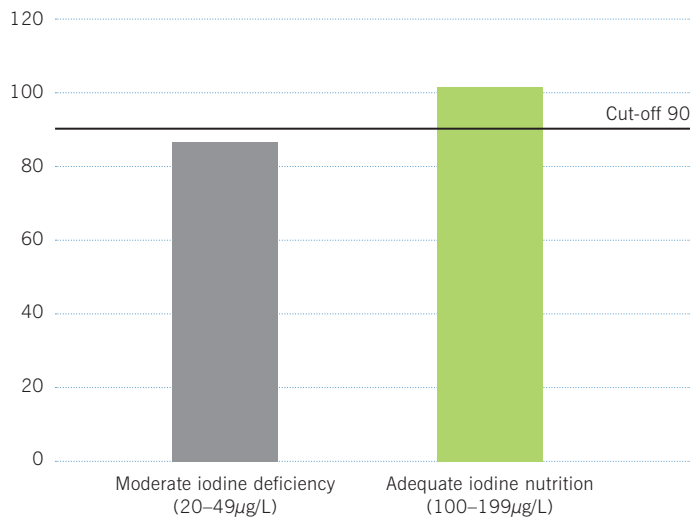
Schoolchildren need adequate iodine to learn well at school

one moderately iodine-deficient (n = 30) and the other with adequate iodine intake (n = 30).

Results

The median UIC was 66.2 µg/L, indicating mild iodine deficiency. The WISC-III

FIGURE 2 Wechsler Intelligence Scale for Children—Third Edition (WISC-III) Full-Scale IQ (mean) according to iodine status: moderate iodine deficiency (UIC 20–49 µg/L, n = 30) vs. adequate iodine intake (UIC 100–199 µg/L, n = 30) subgroups.



was shown to be a good instrument for cognitive function assessment among moderate iodine-deficient schoolchildren; this subgroup had a full-scale IQ 15.13 points lower than the adequate iodine intake subgroup, with a magnitude effect of $d = 0.7$ ($p = 0.013$) (Figure 2). Significant differences were also registered in 6 of the 13 Verbal-Performance IQ subtests.

Conclusions

This is the first study in Portugal and in the Azores archipelago which compares iodine status with cognitive functioning in a large and representative population of schoolchildren: 23% of the 3rd and 4th grades schoolchildren from Terceira Island were studied. The results of this study reveal impairments in the cognitive profile of Portuguese children with moderate iodine deficiency. Working memory, seriously compromised in moderate iodine-deficient schoolchildren, is used to process and store information during complex and demanding activities, supporting many actions that children usually engage in at school. As iodine deficiency represents a significant risk factor for poor educational progress, the need for action by policy makers and governments is urgent. Implementing partnership policies, iodine public health programs and school intervention projects in iodine-deficient areas should be implemented.

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Low use of iodized salt among university students in Germany and Greece

From: Heimberg et al. *BMC Public Health* (2022) 22:1851 → <https://doi.org/10.1186/s12889-022-14008-9>

In many countries of the world—including Germany and Greece—the addition of iodine to salt occurs on a voluntary basis. According to the latest national food consumption survey conducted in Germany between 2005 and 2007, the main natural food sources contributing to iodine intake—in order of the most relevant sources—were milk and milk products, non-alcoholic beverages (water, coffee, tea, fruit juices, vegetable juices and lemonades because of the natural iodine content of the water) and sea fish. However, when being produced with iodized salt, processed foods such as meat, meat products and bread are the most relevant iodine sources. There are no recent data available about the main food sources of iodine from Greece, but older data from 1993 indicate that milk and milk products, meat and sea fish served as the most important contributors besides iodized salt.

Despite improved socioeconomic conditions and the voluntary implementation of salt iodisation in Germany and Greece, which improved iodine status over the past decades, recent data indicate a decreasing iodine status in German children and adults (1) and a suboptimal iodine status in pregnant women in Greece (2).

Good knowledge and awareness about iodine/iodized salt has a positive impact on the use of iodized salt at home and on iodine intake, and a low level of knowledge has been suggested to be a risk factor for suboptimal iodine intake or iodine deficiency. This study assessed knowledge and awareness about the importance of iodine/iodized salt for health and its use at home among German and Greek students. It aimed to determine whether the conscious use of iodized salt was associated with knowledge regarding iodine and related factors such as attendance of a nutrition course, interest in nutrition and

the habit of reading food labels.

It was multi-center cross-sectional survey, conducted among non-nutrition science/non-medical students from October 2018 to April 2019. There were 359 participants in Germany (35% females, median age: 22 years) and the 403 participants in Greece (51% females, median age: 21 years).

The main findings:

- Use of iodized salt among university students in Germany and Greece was low, only 41% and 37% used iodized salt, respectively (*Figures 1 and 2*)
- Vegans had a higher iodized salt use level (57%) than students who followed other plant-based diets or were omnivores (36% and 47%, respectively)
- The overall observed knowledge about iodine and iodized salt in nutrition and health was unsatisfactory, but better in females, in both countries

FIGURE 1 Types of salt used by university students in Germany (n = 359)

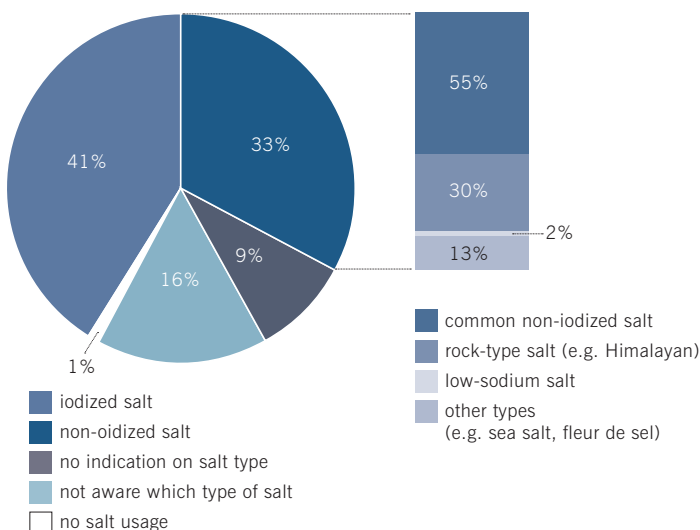
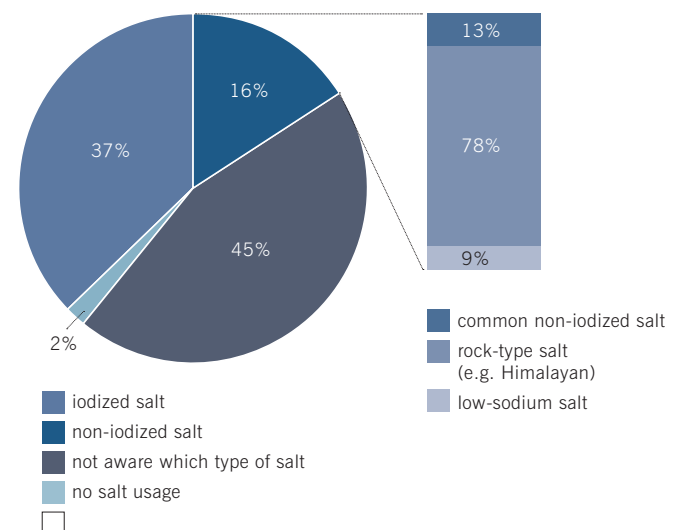


FIGURE 2 Types of salt used by university students in Greece (n = 403)



- An increasing knowledge and the attendance of a nutrition course were associated with a more frequent use of iodized salt

Despite the rather poor knowledge about iodine and iodized salt both in the German and Greek samples, the results do suggest that an increasing level of knowledge is associated with a more frequent conscious use of iodized salt. Thus, there is a need for raising awareness and knowledge about the importance of iodine for human health as well as about relevant iodine food sources and for increasing the use of iodized salt among young adults in Germany and Greece.

