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. 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.

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.

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

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).

**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].

**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
| State       | Name of the district | Year | No. of urine samples | Median (μg/l) | Ref |
|------------|----------------------|------|----------------------|---------------|-----|
| Assam      | Dibrugarh            | 2001 | 2040                 | 115           | NA  |
|            |                      | 2003 | 210                  | 167           | (98.6) |
| Nagaon     |                      | 2001 | 1836                 | 115           | NA  |
| Dibrugarh  |                      | 2003 | 210                  | 12 (5.7)      | (98.6) |
|            |                      |      |                      | 13 (6.2)      |       |
| Dubri      |                      | 2003 | 210                  | 4 (1.9)       | 26 (12.4) |
|            |                      |      |                      | 10 (4.8)      | 159 (75.7) |
| Changlong  |                      | 2003 | 193                  | 110           | 151 (75.7) |
| Andaman    | Andaman and Nicobar  | 2004 | 154                  | 200.0         | 140 (90.9) |
| Andhra     | Meboobnagar          | 2001 | 1748                 | 150           | NA  |
| Pradesh    |                      | 2003 | 210                  | 140           | (98.6) |
| Adilabad   |                      | 2003 | 101                  | 125            | 139 (66.1) |
| E. Godavari|                      | 2003 | 110                  | 4 (3.3)       | 51 (20.4) |
| Vijayanagram|                   | 2004 | 21                   | >200.0        | 151 (75.7) |
| Srikakulam |                      | 2004 | 33                   | >200.0        | 140 (90.9) |
| East Godavari|                | 2004 | 102                  | >200.0        | 140 (90.9) |
| West Godavari|                | 2004 | 70                   | >200.0        | 140 (90.9) |
| Guntur     |                      | 2004 | 120                  | >200.0        | 140 (90.9) |
| Prakasam   |                      | 2004 | 102                  | 150.0         | 140 (90.9) |
| Warangal   |                      | 2004 | 100                  | >200.0        | 140 (90.9) |
| Adilabad   |                      | 2004 | 101                  | 125.0         | 140 (90.9) |
| Kurnool    |                      | 2004 | 103                  | 130.0         | 140 (90.9) |
| Meboobnagar|                      | 2004 | 100                  | 150.0         | 140 (90.9) |
| Chittor    |                      | 2004 | 100                  | 100.0         | 140 (90.9) |
| Nellore    |                      | 2004 | 93                   | >200.0        | 140 (90.9) |
| Krishna    |                      | 2004 | 96                   | >200.0        | 140 (90.9) |
| Khammam    |                      | 2004 | 100                  | 200.0         | 140 (90.9) |
| Hyderabad  |                      | 2004 | 174                  | 150.0         | 140 (90.9) |
| Nizamabond |                      | 2004 | 200                  | 150.0         | 140 (90.9) |
| Rangareddy |                      | 2004 | 107                  | 65.0          | 140 (90.9) |
| Anapur     |                      | 2004 | 98                   | 100.0         | 140 (90.9) |
| Cuddapah   |                      | 2004 | 97                   | 90.0          | 140 (90.9) |
| Vishkapatnam|                    | 2004 | 35                   | >200.0        | 140 (90.9) |
| Bihar      | West Champaran       | 1997 | 123                  | 100.0         | 140 (90.9) |
| East Champaran|                | 1998 | 100.0                | 12 (6.2)      | 140 (90.9) |
| Sahibganj  |                      | 1998 | 136                  | 90.0          | 140 (90.9) |
| Palamu     |                      | 1998 | 159                  | 160.0         | 140 (90.9) |
| Gaya       |                      | 2001 | 1802                 | 90            | 140 (90.9) |
| Patna      |                      | 2001 | 1671                 | 109           | 140 (90.9) |
| West Champaran|                | 2003 | 206                  | 110           | 140 (90.9) |
| Palamu     |                      | 2003 | 209                  | 120           | 140 (90.9) |
| All Districts|                  | 2006 | 1169                 | 85.6          | 140 (90.9) |
| Chattisgarh| Shahdol              | 2003 | 205                  | 50            | 140 (90.9) |
|            | Sarguja              | 2003 | 210                  | 113           | 140 (90.9) |
| Delhi      |                      | 1996 | 1652                 | 170.0         | 140 (90.9) |
| Delhi      |                      | 2004 | 682                  | 150.0         | 140 (90.9) |
| Delhi      |                      | 2005 | 749                  | 150.0         | 140 (90.9) |
| Delhi      |                      | 2010 | 1230                 | 198.4         | 140 (90.9) |
| Delhi      |                      | 2010 | 997                  | 352.8         | 140 (90.9) |
| Gujarat    | Surat                | 2003 | 209                  | 90            | 140 (90.9) |
| Valsad     |                      | 2003 | 209                  | 70            | 140 (90.9) |
| Panchmahal |                      | 2007 | 15900                | 70            | 140 (90.9) |
| Saurashtra|                      | 2010 | 2010                 | 420           | 140 (90.9) |
| Haryana    | Sonepat              | 2003 | 207                  | 150           | 140 (90.9) |
| Sonipat    |                      | 2009 | 152                  | 200           | 140 (90.9) |
| Panipat    |                      | 2009 | 190                  | 150           | 140 (90.9) |
| Karnal     |                      | 2009 | 152                  | 200           | 140 (90.9) |
| Yamuna Nagar|                    | 2009 | 152                  | 210           | 140 (90.9) |
| Kurukshetra|                      | 2009 | 152                  | 200           | 140 (90.9) |
| Ambala     |                      | 2009 | 152                  | 200           | 140 (90.9) |
| Panchkula  |                      | 2009 | 151                  | 210           | 140 (90.9) |
| Kaithal    |                      | 2009 | 168                  | 200           | 140 (90.9) |
| Jind       |                      | 2009 | 152                  | 210           | 140 (90.9) |
| Sirsa      |                      | 2009 | 202                  | 150           | 140 (90.9) |
| Fatehabad  |                      | 2009 | 152                  | 200           | 140 (90.9) |

