

Review Article

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National Iodine Deficiency Disorders Control Programme: Current status & future strategy

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Iodine deficiency disorders (IDDs) constitute a significant public health problem globally. In India, the entire population is prone to IDDs due to deficiency of iodine in the soil of the sub-continent and thus both animal and plant source food grown on the iodine-deficient soil. IDDs encompass the spectrum of disability and disease and include goitre, cretinism, hypothyroidism, abortion, stillbirth, brain damage, learning disabilities, mental retardation, psychomotor defects, hearing and speech impairment. Iodine deficiency is known to be the single largest cause of preventable brain damage. IDDs with their causal association with brain development, cognition, and learning disabilities impair the human resource development and progress of the country. The children born in iodine-deficient regions on an average have 13.5 intelligence quotient (IQ) points lesser than children born in iodine-sufficient regions. IDD control programme in India is a public health success story, with 92 per cent of the population consuming iodized salt. The partnership between government agencies, academic institutions, salt industry, development agencies and civil society has been key to achieve this success story. The sustainable elimination of iodine deficiency in India is within reach, what is required is accelerated and coordinated effort by all key stakeholder at national and State level.

Key words ICCIDD - iodine deficiency disorder - iodized salt - last mile - public health nutrition - success story - way forward

Introduction

Iodine is a trace mineral required for optimal mental and physical development and is a key constituent of thyroid hormones. Iodine deficiency is the single largest cause of preventable brain damage globally¹. Iodine deficiency disorders (IDDs) include goitre, cretinism, hypothyroidism, abortion, stillbirth, brain damage, learning disabilities, mental retardation, psychomotor defects, hearing and speech impairment². Rapidly changing environmental conditions leading to

melting of glaciers, frequent floods, change of river beds and loss of forest cover have led to depletion of the iodine from the top layers of the soil³. The resultant low iodine content of soil leads to low iodine in livestock and vegetation dependent on these soil and also in humans consuming these live stocks and vegetations. Historically, iodine deficiency was causally associated to only goitre and cretinism⁴. Research over the past three decades has shown that iodine deficiency has a significantly wider spectrum,

affecting all the age groups from intrauterine period to adult life with serious impact on the brain of developing child and also manifests a myriad of health and social problems⁵⁻⁷.

It has been shown that even mild iodine deficiency during pregnancy has irreversible effects on foetal neurodevelopment and consequent cognition and learning abilities of the young child⁸⁻¹⁰. The children born in iodine-deficient regions on an average have 13.5 intelligence quotient (IQ) points lesser than children born in iodine sufficient regions¹¹. IDD with its causal association with brain development, cognition, learning disabilities impairs the human resource development (HRD) and progress of the country^{12,13}. It has been estimated that one point increase in a nation's average IQ is associated with 0.11 per cent annual increase in gross domestic product (GDP), thus IDD elimination can potentially contribute to 1.5 per cent GDP growth annually¹⁴. Nearly all the short- and long-term consequences of IDDs are irreversible with the majority of them being difficult to recognise¹⁵. However, with appropriate interventions in place, all the adverse effects of IDD are totally preventable¹⁶. Globally, 1.8 billion people are at risk of iodine deficiency due to insufficient dietary iodine intake¹⁷. The Indian population is prone to IDDs due to deficiency of iodine in the soil and thus both animal and plant source food grown on the iodine-deficient soil^{14,18}. Universal Salt Iodization (USI) has been recognized as a key strategy for control of IDD. In 1994, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) Joint Committee on Health Policy recognized USI as a safe, cost-effective and sustainable strategy to ensure sufficient intake of iodine by all individuals¹⁹. Salt iodization, which costs less than ₹0.2 per person per year²⁰ and has been rated as one of the most cost-effective development interventions (ratio of 1:81) by Copenhagen Consensus Statement 2008²¹ and subsequently again in 2012²².

India has made impressive progress in control of IDDs with successful adoption and scaling up of USI in the country. According to National Iodine and Salt Intake (NISI) survey, 2014-2015, currently, 78 per cent of households in India are consuming adequately iodized salt²³. However, still significant percentage of the population continues to consume inadequately iodized salt (14%) or nil iodine salt (8%). There is a need to reach the unreached population and cover the 'last mile' of USI success story of India. This calls for

developing and implementing the 'end game strategy' to accelerate, achieve and sustain the elimination of IDD in India.

