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Review Article

Indian Thyroid society expert consensus on salt Iodisation

ABSTRACT

Iodine, an essential micronutrient, is crucial for the production of thyroid hormones - triiodothyronine(T3) and thyroxine(T4). Thyroid hormones regulate the optimum mental development, physical growth and development, regulation of body metabolism, heat generation, and maintenance of body temperaturein an individual. Geological processes like flooding, soil erosion, deforestation, and rivers changing course, deplete the surface soil of iodine, as it is present in the top layers of soil and easily soluble in water. As a result, the population residing in the area with iodine-deficient soil, becomes susceptible to a spectrum of functional and developmental abnormalities due to dietary deficiency of iodine. Universal Salt Iodization (USI) for prevention of IDDs in India is a public health success story. The adoption of the salt iodization strategy serves as a textbook example of the journey of an intervention through the iterative loop of research to policy to programme. Salt iodization has proved to be a safe, accessible, available, affordable, and cost-effective strategy to address the burden of IDDs in India. India has been at the forefront of the efforts to control IDDs globally. India is on its way to achieving the target of > 90 percent household coverage of adequately iodized salt. Revised Food Safety and Standards (Fortification of Foods) Regulations released in 2019 introduced an upper limit for iodine concentration in salt, the adequate iodine level required at the production and consumer level, including the distribution channel at 15 – 30 ppm. Universal Salt Iodisation (USI) is India's public health success story. There is a need to consolidate progress so far and focus on strategy to reach the "last mile". Sustainable elimination of Iodine Deficiency Disorders (IDDs) with Universal Salt Iodisation (USI) being the primary strategy needs to also factor in harmonisation with salt reduction strategy for control of non-communicable diseases.

Keywords: Iodization, salt, thyroid

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BACKGROUND

Iodine, an essential micronutrient, is crucial for the production of thyroid hormones – triiodothyronine and thyroxine. Thyroid hormones regulate the optimum mental development, physical growth and development, regulation of body metabolism, heat generation, and maintenance of

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body temperature in an individual. Geological processes such as flooding, soil erosion, deforestation, and rivers changing course, deplete the surface soil of iodine, as it is present in the top layers of soil and easily soluble in water.[1] As a result, the population residing in the area with iodine-deficient soil becomes susceptible to a spectrum of functional and developmental abnormalities due to dietary deficiency of iodine.

Evidence of iodine deficiency disorders (IDDs) has existed for 1000 years, mentioning goiter in ancient Chinese and Indian scriptures. Indian scriptures originating in 1400 B. C. described goiter, called "galganda," in detail. The Chinese physicians, though unaware of the cause of the disease, used burnt sponges and seaweed to treat goiter in 1600 B. C.[2,3] In the modern era, goiter was first described in 1905 in India, in the Gilgit and Chitral valley of Kashmir, by Sir Robert McCarrison.[4]

Salt iodization was first suggested by Boussingaultin (1833) as a public health strategy to reduce the prevalence of goiter.[2] This strategy was first adopted in the United States of America and Switzerland in 1920s for the control of goiter. In India, the high burden of goiter in the Himalayan belt was documented in various studies by several researchers including, McCarrison, Stott, and Ramalingaswami. These led to the materialization of the landmark Kangra Valley study, which clearly demonstrated the effectiveness of the iodization of salt in the prevention of Goiter.[5] The Kangra Valley study paved the way for India's National Goitre Control Programme (NGCP) in 1962. The objectives of NGCP were to identify goiter-endemic districts in India and iodized salt supplementation in the areas detected to be endemic for goiter. With further research, the scope of the control program widened to include a spectrum of mental and physical abnormalities termed IDDs. Moreover, the disorders were not limited to the earlier identified Himalayan and Tarai regions but were found to be affecting nearly all the districts of the country.

SALT IODIZATION FOR CONTROL OF IODINE DEFICIENCY DISORDERS IN INDIA–A SUCCESS STORY

Universal Salt Iodization (USI) for the prevention of IDDs in India is a public health success story. The adoption of the salt iodization strategy serves as a textbook example of the journey of an intervention through the iterative loop of research to policy to program. Salt iodization has proved to be a safe, accessible, available, affordable, and cost-effective strategy to address the burden of IDDs in India. India has been at the forefront of the efforts to control IDDs globally. India is on its way to achieving the target of >90% household coverage of adequately iodized salt. Revised Food Safety and Standards (Fortification of Foods) regulations released in 2019 introduced an upper limit for iodine concentration in salt, the adequate iodine level required at the production and consumer level including the distribution channel at 15–30 ppm.[6] The thrust in the production of iodized salt to achieve high coverage of iodized salt in India was provided by the involvement of the private sector, a classic example of a public–private partnership. Sustenance of the USI strategy was ensured by continued political will, intersectoral coordination, and advocacy, backed by evidence-based research.