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 |
|---------------------|----------------------|------|----------------------|--------------|----------------------------------------|-----|
| Karnataka           | Manipal              | 2002 | <100                 |              | <20.0                                  |     |
|                     | Chickmagalur         | 2003 | 210                  | 0.0 (0.0)    | 22 (10.5)                              | 145 (68.9) |
|                     | Bangalore            | 2003 | 210                  | 1 (0.5)      | 26 (12.4)                              | 136 (64.7) |
|                     | Shimoga              | 2005 | 30                   | 30 (31.3)    | 23 (24.0)                              | 10 (10.4) |
|                     | Dharwad              | 2005 | 99                   | 100.0        | 3 (3.0)                                | 51 (51.5) |
|                     | Haveri               | 2005 | 99                   | 100.0        | 12 (12.1)                              | 55 (55.6) |
|                     | Udupi                | 2005 | 84                   | >200.0       | 0 (0.0)                                | 77 (91.7) |
|                     | Dakshina Kannada     | 2005 | 97                   | 70.0         | 17 (17.5)                              | 30 (30.9) |
|                     | Chikmagalur          | 2005 | 100                  | 5.0 (5.0)    | 19 (19.0)                              | 74 (74.0) |
|                     | Gulbarga             | 2005 | 94                   | 7.0 (4.3)    | 19 (20.2)                              | 28 (29.8) |
|                     | Belgaum              | 2005 | 100                  | 1 (1.0)      | 13 (13.0)                              | 58 (58.0) |
|                     | Uttara Kannada       | 2005 | 100                  | 11 (11.0)    | 15 (15.0)                              | 53 (53.0) |
|                     | Bijapur              | 2005 | 76                   | 85.0         | 9 (11.8)                               | 35 (46.1) |
|                     | Raichur              | 2005 | 93                   | 120.0        | 0 (0.0)                                | 69 (74.2) |
|                     | Bangalore (Urban)    | 2005 | 86                   | 185.0        | 2 (2.3)                                | 79 (91.9) |
|                     | Davangere            | 2005 | 90                   | 52.0         | 19 (21.1)                              | 35 (38.9) |
|                     | Chitradurga          | 2005 | 71                   | >200.0       | 8 (11.3)                               | 59 (83.1) |
|                     | Tumkur               | 2005 | 97                   | 100.0        | 0 (0.0)                                | 63 (64.9) |
|                     | Kodagu               | 2005 | 96                   | 30.0         | 25 (26.0)                              | 16 (16.7) |
|                     | Bangalore (Rural)    | 2005 | 94                   | 100.0        | 5 (5.3)                                | 63 (67.0) |
|                     | Madya                | 2005 | 98                   | 120.0        | 0 (0.0)                                | 66 (67.3) |
|                     | Bellary              | 2005 | 95                   | 65.0         | 5 (5.3)                                | 32 (33.7) |
|                     | Koppal               | 2005 | 86                   | 100.0        | 3 (3.5)                                | 55 (64.0) |
|                     | Kolar                | 2005 | 101                  | 95.0         | 2 (2.0)                                | 44 (43.6) |
| Kerala              | Kottayam             | 2002 | 251                  | 175.0        | 16 (16.4)                              | 168 (86.9) |

