Dhanvantri Oration

Successful Efforts Toward Elimination Iodine Deficiency Disorders in India

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ABSTRACT

Iodine deficiency (ID) is the world's single most important preventable cause of brain damage and mental retardation. Iodine deficiency disorders (IDDs) is a public health problem in 130 countries, affecting 13% of the world population. The simplest solution to prevent the IDD is to consume iodized common salt every day. In India, significant progress has been achieved toward elimination of IDD, in the last 30 years. Satisfactory levels of urinary iodine excretion and iodine content of salt have been documented by the research surveys conducted by research scientists. The results indicate that we are progressing toward elimination of IDD. IDD is due to a nutritional deficiency, which is primarily that of iodine, in soil and water. IDD is known to re-appear if the IDD Control Program is not sustained. To ensure that the population continues to have intake of adequate amount of iodine, there is a need of i) periodic surveys to assess the magnitude of the IDD with respect to impact of iodized salt (IS) intervention; ii) strengthening the health and nutrition education activities to create demand for IS and iii) development of a monitoring information system (MIS) for ensuring that the adequately IS is available to the beneficiaries.

Keywords: Goiter, iodine, salt, urinary iodine excretion

Introduction

Iodine deficiency (ID) is the single most important preventable cause of brain damage.[1] Iodine deficiency disorders (IDDs) refer to all of the consequences of ID in a population, which can be prevented by ensuring that the population has an adequate intake of iodine. Iodine is one of the essential elements. Its daily per capita requirement is 150 µg. Iodine is required for the synthesis of the thyroid hormones, thyroxine (T_4) and triiodothyronine (T_3). Iodine is present in the superficial layers of the soil and absorbed by crops grown on it. Glaciations, heavy snow and heavy rain leach away iodine from the soil. This problem is further accelerated by deforestation and soil erosion. Consumption of crops and plants grown on iodine-deficient soils leads to ID in populations solely dependent on this vegetation for their iodine requirements. When iodine intake falls below the recommended levels, the thyroid may no longer be able to synthesize sufficient amounts of thyroid hormones. The resulting low level of thyroid hormones in the blood (hypothyroidism) is the principal factor responsible for damage to the developing brain of fetus.[2]

ID causes its impact right from the development of fetus to people of all age groups. It results in abortion, stillbirth, mental retardation, deaf-mutism, squint, dwarfism, goiter of all ages, neuromotor defects, etc. ID directly affects human resource development, which in turn greatly affects the human productivity and country's development at large. People living in areas affected by severe ID may have an intelligence quotient (IQ) of up to 13.5 points below that of those from comparable communities in areas where there is no ID.[3]

Magnitude of IDD

IDD constitutes a major nutrition deficiency disorder in India. The survey conducted by the central and state

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health directorates, Indian Council of Medical Research and medical colleges have demonstrated that not even a single state is free from the problem of IDD. Out of 582 districts in the country, district level surveys conducted in 324 districts have revealed that IDD is a major public health problem in 263 districts, i.e. a total goiter prevalence rate of 10% and more in the population.[4] Realizing the magnitude of the problem, the Government of India launched a 100% centrally assisted National Goitre Control Programme (NGCP) in 1962. In 1992, the NGCP was renamed as NIDDCP. The program has the following objectives:[4]

i. initial surveys to assess the magnitude of the IDDs;
ii. supply of iodized salt (IS) in place of common salt; and
iii. resurveys to assess the impact of IS after every 5 years.

The Government of India under the Prevention of Food Adulteration Act (PFA) has defined that IS should have a minimum of 30 ppm iodine at the production level and a minimum of 15 ppm at the retail trader level. India has adopted a policy of Universal Salt Iodization (USI) in 1983 to ensure that all edible salt for human and animal consumption is iodized. The major activities undertaken under the program include i) production and distribution of IS; ii) establishment of goiter cell in all states and UTs; iii) information education and communication activities to increase the consumption of IS; iv) to achieve effective inter-sectoral coordination amongst various government sectors participating in implementation of NIDDCP; v) laboratory support for assessing iodine content of salt and urinary iodine excretion (UIE) levels estimation; vi) training of health functionaries in IDD at different levels; and vii) establishment of monitoring and reporting system for NIDDCP.[4]

Progress achieved toward elimination of IDD in India

According to World Health Organization (WHO), to assess progress toward elimination of IDD, the following two activities should be undertaken: i) measurement of UIE levels and ii) analysis of the iodine content of salt. The data available on these two aspects from India reflect the success story.

Status of UIE in India

In a community with optimal iodine nutriture, the median UIE levels should be in the range of 100–200 μg/l.[5] The status of UIR levels in different regions of country has been extensively assessed by district level surveys in the recent years [Table 1]. More than 86% of districts had median UIE levels of 100 mcg/l, indicating success of NIDDCP.

Status of iodine content of salt in India

The level of salt iodization should provide a physiological intake of 100–150 μg/day, which should bring the median UIE level within a range of 100–200 μg/l. To achieve this, 30 ± 10 ppm iodine needs to be added to salt at the manufacturing level.[5] The status of salt iodization in different districts of the country has been extensively assessed in the recent years. Table 2 depicts the same. More than 58% of districts had an iodine content of salt of 15 ppm and more at beneficiary level, indicating success of Universal Salt Iodization Program activity in the country.

A countrywide evaluation conducted under NFHS-3, in 2005–2006 measured the iodine content of cooking salt [Table 3]. Overall, 49% of the households used salt that was iodized at the recommended level of 15 ppm or more. About 22% salt was inadequately iodized i.e. less than 15 ppm. It was found that the use of IS varied dramatically from one state to another. The use of IS was high (90% and more) in the northeastern region where salt is transported by railways. However, all the states in the southern region had low levels of use of adequately IS, ranging from only 21% in Tamil Nadu to 43% in Karnataka.[6]

The salt department, under its monitoring information system, receives reports from State Health Authorities. During 2005, the reports received from 12 states revealed that 73.7% of IS tested by State Health Laboratories under State Health Department were adequately iodized (15 ppm and more iodine).[7]

Contribution of salt department in the success of NIDDCP

The production of IS in country was about 0.2 million tons in 1983. This had increased to about 5.3.million tons in 2009. There are 807 salt iodization units including 42 refineries, which have a total installed capacity of production of 116 lakh tons. This capacity established is more than double the requirement of salt for human consumption in the country. The Salt Department has facilitated the establishment of 18 potassium iodate manufacturing units to help salt producers to iodize the salt. The sustained joint efforts of NIDDCP and Salt Department have ensured that IS is distributed through Public Distribution System for below the poverty line (BPL) population in the 15 states of the country [Table 4].[7]

Areas requiring strengthening to achieve the elimination of IDD

i. A high priority is needed to be given to the NIDDCP by the state governments to prevent irregular distribution of IS.
ii. Adequate enforcement of PFA by the state/UT governments is required to ensure that the quality of IS is available to the beneficiary.
iii. Adequate coordination is required between salt