In the recent National Iodine Survey of India (2018–2019), 92.4% of the population were consuming iodized salt, while 76.3% were consuming adequately iodized salt (iodine in salt ≥15 ppm). Household coverage of adequately iodized salt was lowest in Tamil Nadu (61.9%), Andhra Pradesh (63.9%), Rajasthan (65.5%), Odisha (65.8%), Jharkhand (68.8%), and Puducherry (69.9%). The median urinary iodine concentration (UIC) for pregnant women was 173.4 μg/L, for lactating women was 172.8 μg/L, and for nonpregnant and nonlactating women was 178.0 μg/L. Median UIC levels were higher in urban areas as compared to rural areas.

In a recent study of pregnant women, which included 100 subjects for each of three trimesters, it was found that 9, 11, and 10 subjects, respectively, in the three trimesters had urinary iodine excretions between 100 and 150 μg/L, indicating that India had entered almost the final stages of iodine sufficiency.[7]

The Salt Iodisation programme in India evolved through the following phases:

i. Phase 1: Scientific research leading to program (1956–1983)
ii. Phase 2: From endemic goiter to IDD (1983–2000)
iii. Phase 3: Lifting and reinstatement of the ban on sale of noniodized salt (2000–2005)
iv. Phase 4: Consolidation of sustainable elimination of IDD– role of National Coalition for Sustained Optimal Iodine Intake (NCSOII)(2005–2020)
v. Phase 5: Reaching the last mile (2020 onward).

USI was implemented in a phased manner in India in 1986. NGCP was renamed to launch the National Iodine Deficiency Disorders Control Programme in 1992, with the objectives to conduct surveys to assess the magnitude of the IDD, supply of iodized salt in place of common salt, and resurvey every 5 years to assess the extent of IDD and the impact of iodized salt, laboratory monitoring of iodized salt and urinary iodine excretion and health education and advocacy.

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The adoption of salt iodization was followed by a ban on noniodized salt under the Prevention of Food Adulteration Act in 1997 accompanied by an expansion of the salt industry. The ban on mandatory iodization was lifted in 2000 leading to a drop in the percentage of the population consuming adequately iodized salt from 49% to 30%.[8,9] The ban was reinstated in 2005 on recommendation by the Core Advisory Group on Public Health and Human Rights of the National Human Rights Commission, realizing the status of IDDs in India to be of public health significance.[3] The NCSOII, established in 2006, brought together the key stakeholders of the USI program, from government agencies, the Salt Commissioner of India, academic institutions, salt producers and traders, to collaborate bilateral and multilateral development agencies and civil society. This coalition was instrumental in providing continued efforts for the elimination of IDDs in India by sustained advocacy.[10]

CHALLENGES

With the changing demographic, scientific, and political environment in the country, the USI program is set to face some challenges hampering its progress to achieve sustainable elimination of IDDs.

Lack of political will

With competing health priorities, political will is crucial to sustain efforts to control salt iodization. In the past, a lack of political will and advocacy had resulted in the lifting of the ban on the sale of noniodized salt which pulled back the progress made by the program.

The closure of the office of the salt commissioner

Salt Commissioner's Organization under the Ministry of Commerce and Industry, Department of Industrial Policy and Promotion, is the nodal agency for monitoring the production and quality of iodized salt at the production level and ensuring its equitable distribution in the country.[11] Involvement of the private sector to bridge the gap in the production of iodized salt by the public sector, quality assurance of adequately iodized salt, and inclusion of iodized salt in the Public Distribution System (PDS) in various states, was due to dedicated efforts by the organization. Closure of the Salt Commissioner's Office at this crucial period, where the country is nearing the target of universal coverage of adequately iodized salt, would make it more difficult to reach the "last mile." It is a retrograde step and the office of the Salt Commissioner should continue.

Increase in thyroid disorders on iodine supplementation

Studies showed a risk of an increase in the incidence of thyroid disorders on the supplementation with iodine in an iodine-deficient population.[12-14] However, this increase is transient and does not have any known clinical significance. Intake of iodine within the tolerable upper level which was addressed in the latest dietary guidelines released by the National Institute of Nutrition (NIN) is safe and beneficial.[15] Food Safety and Standards Authority of India also set an upper limit to the recommended level of iodine in salt to 30 parts per million (ppm) per kg.[6]

Change in pattern of dietary consumption

With the shift in dietary patterns, the proportion of salt consumption by intake of processed foods is on the rise as compared to salt added during cooking at the household level. Regulating the iodization of salt at the production level of processed food could be an opportunity to tackle this threat. The consumption pattern of the population needs to be studied frequently as was previously done by the National Nutritional Monitoring Bureau, a division of NIN, India. Furthermore, there is a need to restrict the salt in processed foods, which are known to high-salt foods.