The poor knowledge observed in our study is in agreement with that seen in previous studies from Germany, Italy and Norway, in which university and even medical students lacked knowledge about iodine-related issues. It may thus be assumed that the lack of knowledge observed is a general problem in young European adults.

The findings suggest that education to young adults on the importance of iodine should be offered consistently and continuously to obtain a sustainable effect. As the attendance of nutrition courses and a better knowledge about iodine/iodized salt had a positive impact on the use of iodized salt, it would be desirable that education about iodine be offered in nutrition courses in school curricula to ensure equal access to this information for all levels of education, preferably starting from an early age.

There is also a need for widespread information campaigns on the importance of iodine in order to assure a sustainable awareness about iodine and related health matters in the public across all age groups, health care professionals, food producing companies and wide-reaching multipliers



German university students have low awareness of the benefits of iodized salt

on social media platforms, as an information source particularly for younger people. In order to be effective, these information campaigns should be planned in a target-group specific manner.

A better knowledge about the importance of iodine and iodized salt for health could not only have a positive impact on the use of iodized salt in private households, but also improve consumer acceptance and demand for processed foods manufactured with iodized salt (such as bread, cheese or meat), thus contributing to an increased iodized salt usage in food manufacturing, which would eventually contribute to an improved iodine status of the population, including those at risk of iodine deficiency.

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‘Ramping up’ salt iodization in Eastern and Southern Africa

A mid-term review of the USI-IDD roadmap for the Eastern and Southern Africa Region finds that overall implementation has been much better than expected

Festo P. Kavishe, *IGN Regional Coordinator for Eastern and Southern Africa*

Introduction

This Mid-Term Review (MTR) Report on the implementation of the “Ramp up USI-IDD Roadmap For The Eastern And Southern Africa Region: A Regional Multi-partner USI-IDD Strategic Action Plan for the Elimination of IDD in Eastern and Southern Africa (2020 – 2024) (hereafter called the RoadMap), summarizes the outcome of an internal mid-point review of its implementation. Developed in 2020, the RoadMap is a strategic implementation of the Mombasa Declaration and Recommendations of the 2019 Eastern and Southern Africa (ESA) of the 2019 Regional USI-IDD Consultation held in Mombasa, Kenya. The overall goal of the RoadMap is to support efforts to ensure elimination of Iodine Deficiency Disorders (IDD) in the 23 ESA countries through Universal Salt Iodation by 2025, focusing on seven key result area (KRA) outcomes.

The adopted strategy is to implement a regional partnership approach that leverages the proficiencies and capacity of different actors; focuses action at the national level that is tailored to the needs of the country; improves the policy and legislative enabling environment for both salt iodization and reduction of excessive salt intake; engages the salt industry to produce quality salt iodized within the required standards; facilitates sharing of experiences; and adopts a common framework for effective monitoring and evaluation (M&E). Moreover, a regional approach helps define a common vision and goal for governments and partners and enhances sharing of responsibilities, optimization of resources, and maximize results. Above all it is a strategic concept that ensures no country is left behind. The MTR covers the period January 2020 – October 2022 period.

Main findings

The overall implementation of the RoadMap at its mid-term was successful and mainly on course, despite being implemented during a complex period when the regional coordination mechanisms (RCM) was nascent, institutional partner collaboration was being developed and the challenges associated with the Covid-19 pandemic were at their peak. Moreover, in a few countries some aspects of country support were constrained by extreme weather conditions like the 2021 and 2022 floods and cyclones in Mozambique and the 2021 drought in southern Madagascar that led to the postponement of the 2021 national nutrition survey.

The adopted strategy of a regional partnership approach has been effective and remains relevant. Though variable, there is clear indication of good performance in outcome results in the key result areas as summarized below. However, it is too early

to provide data on performance of impact indicators.

Performance per the planned seven Key Result Area outcomes

Highly improved Regional Coordination

The establishment and launching of a well-functioning Regional Coordinating Mechanism (RCM) with clear terms of reference (TOR), strategic agendas and results-oriented modus operandi is perhaps the most strategic and impactful implementation of the RoadMap. With a diverse membership, the RCM has greatly improved regional coordination and collaboration among regional partners, leveraged their proficiencies, and monitored the RoadMap’s progress. The key challenge is how to sustain the gains made, especially the RCM function given that only IGN and UNICEF have provided direct support to its functioning.



Salt production in Nampula Province, Mozambique

Strengthened National Programs

Several steps were taken to strengthen national programs in both high-burden and non-high burden countries. These included:

- 1) The appointment of National Coordinators (NCs) in all 23 countries with clear terms of reference and sharing with them the 2019 Mombasa Consultation report and Regional RoadMap.
- 2) Convening documented virtual consultations with all the eight countries that did not attend the 2019 Mombasa Consultation to discuss the main outcomes of the Consultation, their role in implementation of the RoadMap, their country's USI/IDD status, and the importance of developing a Country Action Plan or Strategy.
- 3) More structured country collaborative efforts between RCM partners to create synergies for results towards optimal iodine nutrition were formed with the respective Government counterparts.

Targeted action in high burden countries and those without recent data

The five countries identified by the RoadMap as high burden that have been supported are Angola, Burundi, Madagascar, Mozambique, and South Sudan. Each received considerable support depending on context and identified strategic areas. For example, in Angola IGN collaborated with UNICEF and Agostino Neto University to analyze and write a report on the 2019 national USI-IDD survey, trained laboratory technicians on iodine analysis in urine, prepared national guidelines for monitoring salt iodization, and trained salt producers. In Burundi, IGN and UNICEF supported the Government to finalize the report on the 2018 IDD National survey, trained laboratory technicians on analysis of iodine from urine and salt samples and facilitated a workshop that developed a CAP. In Madagascar, a partnership between IGN, UNICEF, and USAID supported the Government and the salt industry to increase the proportion of households using iodized salt from 21% in 2014 and 42% in 2020 to 70% by September 2022. The South Sudan landscape analysis findings informed the development of a national action plan or roadmap to ensuring a USI-IDD program is initiated, standards developed, and monitoring of imported salt at the borders or points of entry is conducted.