| Himachal Pradesh    | Kangra               | 1997 | 245                  | 165.0        | 6 (2.4)                                | 187 (76.3) |
|                     | Hamirpur             | 1998 | 787                  | 135.0        | 69 (8.8)                               | 516 (65.6) |
|                     | Kinnaur              | 1998 | 226                  | 195.0        | 3 (1.3)                                | 186 (82.3) |
|                     | Solan                | 1999 | 720                  | 150.0        | 21 (2.9)                               | 515 (71.5) |
|                     | Kullu                | 2000 | 147                  | 150.0        | 0 (0.0)                                | 133 (90.5) |
|                     | Kangra               | 2000 | 394                  | 175.0        | 8 (2.0)                                | 318 (80.7) |
|                     | Mandi                | 2004 | 2001                 | 150.0        | NA                                    | (10)     |
|                     | Shimla               | 2003 | 195                  | 140          | 3 (1.5)                                | 134 (68.8) |
|                     | Kullu                | 2003 | 193                  | 205          | 4 (2.1)                                | 160 (82.9) |
|                     | Kullu                | 2005 | 289                  | 100.0        | 1 (0.3)                                | 229 (79.2) |
|                     | Mandi                | 2005 | 214                  | >200.0       | 0 (0)                                  | 210 (98.1) |
|                     | Una                  | 2005 | 206                  | >200.0       | 0 (0)                                  | 204 (99.0) |
|                     | Kannaur              | 2005 | 215                  | >200.0       | 0 (0)                                  | 207 (96.2) |
|                     | Kullu                | 2005 | 208                  | >200.0       | 0 (0)                                  | 190 (86.5) |
|                     | Shillim              | 2005 | 187                  | >200.0       | 4 (2.1)                                | 174 (83.0) |
|                     | Lahaul Spiti         | 2005 | 211                  | >200.0       | 0 (0)                                  | 207 (98.1) |
|                     | Solan                | 2005 | 223                  | >200.0       | 0 (0)                                  | 205 (91.9) |
|                     | Kangra               | 2005 | 225                  | >200.0       | 0 (0)                                  | 185 (82.2) |
|                     | Hamirpur             | 2005 | 238                  | >200.0       | 0 (0)                                  | 233 (97.9) |
|                     | Sirmour              | 2005 | 209                  | >200.0       | 2 (0.9)                                | 180 (81.8) |
|                     | Chamba               | 2005 | 218                  | >200.0       | 0 (0)                                  | 180 (81.8) |
|                     | Bilaspur             | 2005 | 220                  | >200.0       | 0 (0)                                  | 205 (98.1) |
|                     | Kangra               | 2007 | 1952                 | 150.0        | 69 (3.5)                               | 1531 (78.5) |
|                     | Palamu               | 2003 | 209                  | 120          | 16 (7.7)                               | 118 (56.5) |
|                     | All Districts        | 2008 | 1121                 | 173.2        | 42 (3.7)                               | 825 (73.6) |
|                     | Jammu and Kashmir    | 2008 | 134                  | 96.5         | NA                                     | (32)     |
|                     | Jammu                | 2008 | 134                  | 96.5         | NA                                     | (32)     |