Table 1: Urinary iodine excretion levels in selected districts of India

State	Name of the district	Year	No. of urine samples	Median (µg/l)	Urinary iodine excretion levels (µg/l)				Ref
					<20.0	20.0-49.9	50.0-99.9	≥100.0	
Assam	Dibrugarh	2001	2040	115	NA	NA	NA	NA	(8)
	Nagaon	2001	1836	115	NA	NA	NA	NA	(8)
	Dibrugarh	2003	210	167	12 (5.7)	13 (6.2)	26 (12.4)	159 (75.7)	(9)
	Dubri	2003	210	205	4 (1.9)	10 (4.8)	30 (14.3)	166 (79.0)	(9)
	Changlong	2003	193	110	4 (2.1)	31 (16.1)	47 (24.4)	111 (57.4)	(9)
Andaman and Nicobar	Andaman and Nicobar	2004	154	200.0	0 (0.0)	5 (3.3)	9 (5.8)	140 (90.9)	(10)
Andhra Pradesh	Mehboobnagar	2001	1748	150	NA	NA	NA	NA	(8)
	Adilabad	2003	210	140	6 (2.9)	23 (11.0)	42 (20.0)	139 (66.1)	(9)
	E. Godavari	2003	210	118	9 (4.3)	28 (13.3)	51 (24.3)	58.1	(9)
	Vijayanagram	2004	21	>200.0	0 (0.0)	0 (0.0)	1 (4.8)	20 (95.2)	(11)
	Srikakulam	2004	33	>200.0	0 (0.0)	0 (0.0)	2 (6.1)	31 (93.9)	(11)
	East Godavari District	2004	102	>200.0	0 (0.0)	0 (0.0)	0 (0.0)	102 (100)	(11)
	West Godavari District	2004	70	>200.0	0 (0.0)	0 (0.0)	1 (1.4)	69 (98.6)	(11)
	Guntur	2004	120	>200.0	0 (0.0)	0 (0.0)	2 (1.7)	118 (98.3)	(11)
	Prakasam	2004	102	150.0	1 (1.0)	3 (2.9)	14 (13.7)	84 (82.4)	(11)
	Warangal	2004	100	>200.0	1 (1.0)	0 (0.0)	7 (7.0)	92 (92.0)	(11)
	Adilabad	2004	101	125.0	0 (0.0)	8 (7.9)	25 (24.8)	68 (67.3)	(11)
	Kurnool	2004	103	130.0	0 (0.0)	4 (3.9)	18 (17.5)	81 (78.6)	(11)
	Mehboobnagar	2004	100	150.0	2 (2.0)	5 (5.0)	19 (19.0)	74 (74.0)	(11)
	Chittor	2004	100	100.0	0 (0.0)	4 (4.0)	45 (45.0)	51 (51.0)	(11)
	Nellore	2004	93	>200.0	(0.0)	0 (0.0)	0 (0.0)	93 (100)	(11)
	Krishna	2004	96	>200.0	0 (0.0)	0 (0.0)	1 (1.0)	95 (99.0)	(11)
	Khammam	2004	100	200.0	0 (0.0)	0 (0.0)	3 (3.0)	97 (97.0)	(11)
	Hyderabad	2004	174	150.0	8 (4.6)	22 (12.6)	31 (17.8)	113 (64.9)	(11)
	Nizamabad	2004	200	150.0	18 (9.0)	11 (5.5)	25 (12.5)	146 (73.0)	(11)
	Rangareddy	2004	107	65.0	1 (0.9)	23 (21.5)	48 (44.9)	35 (32.7)	(11)
	Anatpur	2004	98	100.0	1 (1.0)	7 (7.1)	38 (38.8)	52 (53.1)	(11)
	Cuddapah	2004	97	90.0	9 (9.3)	15 (15.5)	28 (28.9)	45 (46.4)	(11)
	Vishakapatnam	2004	35	>200.0	0 (0.0)	0 (0.0)	1 (2.9)	34 (97.1)	(11)
Bihar	West Champaran	1997	123	100.0	20 (16.3)	15 (12.2)	25 (20.3)	63 (51.2)	(12)
	East Champaran	1997	138	100.0	12 (8.7)	20 (14.5)	36 (26.1)	70 (50.7)	(12)
	Sahibganj	1998	136	90.0	2 (1.5)	43 (31.6)	29 (21.3)	62 (45.6)	(13)
	Palamu	1998	159	160.0	1 (0.6)	7 (4.4)	17 (10.7)	134 (84.3)	(13)
	Gaya	2001	1802	90	NA	NA	NA	NA	(8)
	Patna	2001	1671	109	NA	NA	NA	NA	(8)
	West Champaran	2003	206	110	10 (4.9)	13 (6.3)	67 (32.5)	116 (56.3)	(9)
	Palamu	2003	209	120	16 (7.7)	32 (15.3)	43 (20.6)	118 (56.5)	(9)
	All Districts	2006	1169	85.6	NA	368 (31.5)	NA	NA	(14)
Chattisgarh	Shahdol	2003	205	50	61 (29.8)	39 (19.0)	43 (21.0)	62 (30.2)	(9)
	Sarguja	2003	210	113	31 (14.8)	11 (5.2)	46 (21.9)	122 (58.1)	(9)
Delhi	Delhi	1996	1652	170.0	35 (2.1)	138 (8.4)	291 (17.6)	1188 (71.9)	(15)
	Delhi	2004	680	150.0	17 (2.5)	35 (5.1)	104 (15.3)	524 (77.1)	(16)
	Delhi	2005	749	150.0	17 (2.3)	48 (6.4)	109 (14.6)	575 (76.8)	(17)
	Delhi	2010	1230	198.4	24 (1.9)	53 (4.3)	117 (9.5)	1036 (84.2)	(18)
	Delhi	2010	997	352.8	NA	NA	NA	NA	(19)
Gujarat	Surat	2003	209	90	31 (15.0)	27 (13.0)	56 (26.6)	95 (45.4)	(9)
	Valsad	2003	209	70	51 (24.6)	29 (13.8)	52 (25.1)	76 (36.5)	(9)
	Panchmahal	2007	15900	70	NA	NA	NA	NA	(20)
	Saurashtra	2010	2010	420	110 (5.4)	NA	NA	NA	(21)
Haryana	Sonepat	2003	207	150	5 (2.4)	13 (6.3)	39 (18.8)	150 (72.5)	(9)
	Sonipat	2009	152	200	1 (0.7)	3 (2.0)	8 (5.3)	140 (92.1)	(22)
	Panipat	2009	190	150	1 (0.5)	5 (2.6)	28 (14.7)	156 (82.1)	(22)
	Karnal	2009	152	200	0 (0.0)	0 (0.0)	1 (0.7)	151 (99.3)	(22)
	Yamuna Nagar	2009	152	210	0 (0.0)	0 (0.0)	3 (2.0)	149 (98.0)	(22)
	Kurukshetra	2009	152	200	0 (0.0)	2 (1.3)	7 (4.6)	143 (94.1)	(22)
	Ambala	2009	152	182	0 (0.0)	1 (0.7)	5 (3.3)	146 (96.1)	(22)
	Panchkula	2009	151	210	0 (0.0)	0 (0.0)	1 (0.7)	150 (99.3)	(22)
	Kaithal	2009	168	200	0 (0.0)	5 (3.0)	12 (7.1)	151 (89.9)	(22)
	Jind	2009	152	210	0 (0.0)	0 (0.0)	7 (4.6)	145 (95.4)	(22)
	Sirsa	2009	202	150	0 (0.0)	5 (2.5)	46 (22.8)	151 (74.8)	(22)
	Fatehabad	2009	152	200	0 (0.0)	0 (0.0)	14 (9.2)	138 (90.8)	(22)

Table 1 (Contd...)