Internal quality control at COSIM Salt Company in Madagascar

Harmonized regional salt standards

Although the EAC and SADC have developed harmonized regional standards on salt iodization and other fortified foods, the levels of iodization provided in both regional standards are slightly different, which poses a challenge in salt trade across the ESA region. Both SADC and ECSA-HC have done some excellent work to harmonize food fortification standards that have been

approved by member states and provided guidance on enforce the legislation. The main challenge is enforcement because many countries have inadequate capacity to enforcement systems of their legislation. The process of developing legislation is long and tedious, and countries may want to just adopt the EAC and SADC USI standards. To provide a good picture of the situation, IGN compiled a regional analysis of the USI standards, those currently in use by the countries and the estimated salt and sodium intakes and compared them with the WHO recommendations and presented to the RCM. There is a need to promote standardization to include mandatory use of iodized salt in the food processing industry in the other countries.

Strategic engagement with the salt industry

There has been some modest success in engaging the salt industry for large-medium- and small-scale producers in some countries. In Angola, engagement with the salt industry was done as part of the process to develop the Country Action Plan (IGN, UNICEF). A planned regional roundtable meeting of large- and medium-scale salt producers could not place because of unforeseeable circumstances. Consolidation efforts to improve quality and iodation was done in Ethiopia (NI, UNICEF), Madagascar (IGN, UNICEF, USAID), Mozambique (GAIN, IGN, UNICEF), and Tanzania (GAIN, IGN, NI, TFNC, UNICEF) through formation and strengthening of Small-Scale Producers' Salt Associations and capacity. The system of procuring and obtaining consistent supply of potassium iodate still remains a challenge for many countries, because of problems related to the supply chain, cost, taxation and the classification of salt as a mineral similar to diamonds and gold.

Aligned salt fortification and salt reduction strategies

Many countries have created awareness on the need for adopting strategies that align salt iodation with reduction in intake of excessive salt as they understand better the relationship between excessive salt intake and NCDs. However, the RCM has noted that there is still a weak balance between salt intake and salt reduction strategies, especially in Mauritius and Seychelles.

Both salt iodization and reduction of excessive salt strategies are important public health strategies and need to be clearly articulated in national policies. To help countries overcome this challenge, WHO has prepared a policy brief that provides guidance on the recommended daily intake of table salt, and the use of salt in processed foods. The brief, which WHO shared with the RCM can be used as a guide in the development of national strategies and policies and can also be used as an advocacy tool.

Tracked program performance

Two template technical guidance documents were developed in 2021 and tested in five countries, mixing salt producing (Kenya, Tanzania and Mozambique) and salt importing countries (Uganda and Zambia). The first template is a “Country Landscape Analysis” tool that supports programme managers to have a deeper understanding on each of the national USI-IDD programs, discusses the challenges faced and innovative approaches adopted in each country that other countries can learn from. It examines the different components of the program, how they are structured, their effectiveness, extent of implementation and application, challenges faced, and any innovative approaches to strengthen the program.

The second template developed is a traffic-light regional scorecard that provides a synopsis of USI-IDD programs in the region based on the results of the country template and allows for comparability across the region. The Country Landscape Analysis tool has started being used in 2022 in some countries. The results of these and others to come will be used to populate the regional scorecard. The tracking templates are seen by some regional partners as one of the most important success stories in the implementation of the RoadMap. The main challenge in tracking progress are the cost and difficulties inherent in collecting USI/IDD data including the lack of data in some program areas in some countries.

Main factors contributing to success in the implementation of the RoadMap

- Establishment of a well-functioning Regional Coordinating Mechanism that is seen as perhaps the most important and impactful factor.



Salt iodization in Inhambane, Mozambique

- Voluntary and active participation of stakeholders (Governments and partners) in the Regional (RCM) and country level coordinating mechanisms.
- Direct financial contributions made by UNICEF and IGN using the RoadMap framework that made it possible to follow the adopted strategy towards planned results.
- ECSA-HC and SADC efforts towards harmonization of standards and rolling out to member states.
- More structured country collaborative efforts among RCM partners and with Government counterparts to create synergies for results towards optimal iodine nutrition
- Deployment by partners of high-level technical expert consultants based on clear terms of reference and deliverables.

Main challenges

Summary of challenges identified by stakeholders during the review include:

- How to sustain the RCM function given that only IGN and UNICEF have provided direct funding support to its

function and overall implementation of the RoadMap.

- The need for greater and more systematic engagement with the National Coordinators so that they are capacitated to take on a more active role.
- How to fill the data gap for countries with data over five years in ways that are innovative and cost-effective e.g., by piggybacking on regular household surveys.
- The lack of standardization and guidance on the use of iodized salt in food processing
- How to address the challenge of obtaining consistent supplies of potassium iodate
- The lack of a strategy at country level to address the weak balance between salt iodization and salt reduction strategies.
- How to use the country and regional tracking tools developed in 2021 to establish a widely accessible data base that provides us with country and regional status annually

Low iodine intake in Norway increases risk of depression in pregnancy and the postpartum

From: Brantsæter AL, et al. *J Affect Disord.* 2022 Dec 1;318:347-356. → <https://doi.org/10.1016/j.jad.2022.09.009>

Perinatal depression is depression that occurs during or after pregnancy and is one of the most common complications in pregnant or postpartum populations affecting around 10–15 % of all women giving birth. In women, thyroid dysfunction has also been linked to perinatal depression. While severe iodine deficiency and a depleted thyroidal hormone store have detrimental effects on fetal neurodevelopment, the potential effect on maternal mental health is less known. No studies to date have examined the association between iodine intake and symptoms of perinatal emotional distress and depression in a mild-to-moderately iodine deficient population. As iodine requirements increase during pregnancy and lactation, women of childbearing age are particularly vulnerable to adverse consequences of insufficient iodine intake.

The aim of a recent Norwegian study was to examine the potential associations between iodine intake and symptoms of perinatal emotional distress and depression during pregnancy and the postpartum period in Norway, in women with mild-to-moderate iodine deficiency.

The study population comprised 67,812 women with 77,927 pregnancies participating in the Norwegian Mother, Father and Child Cohort Study (1). Self-reported emotional distress and depressive symptoms were reported in pregnancy and at six months postpartum. Iodine intake was assessed by a food frequency questionnaire in mid-pregnancy. Urinary iodine concentration (UIC) was available for 2792 pregnancies.

The median calculated iodine intake from food was 121 µg/day. Use of iodine-containing supplements and milk/yoghurt intake were important determinants of iodine intake and urinary iodine.



Iodine deficiency increases risk of postpartum depression

Seventy four percent had an iodine intake from food lower than the estimated average requirement of 160 µg/day for pregnant women, and only 4.6 % reached the recommended intake in pregnancy set by the WHO (i.e., ≥ 250 µg/day) when not including iodine from supplements. Supplemental iodine originated almost exclusively from multi-nutrient supplements, reported by 37.2 % of women.

The median UIC (measured in $n = 2792$) was 68 µg/L and 37 % had UIC < 50 µg/L. The median UIC in non-users

of iodine-containing supplements was 58 µg/L. This is well below the WHO cut-off for adequate iodine intake in groups (i.e., median UIC ≥ 150 µg/L for pregnant women and median ≥ 100 µg/L for non-pregnant).

The prevalence of high scores for emotional distress was 6.6 % in pregnancy and 5.8 % six months postpartum, and for high scores on postpartum depression it was 10.3 %.