Iodine deficiency disorder (IDD) control programme in India: A successful public health programme

IDD control programme in India has been a public health success story. We are within the grasping reach of the target of >90 per cent household level coverage of adequately iodized salt of USI. India has been at the forefront of global efforts by contributing to research and programme for the elimination of IDD. The National Goitre Control Programme (NGCP) was one of the earliest national programmes dedicated to the elimination of IDD launched in year 1962²⁴. The successful evolution of IDD control programme in India highlights factors for successful and sustainable implementation of a health programme and has lot of learning's for other health and nutrition programmes in the country in particular and other programmes related to social sector in general. The experience and lessons learned can be generalized to other countries as well.

Salt iodization was first used as an intervention strategy to present goitre in the United States of America and Switzerland in 1920s²⁵. The landmark study in the Kangra valley in Himachal Pradesh from 1956 to 1972 successfully demonstrated the effectiveness of salt iodization in reducing goitre rates^{26,27}. The Kangra Valley Study led to the establishment of NGCP in India in 1962 even before the study was concluded in 1972²⁸. Providing iodized salt in the endemic areas through iodine subsidy was the key strategy for control of goitre under this Programme. Focus of the NGCP was on endemic districts. In the first decade or so of the Programme only 12 salt iodization plants were established in public sector, with annual production of only two lakh tons, which was able to cater to only 15 per cent of the total requirement of iodized salt. NGCP remained a low priority health programme as goitre was perceived to be a mild cosmetic problem that too restricted to the Himalayan region.

New scientific evidence emerged from India and other countries showed a significant impact of iodine deficiency on early brain development, cognition and learning abilities of children²⁹. The whole country was shown to be endemic for IDD and very high prevalence of neonatal hypothyroidism was reported from some parts in the country⁷. In 1983 in the Meeting of Central

Council of Health, policy decision to ensure USI in the whole of the country by the year 1992 was taken and to facilitate the availability of required amount of iodized salt, private sector was allowed to set up salt iodization plants³⁰. Programme was expanded and renamed as National IDD Control Programme (NIDDCP) in the same year taking into account recent evidence establishing public health significance of IDDs³¹. Due to advocacy by public health experts, the Government of India decided to make salt iodization mandatory for direct human consumption. In 1997, the ban on non-iodized salt was brought under the ambit of Prevention of Food Adulteration (PFA) Act, 1954 and was implemented in all parts of the country³². Concurrently, due to expansion and modernization of salt industry, there was an increase in the production of iodized salt from two lakh tons in 1986 to 44 lakh tons in 2000³³. There was an increase in household coverage of iodized salt with 49 per cent households consuming adequately iodized salt (15 parts per million)³⁴.

The ban on sale of non-iodized salt in India was lifted in 2000 by the then National Democratic Alliance government due to a campaign by a few nationalist groups³⁵. The factors responsible for lifting of the ban were higher price of iodized salt as compared to non-iodized salt; perception that IDD affects only a small proportion of the population; penalties and court cases faced by salt producers under PFA Act due to inadequate iodization, perception of association of salt iodization with multinational aid agencies and companies and question of individuals right to choose type of salt to consume. The lifting of ban resulted in decline in iodized salt production to 41 lakh tons in 2003 and resulted in a drop in the household coverage of iodized salt to 30 per cent in 2002-2003³⁶. In the third round of the National Family Health Survey (NFHS) conducted in 2005-2006, household coverage with adequately iodized salt increased to 51 per cent³⁷.

The lifting of ban and subsequent decline in household coverage with adequately iodized salt forced the scientific community in generating scientifically valid information to counteract the propaganda against iodized salt and establish criticality of IDD problem in India. IDD survey conducted by the International Council for Control of IDD (ICCID) in seven States spread across geography of the country in 2000-2006 established that IDD was a significant public health problem⁷. Intense advocacy campaign was undertaken using the results of these surveys and also global

experiences to address the claims made against the salt iodization. After a prolonged campaign by the scientist community of India, the ban on non-iodized salt was reinstated in 2005³⁸. However, the opposition to a mandatory ban on non-iodized salt continued, and in 2011 in wake of Public Interest Litigation, the Supreme Court of India constituted a committee to review the scientific basis of mandatory salt iodization for control of IDD³⁹. The committee comprising of leading public health experts of India, upheld the relevant salt iodization regulations under the Food Safety and Standards Act, 2006⁴⁰.