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State	Name of the district	Year	No. of urine samples	Median (µg/l)	Urinary iodine excretion levels (µg/l)				Ref
					<20.0	20.0-49.9	50.0-99.9	≥100.0	
	Hissar	2009	152	191	1 (0.7)	1 (0.7)	17 (11.2)	133 (87.5)	(22)
	Bhiwani	2009	159	200	0 (0.0)	1 (0.6)	11 (6.9)	147 (92.5)	(22)
	Mahendragadh	2009	152	210	0 (0.0)	0 (0.0)	1 (0.7)	151 (99.3)	(22)
	Rewari	2009	152	210	0 (0.0)	0 (0.0)	4 (2.6)	148 (97.4)	(22)
	Jhajar	2009	152	210	0 (0.0)	0 (0.0)	1 (0.7)	151 (99.3)	(22)
	Rohtak	2009	149	210	0 (0.0)	1 (0.7)	0 (0.0)	148 (99.3)	(22)
	Gurgaon	2009	152	200	0 (0.0)	0 (0.0)	16 (10.5)	136 (89.5)	(22)
	Faridabad	2009	176	200	0 (0.0)	0 (0.0)	4 (2.3)	172 (97.7)	(22)
Himachal Pradesh	Kangra	1997	245	165.0	6 (2.4)	10 (4.1)	42 (17.1)	187 (76.3)	(23)
	Hamirpur	1998	787	135.0	69 (8.8)	65 (8.3)	137 (17.4)	516 (65.6)	(24)
	Kinnaur	1998	226	195.0	3 (1.3)	13 (5.8)	24 (10.6)	186 (82.3)	(25)
	Solan	1999	720	150.0	21 (2.9)	42 (5.8)	142 (19.7)	515 (71.5)	(26)
	Kullu	2000	147	150.0	0 (0.0)	1 (0.7)	3 (8.8)	133 (90.5)	(27)
	Kangra	2000	394	175.0	8 (2.0)	14 (3.6)	54 (13.7)	318 (80.7)	(28)
	Mandi	2004	2001	150.0	NA	NA	NA	NA	(10)
	Shimla	2003	195	140	3 (1.5)	11 (5.6)	47 (24.1)	134 (68.8)	(9)
	Kullu	2003	193	205	4 (2.1)	13 (6.7)	16 (8.3)	160 (82.9)	(9)
	Kullu	2005	289	100.0	1 (0.3)	4 (1.4)	55 (19.0)	229 (79.2)	(29)
	Mandi	2005	214	>200.0	0 (0)	0 (0)	4 (1.9)	210 (98.1)	(29)
	Una	2005	206	>200.0	0 (0)	0 (0)	2 (1.0)	204 (99.0)	(29)
	Kannaur	2005	215	>200.0	0 (0)	1 (0.5)	7 (3.3)	207 (96.2)	(29)
	Kullu	2005	208	>200.0	0 (0)	6 (2.9)	22 (10.6)	180 (86.5)	(29)
	Shimla	2005	187	>200.0	4 (2.1)	2 (1.1)	7 (3.7)	174 (93.0)	(29)
	Lahaul Spiti	2005	211	>200.0	0 (0)	1 (0.5)	3 (1.4)	207 (98.1)	(29)
	Solan	2005	223	>200.0	0 (0)	3 (1.3)	15 (6.7)	205 (91.9)	(29)
	Kangra	2005	225	>200.0	0 (0)	7 (3.1)	33 (14.7)	185 (82.2)	(29)
	Hamirpur	2005	238	>200.0	0 (0)	0 (0)	5 (2.1)	233 (97.9)	(29)
	Sirmour	2005	209	>200.0	2 (0.9)	3 (1.4)	35 (15.9)	180 (81.8)	(29)
	Chamba	2005	218	>200.0	0 (0)	3 (1.4)	35 (15.9)	180 (81.8)	(29)
	Bilaspur	2005	220	>200.0	0 (0)	0 (0)	4 (1.9)	205 (98.1)	(29)
	Kangra	2007	1952	150.0	69 (3.5)	74 (3.8)	278 (14.2)	1531 (78.5)	(30)
Jharkhand	Palamu	2003	209	120	16 (7.7)	32 (15.3)	43 (20.6)	118 (56.5)	(9)
	All Districts	2008	1121	173.2	42 ((3.7)	70 (6.3)	184 (16.4)	825 (73.6)	(31)
Jammu and Kashmir	Kupwara	2003	206	300	0.0 (0.0)	2 (1.0)	14 (6.8)	190 (92.2)	(9)
	Jammu	2008	134	96.5	NA	9 (6.7)	57 (42.5)	NA	(32)
Karnataka	Manipal	2002	722	<100	NA	NA	NA	NA	(33)
	Chickmagalur	2003	210	140	0.0 (0.0)	22 (10.5)	43 (20.6)	145 (68.9)	(9)
	Bangalore	2003	210	130	1 (0.5)	26 (12.4)	47 (22.4)	136 (64.7)	(9)
	Shimoga	2005	96	30.0	30 (31.3)	23 (24.0)	33 (34.4)	10 (10.4)	(34)
	Dharwad	2005	99	100.0	3 (3.0)	5 (5.1)	40 (40.4)	51 (51.5)	(34)
	Haveri	2005	99	100.0	0 (0.0)	12 (12.1)	32 (32.3)	55 (55.6)	(34)
	Udupi	2005	84	>200.0	0 (0.0)	1 (1.2)	6 (7.1)	77 (91.7)	(34)
	Dakshina Kannada	2005	97	70.0	17 (17.5)	8 (8.2)	42 (43.3)	30 (30.9)	(34)
	Chikmagalur	2005	100	150.0	2 (2.0)	5 (5.0)	19 (19.0)	74 (74.0)	(34)
	Gulbarga	2005	94	70.0	4 (4.3)	19 (20.2)	43 (45.7)	28 (29.8)	(34)
	Belgaum	2005	100	100.0	1 (1.0)	13 (13.0)	28 (28.0)	58 (58.0)	(34)
	Uttara Kannada	2005	100	100.0	11 (11.0)	15 (15.0)	21 (21.0)	53 (53.0)	(34)
	Bijapur	2005	76	85.0	9 (11.8)	0 (0.0)	32 (42.1)	35 (46.1)	(34)
	Raichur	2005	93	120.0	0 (0.0)	3 (3.2)	21 (22.6)	69 (74.2)	(34)
	Bangalore (Urban)	2005	86	185.0	2 (2.3)	1 (1.2)	4 (4.7)	79 (91.9)	(34)
	Davangere	2005	90	52.0	19 (21.1)	17 (18.9)	19 (21.1)	35 (38.9)	(34)
	Chitradurga	2005	71	>200.0	8 (11.3)	0 (0.0)	4 (5.6)	59 (83.1)	(34)
	Tumkur	2005	97	100.0	0 (0.0)	5 (5.2)	29 (29.9)	63 (64.9)	(34)
	Kodagu	2005	96	30.0	25 (26.0)	34 (35.4)	21 (21.9)	16 (16.7)	(34)
	Bangalore (Rural)	2005	94	100.0	5 (5.3)	3 (3.2)	23 (24.5)	63 (67.0)	(34)
	Madya	2005	98	120.0	0 (0.0)	2 (2.0)	30 (30.6)	66 (67.3)	(34)
	Bellary	2005	95	65.0	5 (5.3)	14 (14.7)	44 (46.3)	32 (33.7)	(34)
	Koppal	2005	86	100.0	3 (3.5)	4 (4.7)	24 (27.9)	55 (64.0)	(34)
	Kolar	2005	101	95.0	2 (2.0)	7 (6.9)	48 (47.5)	44 (43.6)	(34)
Kerala	Kottayam	2002	251	175.0	16 (16.4)	15 (6.0)	52 (20.7)	168 (66.9)	(35)