In non-users of iodine supplements (63 %), a low maternal iodine intake from food (lower than ~100–150 µg/day) was associated with increased risk of high scores of emotional distress and depression both in pregnancy and six months postpartum (Figure 1).

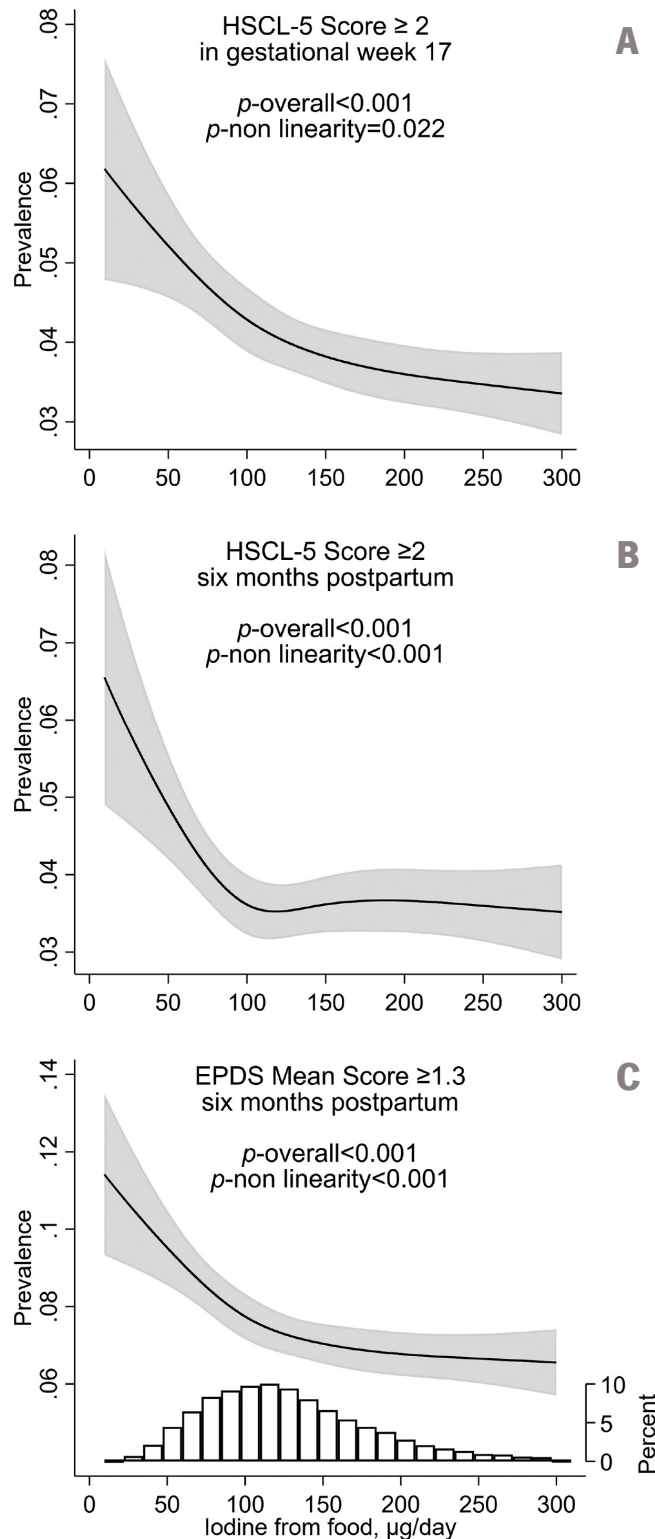
Iodine supplement use was associated with a small but significant increased risk of high scores of emotional distress in pregnancy compared to no supplement use or use of supplements without iodine. The increased risk was similar whether supplement use was initiated before the start of pregnancy or in pregnancy.

In Norway, as in other countries, women of childbearing age, vegans, and vegetarians are particularly prone to inadequate iodine intake. Furthermore, insufficient iodine intake is primarily a problem in countries that have not implemented universal salt iodization as in the Nordic countries that used to rely on milk and saltwater fish as the main iodine sources. Although the potential increased prevalence of symptoms of emotional distress and depression during pregnancy and the postpartum period in mild-to-moderate iodine deficiency found in this study may be modest, it is highly relevant at the population level since iodine deficiency is so prevalent in young women and also, easily preventable. Attention should be given to secure adequate habitual iodine intake in young girls and women of childbearing age.

Reference

1. Magnus P, et al. Cohort profile update: the Norwegian mother and child cohort study (MoBa) *Int. J. Epidemiol.*, 45 (2016), pp. 382-388, 10.1093/ije/dyw029

FIGURE 1 Associations between habitual iodine intake and estimated prevalence of high scores for emotional distress and depression in Norwegian women in non users of iodine supplements. Abbreviations: HSCL, Hopkins Symptoms Checklist; EPDS, Edinburgh Postnatal Depression Scale.



Joint assessment of iodine and sodium intakes in Lithuania

From: Zakauskiene U, et al. *Nutrients* 2022, 14(18), 3817; → <https://doi.org/10.3390/nu14183817>

In the Global Action Plan for the prevention and control of non-communicable diseases, WHO suggests a 30% reduction in salt intake. Assessment of population salt consumption is essential for the planning and monitoring of the effectiveness of national salt reduction plans. WHO has also suggested that joint standardized assessments of population salt and iodine status would be synergistic and could unify the assessment and monitoring of sodium and iodine intake and to develop public health policies (1).

“A balanced approach is needed and may be obtained by promoting the availability of less salt with higher iodine content.”

As more than 90% of ingested sodium and iodine appears in the urine in the following 24 to 48 h, urinary sodium and iodine excretions directly reflect daily dietary intake of sodium and iodine. Currently, twenty-four-hour (24 h) urine collections are the recommended method to monitor population sodium and potassium intake and to investigate the associations between sodium and potassium intake and health outcomes. Similarly, the average 24 h urinary iodine excretion is considered a good indicator of the habitual iodine intake of a given population. The aim of the present study was to investigate sodium, potassium and iodine intake in the adult population of Lithuania.

This study was carried out between September 2019 and November 2020, as part of the project “Assessment of sodium and iodine status in the Lithuanian population and development of public health policy guidelines” supported by Vilnius University Hospital, in collaboration with the State Public Health Promotion Fund and the WHO. Random sampling was used to enroll men and women, aged 18–69 years, across the country. After signed



Joint monitoring of iodine and sodium intakes makes sense

informed consent, every participant was attributed a bar code to allow anonymization. They were handed a self-reported questionnaire, detailed written instructions on how to correctly collect 24 h urine, and two 2.5 L plastic polyethylene containers for the collection. The questionnaire and the containers were marked with the barcode assigned to the subject. Participants completed an anonymous questionnaire to determine knowledge, attitudes and behavior towards salt consumption. Finally, they returned both the questionnaire and the 24 h urine collection to a personal health care facility. A final sample of 888 participants (82.1% of those participating) with complete urine collections was included in the final analysis. For iodine status analysis, 209 subjects with thyroid disorders or known consumption of iodine supplements were also excluded.