The Core Advisory Group on Public Health and Human Rights of National Human Rights Commission examined the public health consequence of lifting of ban on mandatory salt iodization in 2004. The Group recommended that IDD continued to be of public health significance in India and the USI was needed to be mandatorily implemented throughout the country⁴¹. The ban on sale of non-iodized salt was reinstated in 2005 by the Government of India pursuant to the recommendation of the Group.

Partnerships amongst key stakeholders for sustained advocacy and promoting sustained elimination of IDD

The National Coalition for Sustained Optimal Iodine Intake (NCSOII) was established in 2006 with partnership from government agencies, Salt Commissioner of India, academic institutions, salt producers and traders, bilateral and multilateral development agencies and civil society⁴². Small and medium scale salt producers were targeted for strengthening of capacity to establish quality assurance of laboratory monitoring thus improving the quality of iodized salt⁴³. Innovative business models including providing iodized salt in Public Distribution System through salt traders groups were implemented to increase coverage with iodized salt. The multipronged approach of strengthening supply and demand side intervention led to an increase in the household coverage of adequately iodized salt in the country⁴⁴. The iodized salt production was also increased to 6.2 million tons thus meeting the total iodized salt requirement of the country. According to NISI survey, 2014-2015, currently, 78 per cent of households in India are consuming adequately iodized salt⁴⁵. There has been encouraging trend of sustained improvement in salt iodization coverage over the last decade (Fig. 1)^{14,26,38}. However, significant percentage

of the population continues to consume inadequately iodized salt (14%) or nil iodine salt (8%)⁴⁵.

Key milestones in journey of IDD control in India

The results of recently concluded surveys have shown significant sub-national differentials in iodized salt coverage. NISI Survey 2014-2015²³ reported IDD status in India desegregated by geographical zones, rural-urban areas and socio-economic status. There was 17 percentage point differential across urban and rural population and 10 percentage point differential across deprived and non-deprived households (Fig. 2). The south zone (adequately iodized salt coverage only 62%) of India comprising of States of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana continues to have below national level coverage of adequately iodized salt.

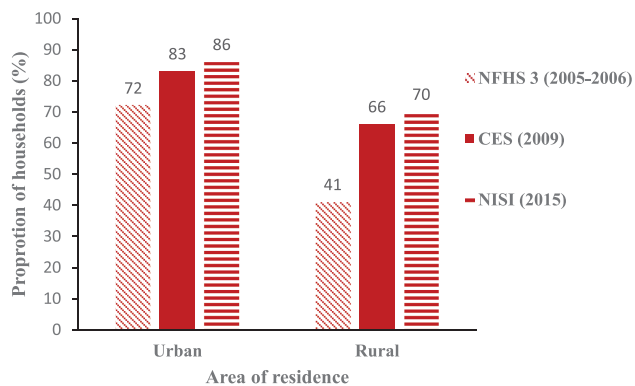


Fig. 1. Trends in use of adequately iodized salt use at national level across urban and rural areas. NFHS 3, National Family Health Survey 3; CES, Coverage Evaluation Survey; NISI, National Iodine and Salt Intake Survey, 2015. Source: Refs 14, 26, 38.

The journey of salt iodization programme in India can be broadly classified into the following phases: (i) Phase 1: Scientific research leading to programme (1956-1983); (ii) Phase 2: From goitre to IDD (1983-2000); (iii) Phase 3: Lifting the ban on sale of non-iodized salt (2000-2005); and (iv) Phase 4: Reinstatement of ban on sale of non-iodized salt and consolidation of sustainable elimination of IDD (Since 2005).

The critical factors for the achievement of success of IDD control programme in India were as follows: (i) Generation of regular, representative and reliable scientific data - Regular, representative and reliable data at the State and national level are required for the development of effective and efficient policy and programmes and effective advocacy. From Kangra Valley study (1956-1972)²⁶ to NISI Survey (2014-2015)²³ generation of evidence has been an iterative process in India and provided inputs for the policy and programme. (ii) Stakeholder analysis and development of partnership - the development of partnership between various stakeholders namely government institutions, academic institutions, international and national non-governmental organization, civil society organization and salt producers helped in sustainability in efforts towards achieving USI and elimination of IDD. (iii) Institutional continuity and mentorship for the achievement of sustainability - Active involvement of All India Institute of Medical Sciences, New Delhi, in IDD control programme provided institutional continuity and allowed mentorship for generations of researchers and workers in the field of IDD. (iv) Addressing