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State	Name of the district	Year	No. of urine samples	Median (µg/l)	Urinary iodine excretion levels (µg/l)				Ref
					<20.0	20.0-49.9	50.0-99.9	≥100.0	
	Ernakulam	2003	210	143	5 (2.5)	23 (11.1)	49 (23.5)	132 (62.9)	(9)
	Wayanad	2003	210	90	12 (5.7)	70 (33.3)	26 (12.4)	102 (48.6)	(9)
	Alappuza	2006	94	100.0	6 (6.4)	4 (4.3)	31 (33.0)	53 (56.4)	(36)
	Idduki	2006	72	55.0	15 (20.8)	15 (20.8)	27 (37.5)	15 (20.8)	(36)
	Kottayam	2006	99	85.0	7 (7.1)	24 (24.2)	19 (19.2)	49 (49.5)	(36)
	Calicut	2006	56	120.0	1 (1.8)	3 (5.4)	12 (21.4)	40 (71.4)	(36)
	Malappuram	2006	88	150.0	8 (9.1)	12 (13.6)	12 (13.6)	56 (63.6)	(36)
	Kannur	2006	90	150.0	0 (0.0)	0 (0.0)	0 (0.0)	90 (100.0)	(36)
	Kasargod	2006	92	75.0	34 (37.0)	3 (3.3)	22 (23.9)	33 (35.9)	(36)
	Wyanad	2006	98	100.0	8 (8.2)	7 (7.1)	29 (29.6)	54 (55.1)	(36)
Madhya Pradesh	Jabalpur	2001	1205	80-150	NA	NA	135 (11.2)	1069 (88.7)	(37)
Maharashtra	Raigarh	2001	2092	100	NA	NA	NA	NA	(8)
	Sindhdurg	2003	210	125	15 (7.1)	22 (10.5)	48 (22.9)	125 (59.5)	(9)
	Kolhapur	2003	209	65	49 (23.3)	28 (13.2)	64 (30.7)	69 (32.8)	(9)
	Nagpur	2010	109	215.0	NA	NA	NA	NA (	(38)
Manipur	Bishnupur	2001	2076	106	NA	NA	NA	NA)	(8)
	Imphal	2003	120	125		NA	NA	NA	(39)
	Bishnupur	2003	210	185	2 (1.0)	16 (7.6)	34 (16.2)	158 (75.2)	(9)
	Chandel	2003	189	250	4 (2.1)	13 (6.9)	23 (12.2)	149 (78.8)	(9)
Mizoram	Aizwal	2003	210	161	2 (1.0)	7 (3.3)	33 (15.7)	168 (80.0)	(9)
	Chhintuipui	2003	210	170	1 (0.5)	12 (5.7)	34 (16.2)	163 (77.6)	(9)
Nagaland	Mon	2003	207	120	5 (2.4)	37 (17.9)	49 (23.7)	116 (56.0)	(9)
Orissa	Cuttack	2003	210	110	20 (9.5)	27 (12.9)	41 (19.5)	122 (58.1)	(9)
	Sundargarh	2003	208	103	25 (12.0)	27 (13.0)	50 (24.0)	106 (51.0)	(9)
	Puri	2004	145	125.0	2 (1.4)	8 (5.5)	33 (22.8)	102 (70.3)	(10)
	All Districts	2007	1200	85.4	NA	386 (32.2)	NA	NA	(40)
	Bhubaneswar	2007	411	50	NA	NA	352 (85.7)	NA	(41)
	Cuttack	2009	168	64.5	NA	125 (74.3)	NA	43 (25.7)	(42)
Pondicherry	Pondicherry	1998	187	145.0	3 (1.6)	6 (3.2)	45 (24.1)	133 (71.1)	(43)
	Kariakal	2004	80	150.0	0 (0.0)	3 (3.8)	9 (11.3)	68 (85.0)	(10)
	Yanam	2004	100	200.0	0 (0.0)	0 (0.0)	15 (15.0)	85 (85.0)	(10)
	Mahe	2004	100	65.0	5 (5.0)	27 (27.0)	34 (34.0)	34 (34.0)	(10)
	Pondicherry	2007	97	200.0	0 (0.0)	2 (2.1)	7 (7.2)	88 (90.7)	(44)
Punjab	Gurudaspur	2003	202	70	38 (18.8)	28 (13.9)	57 (28.2)	79 (39.1)	(9)
Rajasthan	Bikaner	1997	400	155.0	12 (3.0)	36 (9.0)	73 (18.0)	279 (70.0)	(45)
	Bikaner	2001	1824	118	NA	NA	NA	NA	(8)
	Bharatpur	2003	450	155.0	5 (1.1)	5 (1.1)	35 (7.8)	405 (90.0)	(46)
	Udaipur	2003	300	200	NA	NA	NA	NA	(47)
	Bikaner	2003	203	120	19 (9.4)	17 (8.4)	48 (23.6)	119 (58.6)	(9)
	Kota	2003	201	155	33 (16.4)	15 (7.5)	32 (15.9)	122 (60.2)	(9)
	All districts	2008	1200	139	NA	NA	NA	NA	(48)
Sikkim	E. Gangtok	2003	204	137	17 (8.3)	22 (10.8)	32 (15.7)	133 (65.2)	(9)
	N. Mangam	2003	200	57	51 (25.5)	27 (13.5)	56 (28.0)	66 (33.0)	(9)
Tamil Nadu	Dindigul	2003	210	145	5 (2.4)	19 (9.1)	36 (17.2)	150 (71.3)	(9)
	Trichy	2003	210	275	0.0 (0.0)	0.0 (0.0)	14 (6.7)	196 (93.3)	(9)
	Nagapattinam	2004	100	150.0	0 (0.0)	4 (4.0)	2 (2.0)	94 (94.0)	(49)
	Cuddalore	2004	100	>200.0	0 (0.0)	0 (0.0)	3 (3.0)	97 (97.0)	(49)
	Nilgiris	2004	56	180.0	0 (0.0)	4 (7.1)	6 (10.7)	46 (82.1)	(49)
	Coimbatore	2004	90	130.0	0 (0.0)	2 (2.2)	14 (15.6)	74 (82.2)	(49)
	Erode	2004	85	155.0	0 (0.0)	0 (0.0)	10 (11.8)	75 (88.2)	(49)
	Dindigul	2004	90	150.0	0 (0.0)	9 (10.0)	21 (23.3)	60 (66.7)	(49)
	Pudukkotai	2004	56	>200.0	0 (0.0)	1 (2.8)	3 (5.4)	52 (92.9)	(49)
	Thanjavur	2004	89	150.0	0 (0.0)	2 (2.2)	10 (11.2)	77 (86.5)	(49)
	Sivaganga	2004	63	155.0	0 (0.0)	0 (0.0)	8 (12.7)	55 (87.3)	(49)
	Perambalor	2004	157	85.0	13 (8.3)	31 (19.7)	35 (22.3)	78 (49.7)	(49)
	Trichy	2004	112	>200.0	1 (0.9)	0 (0.0)	2 (1.8)	109 (97.3)	(49)
	Karur	2004	110	180.0	0 (0.0)	1 (0.9)	7 (6.4)	102 (92.7)	(49)
	Madurai	2004	107	>200.0	2 (1.9)	0 (0.0)	3 (2.8)	102 (95.3)	(49)
	Salem	2004	98	180.0	0 (0.0)	2 (2.0)	14 (14.3)	82 (83.7)	(49)
	Namakkal	2004	98	>200.0	0 (0.0)	0 (0.0)	4 (4.1)	94 (95.9)	(49)

Table 1 (Contd...)

Table 1 (Contd...)