Mean urinary volume was slightly higher in men than women. Mean urinary sodium excretion was 162.4 mmol/24 h and calculated mean salt intake was 10.0 g/24 h. Men had significantly higher sodium excretion (191.3 mmol/24 h vs. 136.3 mmol/24 h, $p < 0.001$). A total of 12.5% of participants fulfilled the WHO recommendations on daily salt intake: only 4.3% of men and 20% of women consumed < 5 g of salt per day ($p < 0.001$). The majority of participants (87.5%) consumed > 5 g of salt per day: 47.3% of participants had 5–10 g salt intake per day, 26% of participants consumed 10–15 g salt per day and 14.2% of participants consumed > 15 g salt per day (Figure 1).

A total of 679 participants (average age of men was 46.5 years; women 48.1 years) were included into the final analysis of iodine status. The study showed that in Lithuania iodine intake is borderline insufficient. The median value of urinary iodine concentration (UIC) was 95.5 $\mu\text{g/L}$. Only 54.9% of participants indicated that they use iodized salt for salting food at home.

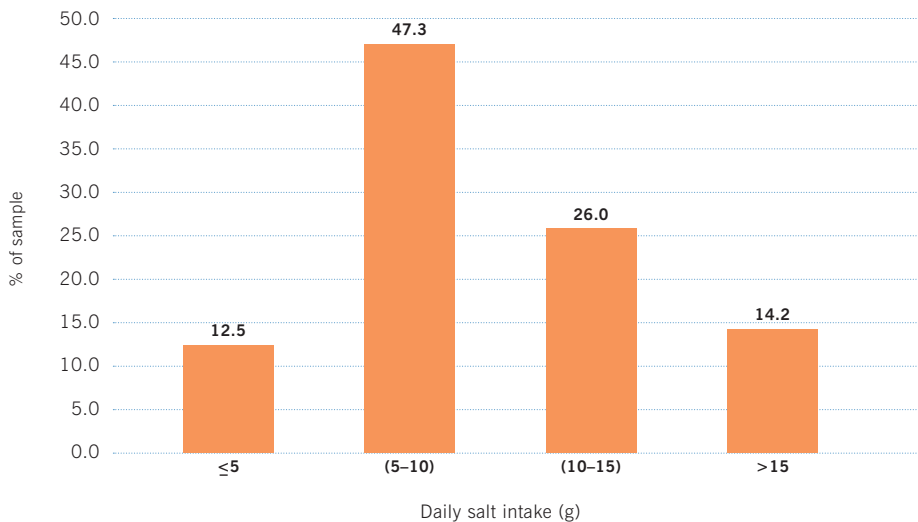
Since salt is an iodine-rich carrier, it is important to reconcile efforts to reduce salt with efforts to maintain adequate iodine intake. This requires a concerted effort to monitor changes in intake and adjust the amount of iodine added to the salt consumed. In Lithuania, salt consumption is high, with a large share of

the population with very high salt intake, and the adult population has inadequate iodine intake. The data will serve for the development of comprehensive policies that would allow the country to address in tandem the challenges of very high salt and inadequate intake of iodine. A balanced approach is needed and may be obtained by promoting the availability of less salt with higher iodine content.

Reference

1. World Health Organization. Salt Reduction and Iodine Fortification Strategies in Public Health; World Health Organization: Geneva, Switzerland, 2014; pp. 1–34.

FIGURE 1 Distribution of 24 h salt intake in Lithuanian adults.



Iodine nutrition and salt iodization across South Asia

M.R. Maharjan, *IGN Expert South Asia*; **Arnold Timmer**, *Senior Adviser, IGN*; **Zivai Murira**, *Regional Nutrition Adviser, UNICEF Regional Office for South Asia*; **Mathilde Maurel**, *Nutrition Specialist, IGN*; and **Renuka Jayatissa**, *IGN Regional Coordinator, South Asia*

Introduction

The South Asia region consists of eight countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The region has the highest population size (1.8 billion) and density (385 persons/ km²) in the world. Iodine deficiency was noted in the region as early as 326 BCE. South Asia has long been at the forefront of global and regional efforts to prevent iodine deficiency. The concept of an International Council for the Control of Iodine Deficiency Disorders (ICCIDD) was proposed at the WHO/ UNICEF intercountry meeting held in New Delhi, India in 1985, and it was formally inaugurated in Kathmandu, Nepal in 1986. Since then, a series of meetings and workshops focusing on scientific and operational aspects of iodine deficiency control have been convened. As a result, the region has made remarkable progress in improving the coverage of iodized salt in the recent years. In 2018, the region had a high coverage rate of iodized salt (with any iodine) at 89% (global coverage rate being 88%).

Several challenges remain in ensuring that all countries and vulnerable population groups benefit from this progress and its sustainability. In this backdrop, the Iodine Global Network (IGN), in partnership with UNICEF's Regional Office for South Asia (ROSA) conducted a landscape analysis of iodine programs in 2019-2020.

Country progress on improving iodine status and salt iodization in South Asia

Salt iodization program and iodine status in South Asia

The South Asian region has seen remarkable progress in improving the coverage of iodized salt in the recent years. In 2000, the regional coverage (with any iodine) was 65%. A backsliding was seen to 49% in 2005 and 55% in 2011, which was mainly caused by coverage reductions in Afgha-



nistan and Pakistan. Improvements in these countries as well as India in the following years led to an improvement to 69% in 2015, 89% in 2018, and 90% in 2020 (Figure 1).

The most recent estimates of household coverage of iodized salt (with any iodine) reveal high coverage across the region with five countries (Bhutan, India, the Maldives, Nepal and Sri Lanka) having coverage of over 90%. Afghanistan, Bangladesh, and Pakistan have lower coverage in the range of 57%-80%. Only Bhutan and Nepal exceeded 90% coverage of adequately iodized salt (> 15 ppm).

The scaled-up salt iodization program across the region has translated into improved iodine status among school age children (SAC) with all countries having median urinary iodine concentration (mUIC) between 100-299 µg/L, and with Nepal having borderline excessive intake at 314 µg/L (Figure 2). Data on iodine

status among women of reproductive age (WRA) is available for 6 countries and it indicates adequate status (Figure 2).

From an equity perspective, 4 countries (Bangladesh, Bhutan, Pakistan and Sri Lanka) have sub-national deficiencies by geographic region, urban/rural, or wealth quintile. In Bangladesh the national average among SAC was 123 µg/L but the mUIC in the lowest wealth quintile was 61 µg/L. Likewise in Bhutan, with a national average of 183 µg/L, the mUIC among SAC in two districts was < 100 µg/L and the lowest was 69 µg/L. In Pakistan, with a national average of 123 µg/L, the mUIC among SAC in three provinces was less than 100 µg/L and the lowest was 59 µg/L. In Sri Lanka, with a national average of 158 µg/L, the mUIC among pregnant women in 11 provinces was less than 150 µg/L with the lowest being 120 µg/L.