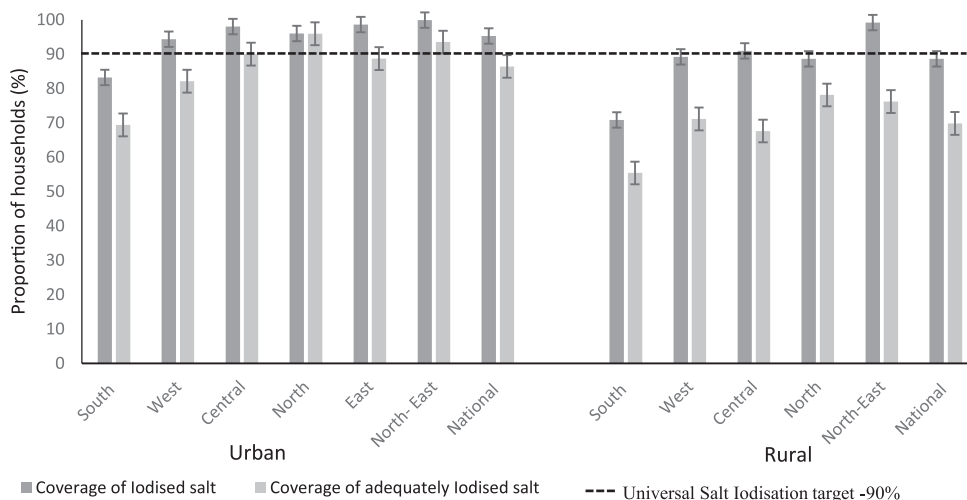


Fig. 2. National and sub-national iodized salt coverage in urban and rural strata. Source: Ref. 23.

the value system of stakeholders - Neglect by the policymakers leads to serious setback to the programme implementation as seen in case of NIDDCP⁴⁶. Addressing these issues through sustained advocacy led to lifting of ban on non-iodized salt and improvement in household coverage with adequately iodized salt. (v) Legislation for achieving public health goals - The PFA Act 1954 and its successor, the Food Safety and Standards Act 2006; which prevents the sale of non-iodized salt for human consumption, were instrumental in creating enabling environment for the achievement of USI in India. (vi) The involvement of private sector in public health efforts - Cooperation from salt industry was one of the main factors in achieving high coverage with adequately iodized salt. Engagement with medium and small-scale salt producers and focus on improvement in quality of iodized salt through maintenance of quality assurance has been one of the prime reasons for improved household coverage with adequately iodized salt.

Future strategy for achieving sustainable elimination of IDD in India

To accelerate the progress towards sustainable elimination of IDD in the country, there is a need to invigorate the efforts at national and State level from production to consumer level. There is a need to reposition the NIDDCP by linking elimination of IDD to HRD of the country. The social process model⁴⁷ based on four main components, Demand for Iodized Salt (Pull), Supply of Iodized Salt (Push), Regular Reliable Representative State Level Scientific Data and Data for Decision Makers and Sustained Political Commitment needs to be followed (Fig. 3).

There is a need for renewed focus and vigour to achieve USI in the country by developing strategy to target and engage small-scale producer/difficult to reach areas/marginalized population and strengthen monitoring of iodine content of salt from production to consumer level. There is also a need to establish national and State level coalitions for sustained optimal iodine intake comprising key stakeholders which include government policymakers, salt industry representatives, civil society, consumer organizations and national and international development agencies working for IDD elimination in India.

There has been long-standing demand to revise the technical guidelines of NIDDCP in line with the maturity of the national iodine elimination programme.

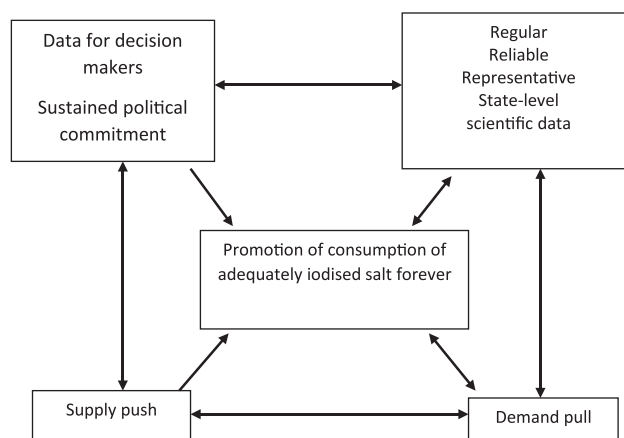


Fig. 3. The multi-component model for Iodine Deficiency Disorder Control Programme.