State	Name of the district	Year	No. of urine samples	Median (µg/l)	Urinary iodine excretion levels (µg/l)				Ref
					<20.0	20.0-49.9	50.0-99.9	≥100.0	
	Kancheepuram	2004	88	>200.0	3 (3.4)	0 (0.0)	1 (1.1)	84 (95.5)	(49)
	Thiruvannamalai	2004	72	120.0	0 (0.0)	4 (5.6)	22 (30.6)	46 (63.9)	(49)
	Villupuram	2004	67	100.0	1 (1.5)	1 (1.5)	21 (31.3)	44 (65.7)	(49)
	Dharmapuri	2004	70	195.0	1 (1.4)	1 (1.4)	6 (8.6)	62 (88.6)	(49)
	Vellore	2004	80	150.0	0 (0.0)	0 (0.0)	14 (17.5)	66 (82.5)	(49)
	Tiruvallore	2004	92	>200.0	0 (0.0)	0 (0.0)	2 (2.2)	90 (97.8)	(49)
	Tiruvarur	2004	94	>200.0	0 (0.0)	1 (1.0)	15 (16.0)	78 (83.0)	(49)
Tripura	North Tripura	2002	1123	>100.0	NA	NA	NA	NA	(50)
	Tripura	2004	133	175.0	0 (0.0)	19 (14.3)	27 (20.3)	87 (65.4)	(10)
Uttrakhand	Udham Singh Nagar	2000	770	98	23 (3)	66 (8.6)	231 (30)	NA	(51)
	Dehradun	2001	1617	127	NA	NA	NA	NA	(8)
	Nainital	2003	194	110	15 (7.7)	30 (15.5)	43 (22.2)	106 (54.6)	(9)
	Pauri	2004	100	175.0	2 (2.0)	2 (2.0)	13 (13.0)	83 (83.0)	(10)
	Pithoragarh	2004	154	200.0	0 (0.0)	2 (1.2)	17 (11.4)	135 (87.6)	(10)
	Uttar Kashi	2004	61	200.0	6 (9.8)	2 (3.2)	7 (11.4)	46 (75.4)	(10)
Uttar Pradesh	Lakhimpur Kheri	2001	2003	90	NA	NA	NA	NA	(8)
	Badaun	2001	1978	118	NA	NA	NA	NA	(8)
	Mainpuri	2001	1050	90	NA	NA	NA	NA	(8)
	Shahjhanpur	2003	182	75	9 (4.9)	21 (11.5)	87 (47.8)	65 (35.7)	(9)
	Shahranpur	2003	135	75	5 (3.7)	33 (24.4)	48 (35.6)	49 (36.3)	(9)
	Meerut	2004	710	150.0	38 (5.4)	21 (2.9)	142 (20.2)	509 (71.7)	(10)
	Saharanpur	2004	192	200.0	1 (0.4)	5 (2.6)	12 (6.2)	174 (90.6)	(10)
	Bareilly	2004	82	102.0	11 (13.4)	18 (21.9)	10 (12.3)	45 (52.4)	(10)
	Agra	2004	92	175.0	0 (0.0)	0 (0.0)	10 (10.8)	82 (89.1)	10
	Kanpur	2004	72	105.0	1 (1.4)	2 (2.8)	25 (34.7)	44 (61.1)	(10)
	Lakhimpur	2004	128	50.0	18 (14.1)	18 (14.1)	39 (30.4)	53 (41.4)	(10)
	Lalitpur	2004	109	135.0	0 (0.0)	10 (9.3)	28 (25.7)	61 (55.9)	(10)
	Sidharth Nagar	2004	148	100.0	15 (10.1)	13 (8.8)	37 (25.0)	83 (56.1)	(10)
	Padrona	2004	80	200	0 (0.0)	0 (0.0)	5 (6.2)	75 (93.8)	(10)
	Sultanpur	2004	103	100.0	1 (1.0)	13 (12.6)	37 (35.9)	52 (50.5)	(10)
	Gorakhpur	2004	147	150.0	7 (4.8)	3 (2.0)	17 (11.6)	120 (81.6)	(10)
	Varanasi	2004	107	100.0	8 (16.8)	0 (0.0)	30 (28.0)	59 (55.1)	(10)
	Meerut	2004	710	150.0	8 (5.4)	21 (2.9)	142 (20.0)	509 (71.7)	(10)
	Sidharth Nagar	2009	240	60.0	42 (17.5)	NA	NA	NA	(52)
	Gonda	2010	1236	100.0	99 (8.0)	155 (12.5)	337 (27.3)	645 (52.2)	(53)
West Bengal	Darjeeling	2003	206	110	10 (4.9)	13 (6.3)	67 (32.5)	116 (56.3)	(9)
	Jalpaiguri	2003	208	120	21 (10.1)	29 (9.1)	34 (16.3)	134 (64.4)	(9)
	South 24 Parganas	2005	520	225	NA	NA	NA	NA	(54)
	Dakshin Dinajpur	2005	2250	16	372 (16.5)	NA	NA	NA	(55)
	North 24 Parganas	2006	363	160	NA	NA	10 (6.0)	150 (94.0)	(56)
	Purulia	2006	2400	92.5	759 (31.6)	NA	NA	NA	(57)
	Howrah	2008	200	250	NA	NA	NA	NA	(58)

traders and food inspectors in the states (the implementers of PFA) for smooth procurement, distribution and sale of IS.

iv) There are three states which have not implemented the ban notification in all the districts on sale of non-IS. This is helping the sale of non-IS. There is need of implementing complete ban in the entire state.

v) There is a need of undertaking regular periodic surveys for monitoring of UIE levels and assessing the iodine contents of salt. This would help in identifying the areas with poor iodine content of salt and initiating the remedial measures.

vi) In southern states that have high level of literacy but there is resistance for the consumption of IS, qualitative research is required for identification of points of resistance toward consumption of IS.

IS versus iodized oil in the prevention of IDD

The inexpensive technology, a time-honored and time-tested one, for the control of IDD is the iodization of common salt. Programs for IDD control must rest squarely and socially on this technology. Periodic parenteral administration of iodated oil (not presently manufactured in India) at times is suggested as an alternative approach, especially in areas inaccessible to common salt. It is difficult to imagine any area in India, which is now inaccessible to common salt but readily accessible to disposable syringes and to an army of "injectors". There has been a steep rise in the HIV seropositivity rate and hepatitis "B" carriers in India during the last few years. The consequences of resorting to a technology that is dependent on repeated injections could increase the

Table 2: Iodine content of salt samples collected at beneficiary level in selected districts of India

State	Name of the district	Year	No. of salt samples	Iodine content of salt (ppm)		Ref
				<15	15 ppm and more	
Assam	Dibrugarh	2001	300	170 (56.7)	130 (43.3)	(8)
	Nagaon	2001	691	2 (0.3)	689 (99.7)	(8)
	Dibrugarh	2003	211	39 (18.5)	172 (81.5)	(9)
	Dubri	2003	210	72 (34.3)	138 (65.7)	(9)
	Changlong	2003	196	98 (50.0)	98 (50.0)	(9)
Andaman and Nicobar	Andaman and Nicobar	2004	211	27 (12.8)	184 (87.2)	(10)
Andhra Pradesh	Mehboob Nagar	2001	172	164 (95.3)	8 (4.7)	(8)
	Adilabad	2003	210	155 (73.8)	55 (26.2)	(9)
	E. Godavari	2003	210	190 (90.5)	20 (9.5)	(9)
	Vijayanagram	2004	211	165 (78.2)	46 (21.8)	(11)
	Srikakulam	2004	205	178 (86.8)	27 (13.2)	(11)
	East Godavari District	2004	152	142 (93.4)	10 (6.6)	(11)
	West Godavari District	2004	148	127 (85.6)	21 (14.2)	(11)
	Guntur	2004	150	103 (68.7)	47 (31.3)	(11)
	Prakasam	2004	150	136 (90.6)	14 (9.3)	(11)
	Warangal	2004	158	136 (86.1)	22 (14.0)	(11)
	Adilabad	2004	155	105 (67.3)	51 (32.7)	(11)
	Kurnool	2004	106	97 (91.5)	9 (8.4)	(11)
	Mehboob Nagar	2004	116	103 (88.8)	13 (11.2)	(11)
	Chittor	2004	183	145 (79.2)	38 (20.8)	(11)
	Nellore	2004	119	116 (97.4)	3 (2.5)	(11)
	Krishna	2004	150	113 (75.3)	37 (24.6)	(11)
	Khammam	2004	150	112 (74.7)	38 (25.3)	(11)
	Nalgonda	2004	150	131 (87.3)	19 (12.6)	(11)
	Karim Nagar	2004	150	79 (52.6)	71 (47.4)	(11)
	Medak	2004	150	98 (65.4)	52 (34.7)	(11)
	Hyderabad	2004	200	118 (58.7)	82 (40.8)	(11)
	Nizamabad	2004	200	156 (78.0)	44 (22.0)	(11)
	Rangareddy	2004	204	196 (96.1)	8 (3.9)	(11)
	Anatpur	2004	155	147 (90.8)	8 (5.1)	(11)
	Cuddapah	2004	155	137 (88.3)	18 (11.6)	(11)
	Vishakapatnam	2004	205	195 (95.0)	10 (4.9)	(11)
Bihar	West Champaran	1997	164	108 (65.9)	56 (34.1)	(12)
	East Champaran	1997	292	78 (26.7)	214 (73.3)	(12)
	Munger	1998	198	40 (20.2)	216 (79.8)	(13)
	Muzafarpur	1998	210	42 (20.0)	168 (80.0)	(13)
	Vaishali	1998	188	32 (17.0)	156 (83.0)	(13)
	Sahibganj	1998	345	273 (79.1)	72 (20.9)	(13)
	Gaya	2001	288	281 (97.6)	7 (2.4)	(8)
	Patna	2001	764	398 (52.1)	366 (47.9)	(8)
	W. Champaran	2003	210	103 (49.0)	107 (51.0)	(9)
	Palamu	2004	102	56 (54.9)	46 (45.1)	(10)
	All Districts	2006	1169	700 (59.9)	469 (40.1)	(7)
Chattisgarh	Shahdol	2003	205	150 (73.2)	55 (26.8)	(9)
	Sarguja	2003	239	164 (68.6)	75 (31.4)	(9)
Delhi	Delhi	2004	1307	455 (34.8)	852 (65.2)	(16)
	Delhi	2005	1854	785 (42.3)	1069 (57.7)	(17)
	Delhi	2010	1230	138 (11.2)	1092 (88.8)	(19)
Goa	Goa	1996	133	94 (70.9)	39 (29.1)	(13)
Gujarat	Surat	2003	208	151 (72.6)	57 (27.4)	(9)
	Valsad	2003	209	145 (69.3)	64 (30.7)	(9)
	Panchmahal	2007	15900	7266 (45.7)	8634 (54.3)	(20)