FIGURE 1 Household coverage of iodized salt in South Asia

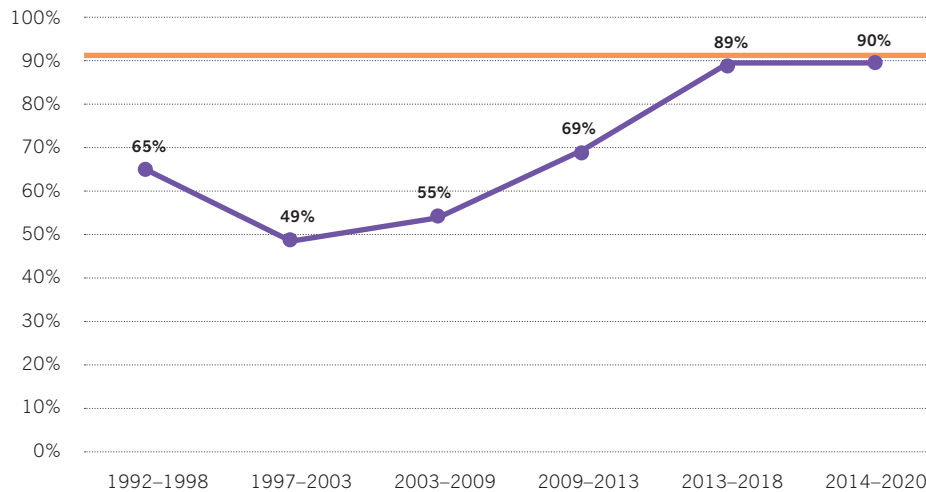
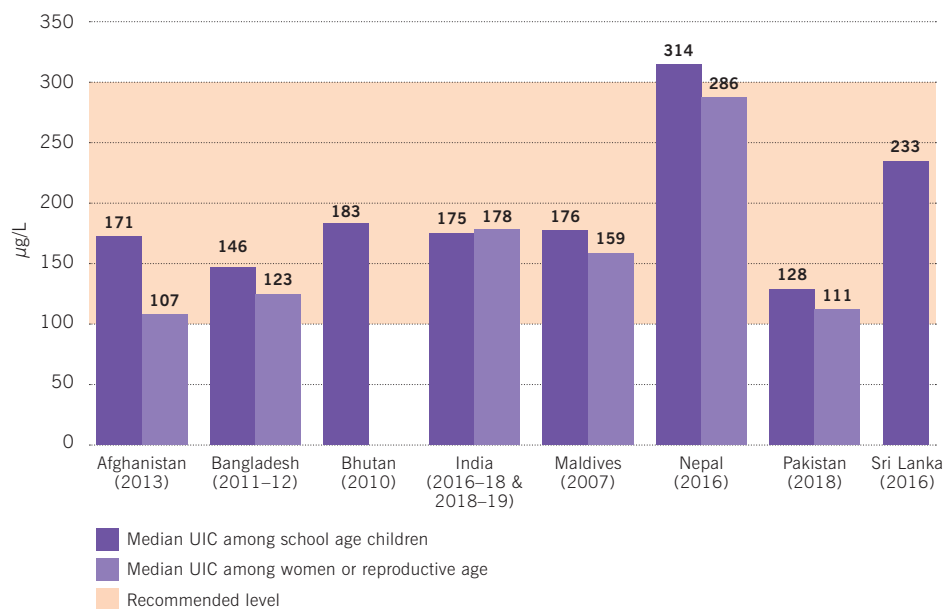


FIGURE 2 Median urinary iodine concentration among school aged children and women of reproductive age in South Asia



In India and Nepal, no sub-national inequities in terms of low mUIC were found.

Another dimension of equity is to look at iodine status by household salt iodine content: does a household that has no iodized salt have a poorer iodine status than those that have iodized salt (note that this comparison can only be made for household salt and not for iodized salt in processed food since this information is not available through surveys). For the 4 countries with data, those living in households with inadequately iodized salt were deficient in Bangladesh. However, in India,

Nepal, and Sri Lanka, households with non- or inadequately iodized salt had adequate iodine status, indicating that other sources of iodine play a role particularly processed foods that is made with iodized salt and contributes iodine to the diet.

While countries have made tremendous progress and enjoy adequate iodine status on average, some population groups are still deficient, which is a cause for concern. The reason for this gap can be found in program design flaws, such as too low iodization levels in salt or loopholes in legislation, and/or in weaknesses in the

implementation of the program such as difficulty to iodize salt produced by small producers.

Policies and Plans

Inclusion of iodine goals and strategies in broader health policies and nutrition plans is an indicator for sustained attention for the program. In South Asia region, all countries have made commitments toward the elimination of IDD by incorporating iodine nutrition and salt iodization into national policies, strategies or programs. Iodine programs however are missing in national budgets in most of the countries. In recent years, most of the countries in the region (except Afghanistan and Pakistan) have developed and put in place policies, strategies and programs for reduction of salt consumption to reduce non-communicable diseases (NCDs). Alignment of salt iodization and salt reduction is programmatically very feasible. This would include a) alignment of communication to the general public on the importance of reducing salt intake and of importance of iodine in salt, b) alignment of monitoring of sodium intake and iodine status in assessments and surveys, and c) reformulation of processed foods to reduce salt content as well as ensure iodized salt is used.

Legislation and Regulation

All countries (except Maldives) have mandatory salt iodization legislation and have set iodization standards at production and distribution levels but vary across countries (Table 1). This does not seem to create any barrier in iodized salt trade in the region since iodization levels are adjusted by the producer for the receiving country. One country (Bhutan) re-iodizes upon entry of the imported salt from India (that is already iodized at 30 ppm) with another 20 ppm to meet its own national salt iodization standard of 50 ppm.

Of the seven countries with mandatory salt legislation, regulatory enforcement functions relatively well in Nepal and Sri Lanka, and is weak in the others. The major enforcement issues include insufficient funding, inadequate human resources and limited infrastructure, which all link back to insufficient political commitment.

TABLE 1 Legislation and salt iodization standards in South Asia

	Mandatory	Production/importation level (ppm)					Distribution/market level (ppm)					
		10	20	30	40	50	10	20	30	40	50	>50
Afghanistan	Yes			●	—	●			●	—	●	
Bangladesh	Yes			●	—	●			●	—	●	
Bhutan	Yes					●			●			
India	Yes		●	—	●				●	—	●	
Maldives	No	No standard					No standard					
Nepal	Yes					●	—	—	—	—	—	—
Pakistan	Yes			●					●	—	●	
Sri Lanka	Yes		●	—	●		Not specified					

Coordination and Management

Except Maldives, all countries have coordination and management mechanisms for overseeing salt iodization programs. Afghanistan, Bangladesh, India, Pakistan, and Sri Lanka have stand-alone coordination mechanisms dedicated for USI, however in Bhutan and Nepal they are integrated into overall nutrition/multisectoral platforms. Overall, coordination was found to be weak, irrespective of whether it was a stand-alone or integrated mechanism. The main reasons were attributed to inadequate funding, unclear roles and responsibilities, and lack of regular meetings. There is a need for more attention to oversight in most countries.