Salt reduction for noncommunicable disease control

Reduction of salt intake to <5 g/day is advised to reduce the prevalence of noncommunicable diseases (NCDs).[16] The current diet prepared using iodized salt is considered adequate to fulfil the daily requirement, considering the salt intake to be 10 g per day.[15] Hence, if salt intake is reduced to 5 g, then iodine levels would require an increase to 30 ppm. The World Health Organization (WHO) and other organizations have endorsed that salt iodization and salt reduction strategy are compatible and harmonization of both is the way forward to achieve the control of IDDs and NCDs.

Small-scale salt production

Iodization of salt is an added cost for the financially constrained scattered small-scale salt producers. Regulating the quality of iodized salt produced by them would be crucial to reaching the last mile. Low-cost innovations for the iodization of salt would help bridge this gap. State and district IDD cells need strengthening to map such producers in the area and effectively implement iodization regulations.

Climate change

India is the third largest producer of salt in the world. Salt production is dependent on the temperature and the rainfall in the area. With the phenomenon of climate change limiting salt production due to rising sea levels, changing monsoon patterns, and temperature fluctuations, producers would be required to identify appropriate adaptation measures.[17,18]

Salt as a vehicle for other micronutrients

Apart from iodine, salt is identified as a suitable vehicle for fortification with other micronutrients such as iron,

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Vitamin B12, and zinc. Double-fortified salt is being introduced in the Public Distribution System in various states of India. Fortification of salt with iron might alter the color and taste of food.[18] With multiple micronutrient fortifications of salt, issues related to rising cost and acceptability of the product would need addressal.

Consumption of rock salt

The consumption of rock salt is wrongly perceived to have benefits such as lowering blood pressure and relief in cough and cold. However, these health effects are not proven and might contribute to an increase in blood pressure by increasing daily consumption of salt with the belief that it lowers blood pressure. Rock salt has been found to contain minerals such as iron, potassium, zinc, and calcium, but they are present in trace quantities with little contribution to RDA.[19] Studies have also found harmful constituents in rock salts such as hard metals and microplastics, posing a risk to consumers.[19,20] Rock salt lacks iodine and caters to a niche market creating pockets of population with inadequate iodine intake, posing a threat to reach the last mile. The recent trend of marketing rock salt as fad/gourmet food should also be discouraged as it has the potential of derailing a successful USI program.

THE WAY FORWARD

Evolution of the program would be crucial moving ahead, to not only maintain the success of the interventions but also to reach the "last mile" to ensure the sustainable elimination of IDDs. Strengthening state and district IDD cells would help tailor the control strategy to tackle IDDs in the area. Capacity building of salt manufacturing private sector industries in the domain of quality iodization and laboratory monitoring, to ensure adequate production of iodized salt in the country would be essential. Progression from quantity to quality is essential to ensure adequate salt iodization at different levels of the supply chain. This could be achieved by strict vigilance by public health laboratories which need to now relocated from the erstwhile Salt Commissioners Office to a new department. The USI program should aim to achieve equitable distribution of iodized salt to the vulnerable population. Linkages with the Public Distribution System (PDS), Integrated Child Development Services scheme, and PM-POSHAN Midday Meal (MDM) program might serve as an opportunity to reach vulnerable population. Moreover, with the rising intake of junk food, expanding salt iodization to fast food industries serves as an opportunity to achieve the target iodine levels in the population. All these are to be coupled with intensified social behavior change and communication for demand generation in the population. With the research development in micronutrient deficiencies in India, a comprehensive approach to tackling various micronutrient deficiencies could be the pathway of evolution for the program. Regular monitoring and evaluation of the program are key to identify the challenges and modify the control approach to achieve the elimination of IDDs. Even with the presence of a dedicated program for IDDs in India, there is a lack of sufficient data for routine monitoring of the program. Globally, the Vitamin and Mineral Nutrition Information System by WHO exists for surveillance of micronutrient deficiencies. A similar information system can be set up, based on data generated by routine surveys, to strengthen surveillance of IDDs in India, to identify risk groups and to monitor the progress of the program. Moving forward, the "end-game" strategy should be focused on research, advocacy, and innovation to achieve the elimination of IDDs from the country and globally, as guided by G. H. Beaton in his famous quote – "In the field of Nutrition, as in Politics, the task is to do what is possible, without forgetting to make possible what is necessary."

CONCLUSION

USI is a public health success story in India. There is a need to consolidate the progress made so far and focus on strategy to reach the "last mile." Sustainable elimination of IDDs with USI being the primary strategy needs to also factor in harmonization with salt reduction strategy for the control of noncommunicable diseases. The research agenda for IDDs need to focus on processed food as a source of iodine, harmonization of salt reduction and salt iodization, and ensuring optimal iodine intake during pregnancy.

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Conflicts of interest

There are no conflicts of interest.

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