Table 2 (Contd...)

Table 2 (Contd...)

State	Name of the district	Year	No. of salt samples	Iodine content of salt (ppm)		Ref
				<15	15 ppm and more	
	Saurashtra	2010	840	160 (19)	680 (81)	(20)
Haryana	Sonepat	2003	210	40 (19.1)	170 (80.9)	(9)
	Ambala	2009	139	47 (34.0)	92 (66.0)	(22)
	Bhiwani	2009	94	66 (70.0)	28 (30.0)	(22)
	Faridabad	2009	135	73 (54.0)	62 (46.0)	(22)
	Gurgaon	2009	249	38 (15.3)	211 (84.7)	(22)
	Hissar	2009	152	122 (80.0)	30 (20.0)	(22)
	Jind	2009	149	106 (70.0)	43 (30.0)	(22)
	Kaithal	2009	239	98 (41.0)	141 (59.0)	(22)
	Karnal	2009	77	24 (31.0)	53 (69.0)	(22)
	Kurukshetra	2009	174	53 (30.0)	121 (70.0)	(22)
	Mahendergarh	2009	174	147 (84.5)	27 (15.5)	(22)
	Panipat	2009	185	18 (10.0)	167 (90.0)	(22)
	Rewari	2009	93	49 (52.7)	44 (47.3)	(22)
	Rohtak	2009	664	388 (52.5)	276 41.5)	(22)
	Sirsa	2009	146	94 (66.4)	52 (35.6)	(22)
	Sonepat	2009	188	41 (22.0)	147 (78.0)	(22)
	Yamuna Nagar	2009	142	36 (25.0)	106 75.0)	(22)
Himachal Pradesh	Hamirpur	1996	242	390 (13.3)	217 (89.6)	(24)
	Kangra	1997	372	87 (23.0)	285 (77.0)	(23)
	Kinnaur	1998	242	25 (10.3)	217 (89.6)	(25)
	Solan	1999	1481	395 (26.7)	1086 (73.3)	(26)
	Kangra	2000	746	49 (6.6)	697 (93.4)	(28)
	Mandi	2001	293	103 (35.2)	190 (64.8)	(8)
	Shimla	2003	204	70 (34.2)	134 (65.8)	(9)
	Kullu	2003	204	50 (24.5)	154 (75.5)	(9)
	Kullu	2005	113	17 (15.0)	96 (84.9)	(29)
	Mandi	2005	191	40 (21.0)	151 (79.1)	(29)
	Una	2005	245	70 (28.5)	175 (71.4)	(29)
	Kinnaur	2005	203	9 (4.4)	194 (95.6)	(29)
	Kullu	2005	214	29 (13.5)	185 (86.4)	(29)
	Shimla	2005	179	22 (12.3)	157 (87.7)	(29)
	Lahol Spiti	2005	201	61 (30.4)	140 (69.7)	(29)
	Solan	2005	220	29 (13.2)	191 (86.8)	(29)
	Kangra	2005	241	30 (12.4)	211 (87.6)	(29)
	Hamirpur	2005	217	46 (21.2)	171 (78.8)	(29)
	Sirmour	2005	193	41 (20.4)	152 (78.8)	(29)
	Chamba	2005	214	60 (28.0)	154 (72.0)	(29)
	Bilaspur	2005	207	19 (9.2)	188 (90.8)	(29)
	Kangra	2007	1175	149 (12.7)	1026 (87.3)	(30)
Jharkhand	Palamu	2003	210	163 (77.6)	47 (22.4)	(9)
	Entire State	2008	1150	411 (35.8)	739 (64.2)	(31)
Jammu and Kashmir	Baramulla	2000	300	52 (17.3)	248 (82.7)	(8)
	Srinagar	2001	298	52 (17.4)	246 (82.6)	(8)
	Kupwara	2003	208	62 (29.8)	146 (70.2)	(9)
	Jammu	2008	99	2 (1.9)	97 (98.1)	(32)
Karnataka	Manipal	2002	722	373 (51.7)	349 (48.3)	(33)
	Chickmagalur	2003	210	133 (63.3)	77 (36.7)	(9)
	Bangalore	2003	210	160 (76.2)	50 (23.8)	(9)
	Wayanad	2003	210	90 (42.9)	120 (57.1)	(9)
	Shimoga	2005	165	126 (76.3)	39 (23.6)	(34)
	Dharwad	2005	150	99 (66.0)	51 (34.0)	(34)

Table 2 (Contd...)

Table 2 (Contd...)