Supply of Iodized Salt including processed foods

South Asia is virtually self-sufficient in the supply of iodized salt to meet its needs. The region produces 8.34 million MT of edible salt annually (of which 8.33 MT is iodized), nearly sufficient to meet the annual requirement of approximately 8.6 million MT of edible salt. India is the major producer of iodized salt in the region, producing adequate quantities to satisfy its own domestic consumption as well as exporting to Nepal, and Bhutan, two countries in the region that rely exclusively on imports. While Afghanistan produces salt it also covers its domestic needs through imports salt, mainly from Iran and Pakistan. Figure 3 presents the trade of salt across the South Asian and other countries (From: Review of regional trade standards pertaining to processed foods and iodised salt in South Asia; IMARC, 2020). Illegal trade of non-iodized salt and inability of small producers to iodize salt remains a challenge in several countries in the region.

Most producers and processors of

iodized salt have internal monitoring mechanisms in place for the iodization process. However, in most countries in the region, the monitoring systems are not performing optimally. This is an area that requires technical support and better commitment from the private sector. Subsidies for potassium iodate no longer exist in any South Asian country, indicating the supply has been sustainable over the long term.

Iodized Salt in Processed Food

Increased consumption of processed foods as a share of total food intake has implications on salt as well as to iodine intake in the region. An initial regional scoping showed that the most commonly and widely consumed processed foods containing salt include baked products, dairy products, savoury snacks, ready-to-cook/convenience foods, and sauces, dressings and condiments (Table 2). Iodized salt use in processed food is mandatory, with specific mention, in Bangladesh, India and Sri Lanka, and it is mandatory (but not specifically mentioned) in Bhutan and Nepal. Iodized salt is commonly used by domestic food industries in Bhutan, Bangladesh, India, Nepal and Sri Lanka, although most may not indicate this on labeling. Both iodized and non-iodized salt is used by food industries in Afghanistan, Maldives and Pakistan. There is tremendous trade of processed food between countries in the region. A monitoring and enforcement system with regards to iodized salt use in processed foods is virtually non-existent.

FIGURE 3 Edible salt trade flow in South Asia



TABLE 2 Use of iodized salt in processed foods and the food industries

	Bakery products including biscuits	Dairy products	Savoury snacks	Ready to cook/ convenience foods (e.g. instant noodles)	Condiments, sauces and dressings	Frozen foods	Status of iodized salt use in processed foods and condiments	
							Iodized salt is used	Non-iodized salt is used
Afghanistan				No		No		Yes
Bangladesh		No				No		Yes
Bhutan	No					No		No
India						No		No
Maldives		No	No					Yes
Nepal		No				No		No
Pakistan		No		No				Yes
Sri Lanka			No			No		No

Awareness raising

In the early days of salt iodization programs, short-lived intensive promotion campaigns were undertaken by using various channels and approaches including mass media in all countries of the region. This resulted in high level of awareness about the benefits of iodized salt and the importance of iodine. In low performing areas where non-iodized salt is still available in the market, intensified awareness raising can be an important force to improve iodine intake.

Monitoring

Population based national surveys have been the standard tool to collect data on the performance of iodine programs, often carried out as standalone iodine surveys. The trend is that surveys are carried out less frequently (for a variety of reasons) resulting in reduction of updated information. There is lack of recent data in Maldives and Bhutan.

Iodine in salt has been typically assessed qualitatively using the Rapid Test Kits (RTKs) in Afghanistan, Maldives and Pakistan. In Bangladesh, Bhutan, India, Nepal and Sri Lanka quantitative assessment tools have been the preferred method.

Bhutan, India and Pakistan have made efforts to incorporate iodine indicators into existing health/nutrition surveillance systems which enhances sustainability.

As a result of persistence of inequities in iodine nutrition status, it is important that countries make better use of the information collected, particularly to perform sub-group analysis of iodine status by region and household use category of iodized

salt (not iodized, inadequately iodized, adequately iodized, and over-iodized).

This will enable program managers to determine a) to what extent household salt is the main source of iodine; b) whether the iodization level is sufficient and c) direct corrective measures towards those population groups that are not effectively reached with iodized salt. Furthermore, oversight of iodine programs beyond the program management level by public health officials is still not sufficient.

In conclusion Maldives, Bhutan, and Bangladesh have outdated program status data. Updated information should be collected preferably using sustainable methods such as routine surveillance which can include data on salt iodine content and iodine status. Pregnant women as the main group of interest from an iodine deficiency perspective should be included as a target group in data collection.

Recommendations for Strengthening Regional efforts to Achieve Optimal Iodine Nutrition in the South Asia Region

Networking capacity

- Create a sustainable regional platform to improve networking capacity through regional meetings/workshops, exchange visits and creating subgroup networks. The funding and ownership of such platform need to be clear and secured from the beginning. Ideally, such co-ordination platform should be incorporated into other existing platforms to ensure sustainability.

Support mechanism

- Establish a support mechanism at regional level for strengthening the key elements of USI program such as the production of better quality of salt, establishing innovative mechanisms for enforcement of USI legislation, monitoring of iodized salt in processed foods, exploring iodine nutrition surveillance, capacity building of iodine laboratories, etc. Inter-country use of expertise should be optimized.

Knowledge Management

- Develop (i) communication packages and knowledge products, and (ii) regional guidelines on the use of iodized salt in processed foods and condiments;
- Create knowledge management mechanism to stimulate, support and disseminate publications, blogs, stories, grey literature that often remain unknown and which motivate key actors

Advocacy

- Undertake advocacy efforts to ensure sustained commitments from the stakeholders to address existing and emerging challenges such as need for synchronizing both salt iodization and salt reduction strategies.

Oversight

- Establish a regional level oversight mechanism to review programme performance information from countries on a regular basis, synthesize this, identify action items and maintain a regional agenda of issues that need discussion and attention by regional players or by national governments. These issues should then be tracked and followed up on a regular basis. Available data should be collated and summarized in user-friendly dashboards.

Abstracts

Iodine deficiency and thyroid dysfunction: Current scenario in Nepal

Iodine deficiency is a major cause of thyroid disorders worldwide. Nepal lies in the endemic area of iodine deficiency which was previously referred to as Himalayan goiter belt, with high prevalence of iodine deficiency disorders including goiter, cretinism and hypothyroidism. With effective implementation of universal salt iodization program, Nepal has a successful public health story to share having drastically reduced the iodine deficiency disorders. Moreover, a challenge has appeared with rising number of excess iodine states. Thyroid dysfunction is growing higher and the increasing proportion of hyperthyroidism is particularly concerning. Time has come to suitably revise the standards of salt iodization and control the increasing number of cases with thyroid dysfunction by the coordinated efforts of all stakeholders, along with sustaining the optimal level of iodine.

Lamichhane S, et al. *Ann Med Surg (Lond)*. 2022 Sep 14;82:104673.

Elimination of iodine deficiency is a concern for the health of the nation. An excursion into the history, scientific aspects and the current state of the legal regulation of the problem in Russia [Article in Russian]

The article presents current data on the prevalence of thyroid diseases associated with iodine deficiency in Russia, focuses on the features of the comorbidity of iodine deficiency and autoimmune thyroid pathologies, and methods for assessing the iodine supply of the population. Information about the study and prevention of iodine deficiency diseases (IDD) in the USSR and the Russian Federation is given. The history of legislative initiatives aimed at eliminating dietary iodine deficiency and preventing IDD is illustrated in detail. The ways of solving the problem of iodine deficiency at the present stage, both at the federal and regional levels, are proposed.