Source: Ref. 20.

The district-based approach of the periodic IDD survey guidelines should be revamped to focus on generating meaningful epidemiological data which can guide programme and policy. The regulatory framework to ensure stringent implementation of mandatory salt iodization needs to be strengthened. The Food Safety and Standards Act (FSSA) at the national level should issue guidelines and advisory for mandatory salt iodization. At the State level, adequate resources including workforce need to be allocated to salt iodization regulation and use of Management Information System (MIS) for monitoring of salt iodization from production to consumer level. Consolidation, modernization and mechanization of salt industry have been an essential component of the successful progress towards USI and policy changes should be made to enable this to continue, to improve access to adequately iodized salt for all sub-national population groups.

Strong government leadership and coordination amongst all stakeholders, which has been a cornerstone of the success, should be maintained. The success of the NCSOII and State USI coalitions in Bihar, Gujarat, Rajasthan and Uttar Pradesh highlights key the role of all stakeholders in USI. These partnerships should be sustained, strengthened and most importantly replicated in other States as well. The initial stages of formation of district USI coalitions in 12 leading salt producing districts of the country (accounting for 90% iodized salt production) should also be accelerated. There is a need to consolidate, modernize and mechanize salt industry particularly iodized salt industry to ensure availability of good quality, affordable, quality adequately iodized salt across India.

Strengthening quality assurance of salt iodization at production level

Experience across the globe and in India has shown that strengthening quality assurance of salt iodization at the point of production is the most efficient way to achieve and sustain USI. There is a need to strengthen quality assurance at production facilities in India particularly in southern States. The provision of FSSA, 2005³⁸, regarding mandatory iodization of all edible salt needs to be implemented with zero tolerance. The significant augmentation of infrastructure and human resource under the Act needs to be optimally harnessed to ensure stringent implementation of the salt iodization provision. The success achieved in special campaigns on salt iodization by a few States in India (UP, Bihar and Gujarat)^{48,49} needs to be replicated in other States of the country.

The non-availability of quality affordable salt due to supply chain bottlenecks is responsible for the zonal difference in the iodized salt coverage. Reforms in iodized salt transportation policy are required to facilitate the availability of quality, affordable iodized salt in all regions of the country. A behaviour change communication (BCC) strategy focussing on promoting awareness regarding the linkage between iodine nutrition and iodized salt needs to be developed and implemented. The 2014-2015 national survey highlighted the differentials across zones, rural-urban and socio-economic strata in iodized salt coverage⁵⁰. There is a need to conduct sub-national and State level USI surveys to build on this new evidence base to further understand determinants of these differentials and develop a strategy to address them. Existing network of quantitative estimation of iodine content of salt needs to be strengthened. These include the Salt Commissioner Office Laboratory and Salt producer's laboratories at production end and FSSA and State IDD cell at the consumer end. The novel experiment to establish laboratories for quantitative analysis of salt iodine level by salt traders and in State medical colleges (USI laboratories in UP and Bihar) should be replicated in other States of the country. Although the survey was not powered to estimate the iodine intake of pregnant women, the findings of the survey provided an indication of sub-optimal iodine status among pregnant women²³. There is a need to undertake research on ascertaining iodine intake in pregnant women in India and to develop appropriate strategies to ensure achieving optimal iodine nutrition amongst pregnant women.

Production and distribution of good quality iodized salt are critical determinants for universal coverage of adequately iodized salt. Only three States of India account for more than 90 per cent of the iodized salt production and in these three States 10 districts account for more than 95 per cent of iodized salt production⁵¹. Iodized salt from these salts producing areas is transported by rail or roadways depending upon several factors.

Conclusion

The elimination of IDD is eminently possible. We are at a turning point in our battle against the ancient and pervasive scourge of iodine deficiency. IDD control programme in India is one of the success stories of public health in India. The current 92 per cent household level coverage of iodized salt in India, of which 78 per cent is adequately iodized salt, is a huge achievement. USI programme in India is in critical phase, and its success needs to be sustained to prevent slip backs. Government and all partner agencies are striving to develop an 'end game strategy' to cover the last mile towards achieving USI. Achieving sustainable elimination of the IDD would require coordinated effort; what is required now is mission approach with effective and efficient coordination amongst all stakeholders of IDD control efforts in India. With accelerated and coordinated efforts it would be possible to achieve the IDD control goal in the near future and sustain it thereafter.

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