State	Name of the district	Year	No. of salt samples	Iodine content of salt (ppm)		Ref
				<15	15 ppm and more	
	Haveri	2005	150	140 (93.3)	10 (6.7)	(34)
	Udupi	2005	149	126 (84.5)	23 (15.4)	(34)
	Dakshina Kannada	2005	151	133 (88.1)	18 (12.0)	(34)
	Chikmagalur	2005	150	101 (67.3)	47 (32.7)	(34)
	Gulbarga	2005	150	150 (100.0)	0 (0.0)	(34)
	Belgaum	2005	200	169 (84.5)	31 (13.5)	(34)
	Uttara Kannada	2005	201	212 (90.1)	20 (10.0)	(34)
	Bijapur	2005	190	174 (91.5)	16 (8.4)	(34)
	Raichur	2005	153	150 (98.1)	3 (2.0)	(34)
	Bangalore (Urban)	2005	178	104 (58.5)	74 (41.6)	(34)
	Davangere	2005	156	151 (96.8)	5 (3.2)	(34)
	Chitradurga	2005	156	102 (65.4)	54 (34.6)	(34)
	Tumkur	2005	150	147 (98.0)	3 (2.0)	(34)
	Kodagu	2005	150	124 (82.7)	26 (17.3)	(34)
	Bangalore (Rural)	2005	163	116 (71.1)	47 (28.4)	(34)
	Madya	2005	154	121 (78.6)	33 (21.4)	(34)
	Hassan	2005	152	146 (96.1)	6 (3.9)	(34)
	Mysore	2005	152	112 (73.6)	40 (26.3)	(34)
	Bellary	2005	152	148 (97.3)	4 (2.6)	(34)
	Koppal	2005	152	146 (96.1)	6 (3.9)	(34)
	Chamaraja Nagar	2005	158	137 (86.7)	21 (13.3)	(34)
	Kolar	2005	150	142 (94.7)	8 (5.3)	(34)
Kerala	Palghat	1997	149	69 (46.2)	80 (53.7)	(13)
	Ernakulam	1998	199	22 (11.0)	177 (89.0)	(13)
	Kottayam	2002	420	165 (39.2)	255 (60.6)	(35)
	Ernakulam	2003	210	139 (66.2)	71 (33.8)	(9)
	Kollam	2006	155	58 (37.5)	97 (62.6)	(36)
	Pathanmthita	2006	146	66 (45.2)	80 (54.8)	(36)
	Alappuza	2006	148	78 (52.7)	70 (47.3)	(36)
	Idduki	2006	152	103 (67.8)	49 (32.2)	(36)
	Kottayam	2006	153	76 (49.7)	77 (50.4)	(36)
	Trissur	2006	150	91 (60.6)	59 (39.3)	(36)
	Palakkad	2006	151	133 (48.0)	18 (11.9)	(36)
	Ernakulum	2006	156	109 (69.8)	47 (30.2)	(36)
	Calicut	2006	146	67 (45.9)	79 (54.1)	(36)
	Malappuram	2006	150	6 (4.0)	144 (96.0)	(36)
	Kannur	2006	153	102 (66.7)	51 (33.3)	(36)
	Kasargod	2006	149	121 (81.2)	28 (18.7)	(36)
	Wyanad	2006	146	108 (74.0)	38 (26.0)	(36)
	Thiruvantha-puram	2006	156	70 (44.8)	86 (55.2)	(36)
Madhya Pradesh	Bastar	1996	201	58 (28.9)	143 (71.1)	(13)
	Dhar	1996	168	47 (28.0)	121 (72.0)	(13)
	Gwalior	1996	321	62 (19.3)	259 (80.6)	(13)
	Ratlam	1996	199	131 (37.7)	124 (62.3)	(13)
	Shahdol	1996	153	37 (24.1)	116 (93.8)	(13)
	Vidisha	1996	169	79 (46.5)	90 (53.2)	(13)
	Indore	1996	212	96 (45.3)	116 (75.8)	(13)
	Morena	1996	185	88 (47.6)	57 (52.4)	(13)
	Sidhi	1996	168	82 (48.8)	86 (51.2)	(13)
	Sihore	1996	216	77 (35.6)	139 (64.4)	(13)
Maharashtra	Raigarh	2001	300	182 (60.7)	118 (39.3)	(8)
	Sindhdurg	2003	240	113 (47.1)	127 (52.9)	(9)

Table 2 (Contd...)

Table 2 (Contd...)

State	Name of the district	Year	No. of salt samples	Iodine content of salt (ppm)		Ref
				<15	15 ppm and more	
	Kolhapur	2003	197	116 (58.9)	81 (41.1)	(9)
Manipur	Bishnupur	2001	651	14 (2.2)	637 (97.8)	(8)
	Bishnupur	2003	210	11 (5.5)	199 (94.8)	(9)
	Chandel	2003	189	16 (8.4)	173 (91.6)	(9)
	Imphal	2003	105	19 (18)	86 (82)	(9)
Mizoram	Aizwal	2003	210	26 (12.4)	184 (87.6)	(9)
	Chhintuipui	2003	210	71 (33.8)	139 (66.2)	(9)
Nagaland	Mon	2003	210	167 (79.5)	43 (20.5)	(9)
Orissa	Cuttack	2003	210	162 (77.1)	48 (22.9)	(9)
	Sundergarh	2003	210	163 (77.6)	47 (22.4)	(9)
	All Districts	2007	1200	660 (55)	540 (45)	(40)
	Bhubaneswar	2007	368	180 (49)	188 (51)	(41)
	Cuttack	2009	336	134 (39.9)	202 (60.1)	(42)
Pondicherry	Pondicherry	1998	201	138 (68.6)	63 (31.4)	(43)
	Kariakal	2004	150	147 (98.0)	3 (2.0)	(10)
	Yanam	2004	150	129 (86.0)	21 (14.0)	(10)
	Mahe	2004	150	81 (54.0)	69 (46.0)	(10)
	Pondicherry	2004	150	140 (93.4)	10 (6.6)	(10)
	Pondicherry	2007	290	214 (73.8)	76 (26.2)	(44)
Punjab	Amritasr	1998	170	79 (46.5)	34 (53.5)	(13)
	Bhatinda	1998	417	107 (25.6)	195 (66.8)	(13)
	Faridkot	1998	164	36 (22.0)	128 (78)	(13)
	Fatehgarh	1998	205	73 (35.6)	132 (64.4)	(13)
	Ferozpur	1998	196	59 (29.1)	137 (69.8)	(13)
	Gurdaspur	1998	199	43 (21.6)	156 (78.3)	(13)
	Hoshiarpur	1998	341	61 (17.9)	280 (82.1)	(13)
	Jalandhar	1998	201	47 (23.4)	157 (78.1)	(13)
	Kapurthala	1998	240	88 (36.7)	152 (63.3)	(13)
	Ludhiana	1998	201	31 (16.9)	167 (83.1)	(13)
	Mansa	1998	395	264 (66.9)	131 (33.2)	(13)
	Moga	1998	204	24 (11.8)	180 (88.2)	(13)
	Muktsar	1998	138	15 (10.9)	123 (89.1)	(13)
	Navashahar	1998	208	24 (11.5)	184 (88.4)	(13)
	Patiala	1998	144	97 (67.4)	47 (32.6)	(13)
	Ropar	1998	197	14 (7.1)	183 (92.9)	(13)
	Sangrur	1998	249	47 (18.9)	202 (81.2)	(13)
	Gurudaspur	2003	206	116 (56.3)	90 (43.7)	(9)
Rajasthan	Bikaner	1997	526	210 (39.9)	316 (60.1)	(45)
	Bikaner	2001	35	29 (82.9)	6 (17.1)	(8)
	Udaipur	2003	281	42 (15)	239 (85)	(47)
	Bikaner	2003	211	184 (87.2)	27 (12.8)	(9)
	Kota	2003	187	142 (75.9)	45 (24.1)	(9)
	All Districts	2008	1157	751 (64.9)	406 (35.1)	(48)
Sikkim	E. Gangtok	2003	210	64 (30.5)	146 (69.5)	(9)
	N. Mangam	2003	210	63 (30.0)	147 (70.0)	(9)
Tamil Nadu	Dindigul	2003	210	175 (83.3)	35 (16.7)	(9)
	Trichy	2003	210	189 (90.0)	21 (10.0)	(9)
	Nagapattinam	2004	150	149 (99.3)	1 (0.7)	(49)
	Cuddalore	2004	149	143 (95.9)	6 (4.1)	(49)
	Nilgiris	2004	150	113 (65.5)	37 (24.5)	(49)
	Coimbatore	2004	150	126 (84.1)	24 (15.9)	(49)
	Erode	2004	150	114 (76.2)	36 (23.8)	(49)
	Dindigul	2004	150	132 (88.0)	18 (12.0)	(49)
	Ramanathapuram	2004	140	126 (90.0)	14 (10.0)	(49)

Table 2 (Contd...)

Table 2 (Contd...)