Troshina EA. *Probl Endokrinol (Mosk)*. 2022 Jul 27;68(4):4-12.

The prevalence of insufficient iodine intake in pregnancy in Africa: a systematic review and meta-analysis

Fortification of foodstuffs with iodine, mainly through iodization of salt, which commenced in several African countries after 1995 is the main method for mitigating iodine deficiency in Africa. The authors assessed the degree of iodine nutrition in pregnancy across Africa before and after the implementation of national iodine fortification programs. Of 54 African countries, 23 had data on iodine nutrition in pregnancy mostly from subnational samples. Data before 1995 showed that severe iodine deficiency was prevalent in pregnancy with a pooled pregnancy median UIC of 28.6 µg/L (95% CI 7.6–49.5). By 2005, five studies revealed a trend towards improvement in iodine nutrition state in pregnancy with a pooled pregnancy median UIC of 174.1 µg/L (95% CI 90.4–257.7). Between 2005 and 2020 increased numbers of national and subnational studies revealed that few African countries had sufficient, while most had mildly inadequate, and some severely inadequate iodine nutrition in pregnancy. The pooled pregnancy median UIC was 145 µg/L (95% CI 126–172). The authors concluded that improvement in iodine nutrition status in pregnancy

following the introduction of fortification of foodstuffs with iodine in Africa is suboptimal, exposing a large proportion of pregnant women to the risk of iodine deficiency and associated disorders.

Businge et al. *Systematic Reviews (2022)* 11:231

Stable thyroid function despite regular use of povidone-iodine throat spray for SARS-CoV-2 prophylaxis

It is unclear whether unintentional ingestion of povidone-iodine following its application to the oropharyngeal space could affect thyroid function. The objective of this study was to examine thyroid function among individuals who regularly apply povidone-iodine throat spray for SARS-CoV-2 prophylaxis. The authors designed a case-control study to compare thyroid function among participants who received povidone-iodine throat spray three times a day for 42 days ('cases') and those who received vitamin C ('controls'). Thyroid function was assessed by profiling serum TSH, free T3, and free T4; iodine status was estimated using serum thyroglobulin level, while infection status was determined by measuring anti-SARS-CoV-2 antibody against the nucleocapsid antigen. All measurements were performed in pairs, at baseline and 42 days later. A total of 177 men (117 cases and 60 controls) (mean age, 32.2 years) were included. Despite comparable demographics and clinical profiles, no clinically or statistically significant differences were observed in thyroid indices between 'cases' and 'controls' before and after stratification according to TSH quartiles. None of the participants developed symptomatic hypo- or hyperthyroidism throughout the study. Post-hoc analysis did not reveal differences in thyroid function according to infection status. This study supports the overall safety of povidone-iodine use in the oropharyngeal space for SARS-CoV-2 prophylaxis among individuals with normal thyroid function and subclinical thyroid disease.

Quek AML, et al. *Ann Med*. 2022 Dec;54(1):3299-3305. doi: 10.1080/07853890.2022.2108132.

The remarkable impact of iodisation programmes on global public health

The objective of this paper was to review the global effort to eliminate iodine deficiency and its impact on public health. Iodine deficiency has multiple adverse effects in humans due to inadequate thyroid hormone production that are termed the iodine deficiency disorders. The major adverse effect is impaired cognition in children. The WHO's first estimate of the global prevalence of goitre in 1960 suggested that 20–60 % of the world's population was affected, with most of the burden in low- and middle-income countries. Iodine deficiency was identified as a key global risk factor for impaired child development where the need for intervention was urgent. This spurred a worldwide effort to eliminate iodine deficiency led by a coalition of international organisations working closely with national governments and the salt industry. In most countries, the best strategy to control iodine deficiency is carefully monitored iodization of salt. The reach of current iodized salt programs is remarkable: in 2018, 88 % of the global population used iodized salt. The number of countries with adequate iodine intake has nearly doubled over the past 20 years from 67 in 2003 to 118 in 2020. The resulting improvement in

cognitive development and future earnings suggests a potential global economic benefit of nearly \$33 billion. Iodine programmes are appealing for national governments because the health and economic consequences are high and can be easily averted by salt iodization, a low-cost and sustainable intervention.

Zimmermann MB. *Proc Nutr Soc*. 2022 Nov 2;1-7. doi: 10.1017/S0029665122002762.

The Interactive Effects of Severe Vitamin D Deficiency and Iodine Nutrition Status on the Risk of Thyroid Disorder in Pregnant Women

Thyroid dysfunction is associated with both vitamin D deficiency and iodine; however, it is unclear whether they interact. This study aimed to investigate whether and to what extent the interactions between vitamin D and iodine contribute to the risk of thyroid disorder. Participants (n = 4280) were chosen using multistage, stratified random sampling from Shanghai. Fasting blood was drawn for the 25(OH)D and thyroid parameter tests. Spot urine samples were gathered to test for urine iodine. Pregnant women with a high urinary iodine concentration (UIC) and severe vitamin D deficiency had a significantly higher risk of thyrotropin receptor antibody (TrAb) positivity (odds ratio = 2.62, 95% confidence interval (CI): 1.32, 5.22) in the first trimester. Severe vitamin D deficiency and high UIC interacted positively for the risk of TrAb positivity (relative excess risk due to interaction = 1.910, 95%CI: 0.054, 3.766; attributable proportion = 0.700, 95%CI: 0.367, 1.03). Severe vitamin D deficiency combined with excess iodine could increase the risk of TrAb positivity in pregnant women in the first trimester.

Lu w, et al. *Nutrients*. 2022 Oct 25;14(21):4484. doi: 10.3390/nu14214484.

Severe hypothyroidism and large goiter due to iodine deficiency in an adolescent male in the United States: a case report and review of the literature

Acquired hypothyroidism due to iodine deficiency is extremely rare in the United States due to the introduction of table salt iodization in the 1920s. The authors present the case of an adolescent male with a history of mild autism spectrum disorder and an extremely restrictive diet who was found to have iodine deficiency as the etiology for his rapidly enlarging goiter and antibody-negative hypothyroidism. Thyroid-stimulating hormone (TSH) was 416 µIU/mL, free thyroxine (T4) was <0.1 ng/dL, and triiodothyronine (T3) was 41 ng/dL at diagnosis. The patient's 24-hour urinary iodine was undetectable. He was started on iodine supplementation with rapid visible improvement of goiter within two weeks and normalization of thyroid function tests within four weeks. Thorough dietary history and nutritional screening are important in cases of acquired hypothyroidism and/or goiter. Alternatively, diets that are low in iodized salt, dairy, bread, and seafood should raise concern for iodine deficiency, and patients with suspected or proven iodine deficiency should be screened for hypothyroidism.

Moore CE, et al. *Case Rep Endocrinol*. 2022 Nov 2;2022:7235102. doi: 10.1155/2022/7235102.

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For further details about the IDD Newsletter, please contact: Michael B. Zimmermann, M.D., the editor of the Newsletter, at the Human Nutrition Laboratory, Swiss Federal Institute of Technology Zürich, newsletter@ign.org.

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