State	Name of the district	Year	No. of salt samples	Iodine content of salt (ppm)		Ref
				<15	15 ppm and more	
	Pudukkotai	2004	151	122 (80.8)	29 (18.2)	(49)
	Thanjavur	2004	202	183 (90.6)	19 (9.4)	(49)
	Sivaganga	2004	180	108 (60.0)	72 (40.0)	(49)
	Perambalor	2004	150	133 (88.7)	17 (11.3)	(49)
	Villupuram	2004	181	177 (97.8)	4 (2.2)	(49)
	Trichy	2004	157	110 (70.1)	47 (29.9)	(49)
	Karur	2004	200	138 (69.0)	62 (31.0)	(49)
	Madurai	2004	150	145 (96.6)	5 (3.3)	(49)
	Salem	2004	200	167 (83.5)	33 (16.5)	(49)
	Namakkal	2004	207	145 (70.0)	62 (30.0)	(49)
	Kancheepuram	2004	200	169 (84.5)	31 (15.9)	(49)
	Thiruvannamalai	2004	162	157 (96.9)	5 (3.1)	(49)
	Virudunagar	2004	160	156 (97.5)	4 (2.5)	(49)
	Dharmapuri	2004	100	80 (80.0)	20 (20.0)	(49)
	Vellore	2004	130	113 (87.0)	17 (13.1)	(49)
	Tiruvallore	2004	170	104 (61.2)	26 (38.8)	(49)
	Tiruvarur	2004	150	148 (98.7)	2 (1.3)	(49)
Tripura	Tripura	2002	1123	375 (33.4)	748 (66.6)	(50)
	Tripura	2004	60	36 (60.0)	24 (40.0)	(10)
Uttrakhand	Uttar Kashi	1998	255	33 (13.0)	222 (87.1)	(10)
	Pauri	1998	224	22 (10.0)	202 (90.1)	(10)
	Pithoragarh	1998	244	40 (16.4)	204 (83.6)	(10)
	Udham Singh Nagar	2000	736	168 (22.8)	568 (77.2)	(51)
	Dehradun	2001	300	58 (19.3)	242 (80.7)	(8)
	Nainital	2003	210	116 (55.2)	94 (44.8)	(9)
Uttar Pradesh	Lakhimpur Kheri	2001	298	276 (92.6)	22 (7.4)	(8)
	Mainpuri	2001	394	355 (90.1)	39 (9.9)	(8)
	Badaun	2001	797	484 (60.7)	313 (39.3)	(8)
	Saharanpur	2001	290	236 (81.4)	54 (18.6)	(59)
	Meerut	2001	205	140 (68.3)	65 (31.7)	(59)
	Meerut	2001	716	382 (53.4)	334 (46.6)	(59)
	Bareilly	2001	200	164 (82.0)	36 (18.0)	(59)
	Agra	2001	195	113 (57.9)	82 (42.0)	(59)
	Kanpur	2001	200	198 (99.0)	2 (1.0)	(59)
	Lakhimpur	2001	238	230 (96.6)	8 (3.3)	(59)
	Jhansi	2001	855	461 (53.9)	394 (46.0)	(59)
	Mahoba	2001	390	275 (70.5)	115 (29.5)	(59)
	Lalitpur	2001	202	146 (72.3)	56 (27.7)	(59)
	Sidharth Nagar	2001	184	126 (68.5)	58 (31.5)	(59)
	Padrona	2001	225	48 (21.3)	177 (78.6)	(59)
	Sultanpur	2001	179	120 (67.1)	59 (32.9)	(59)
	Gorakhpur	2001	212	38 (18.0)	174 (82.1)	(59)
	Varanasi	2001	288	220 (76.4)	68 (23.6)	(59)
	Shahjhanpur	2003	210	203 (96.6)	7 (3.4)	(9)
	Shahranpur	2003	209	154 (73.7)	55 (26.3)	(9)
	Sidharth Nagar	2009	210	174 (82.9)	36 (17.1)	(52)
	Gonda	2010	338	267 (79)	71 (21)	(53)
West Bengal	Darjeeling	2003	210	103 (49.0)	107 (51.0)	(9)
	Jalpaiguri	2003	209	115 (55.0)	94 (45.0)	(9)
	Dakshin Dinajpur	2004	2250	733 (32.6)	1517 (67.4)	(55)
	South 24 Parganas	2005	455	202 (44.4)	253 (55.6)	(54)
	North 24 Parganas	2006	363	109 (30)	254 (70)	(56)
	Purulia	2006	2400	1598 (66.6)	802 (33.4)	57
	Howrah	2008	175	53 (30)	122 (70)	58

Table 3: Percent distribution of households with salt tested for iodine content, by level of iodine in salt (parts per million), according to state, India, 2005-06:NFHS-3

State	Iodine Content of Salt			
	Non (0 ppm)	Inadequate (<15 ppm)	Adequate (15+ ppm	Total
India	23.9	25.0	51.1	100.0
North				
Delhi	8.1	5.9	86.0	100.0
Haryana	28.2	16.5	55.3	100.0
Himachal Pradesh	5.9	11.6	82.5	100.0
Jammu & Kashmir	9.5	14.7	75.8	100.0
Punjab	14.2	11.2	74.6	100.0
Rajasthan	36.7	22.5	40.8	100.0
Uttaranchal	29.0	25.1	45.9	100.0
Central				
Chhattisgarh	21.0	24.1	54.9	100.0
Madhya Pradesh	41.2	22.4	36.3	100.0
Uttar Pradesh	23.4	40.2	36.4	100.0
East				
Bihar	5.3	28.6	66.1	100.0
Jharkhand	7.3	39.1	53.6	100.0
Orissa	23.9	36.5	39.6	100.0
West Bengal	6.7	24.2	69.1	100.0
Northeast				
Arunachal Pradesh	1.2	15.2	83.6	100.0
Assam	2.8	25.4	71.8	100.0
Manipur	1.2	5.0	93.8	100.0
Meghalaya	2.9	15.2	81.9	100.0
Mizoram	1.2	12.9	85.9	100.0
Nagaland	2.2	14.5	83.3	100.0
Sikkim	2.9	18.8	78.3	100.0
Tripura	2.9	21.7	75.5	100.0
West				
Goa	22.7	12.5	64.8	100.0
Gujarat	27.9	16.4	55.7	100.0
Maharasthra	25.8	13.3	61.0	100.0
South				
Andhra Pradesh	40.0	29.0	31.0	100.0
Karnataka	34.0	22.7	43.3	100.0
Kerala	17.4	8.7	73.9	100.0
Tamilnadu	34.5	24.2	41.3	100.0

risk of transmission of HIV and hepatitis B and is not recommended.

Conclusion

The sustainability of activities of NIDDCP is vital for achieving elimination of IDD. The subjects with large goiter are no more seen. The hidden consequences like neonatal hypothyroidism in specific areas may possibly continue. There is a need of undertaking IDD surveys to assess the current incidence of neonatal hypothyroidism. There is a need to give more emphasis on impact of ID on loss of IQ points in school children and their poor scholastic performance.

Table 4: States undertaking distribution of iodized salt through public distribution system

Name of the state	Price per Kg at which sold (Rs)	Variety of salt
Andhra Pradesh	4.00	Powder-Refined
	3.00	Crystal Iodised - Unrefined
Sikkim	2.90	Crushed unpacked
Karnataka	3.00	Crystal 1 Kg pouch
Tripura	3.50	Crushed 1 Kg pouch
Arunachal Pradesh	3.15	Crushed 1 Kg pouch
Gujarat	0.50*	Powder 1 Kg pocuh
Orissa	1.80	Crushed unpacked
	3.80-5.40	Powder 1 kg pouch
Himachal Pradesh	5.50	Refined Powder 1 kg Pouch
Haryana	3.50	Powder 1 kg pouch
Chhattisgarh	0.25**	Powder 1 kg pouch
Assam	4.70	Crushed 1 kg pouch
	3.50	Crushed unpacked
Tamilnadu	2.50	Crystal 1 Kg Pouch
Rajasthan	Free of cost***	Crushed 1kg packed
Jarkhand	0.25	Crushed Polypack
Uttar Pradesh	3.50	Powered in 1 kg pack

*Supplied to Tribal population under PDS. **Supplied to BPL population under PDS. ***Supplied free of cost to BPL population and Antyodaya families residing in the Scheduled Area of Udaipur, Banswara, Dungarpur, Sirohi, Chittorgarh districts and Saharia Project Area of Baran District of Rajasthan

IDD is a nutritional deficiency that primarily results from deficiency of iodine in soil and water. IDD can therefore re-emerge at any time after its elimination, if program success is not sustained. There is evidence that ID is returning to some countries where it had been eliminated in the past. Hence, we need continued efforts for all time to come in the future.

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