Table 1 (Contd...)
| State          | Name of the district | Year | No. of urine samples | Median (μg/l) | Urinary iodine excretion levels (μg/l) | Ref |
|---------------|----------------------|------|----------------------|--------------|----------------------------------------|-----|
| Tamil Nadu    | Dindigul             | 2003 | 210                  | 145          | 5 (2.5) 23 (11.1) 49 (23.5) 132 (62.9) | (9) |
|               | Trichy               | 2003 | 210                  | 275          | 0.0 (0.0) 14 (6.7) 196 (93.9)           | (3) |
|               | E. Gangtok           | 2003 | 204                  | 137          | 17 (8.3) 22 (10.8) 32 (15.3) 133 (65.2) | (9) |
| Sikkim        | N. Mangam            | 2003 | 200                  | 57           | 25 (12.5) 36 (18.0) 100 (50.0)          | (3) |
| Tamil Nadu    | Dindigul             | 2004 | 100                  | 150.0        | 0.0 (0.0) 4.0 (2.0) 94 (46.0)            | (49) |
|               | Coimbatore           | 2004 | 90                   | 130.0        | 0.0 (0.0) 2.2 (1.6) 14 (7.0) 74 (36.0)  | (49) |
|               | Erode                | 2004 | 85                   | 155.0        | 0.0 (0.0) 10 (5.0) 75 (38.0)            | (49) |
|               | Sundargarh           | 2003 | 200                   | 109          | 0.0 (0.0) 2.0 (1.0) 106 (53.0)          | (9) |
|               | Pudukottai           | 2004 | 100                  | 150.0        | 0.0 (0.0) 9 (4.5) 170 (85.0)            | (49) |
|               | Thanjavur            | 2004 | 89                   | 150.0        | 0.0 (0.0) 2.2 (1.6) 110 (55.0)          | (49) |
|               | Sivaganga            | 2004 | 63                   | 155.0        | 0.0 (0.0) 2.2 (1.6) 109 (54.0)          | (49) |
|               | Perambalor           | 2004 | 157                  | 85.0         | 0.0 (0.0) 2.2 (1.6) 108 (54.0)          | (49) |
|               | Trichy               | 2004 | 112                  | >200.0       | 0.0 (0.0) 3 (1.5) 102 (51.0)            | (49) |
|               | Madurai              | 2004 | 107                  | >200.0       | 0.0 (0.0) 3 (1.5) 102 (51.0)            | (49) |
|               | Salem                | 2004 | 98                   | 180.0        | 0.0 (0.0) 2 (1.0) 82 (41.0)            | (49) |
|               | Namakkal             | 2004 | 98                   | >200.0       | 0.0 (0.0) 4 (2.0) 94 (47.0)            | (49) |
| Rajasthan     | Bikaner              | 1997 | 400                  | 155.0        | 12 (3.0) 36 (12.0) 279 (85.0)          | (49) |
|               | All districts        | 2008 | 1200                 | 85.4         | NA (386 (32.2) NA (40)                   | (49) |
|               | Madhya Pradesh       | Jabalpur | 2001              | 1205        | 80-150 | NA  | NA  | 135 (11.2) 1069 (88.7) | (37) |
| Maharashtra   | Raigarh              | 1999 | 2092                 | 1100        | NA  | NA  | NA  | NA  | (39) |
|               | Sinhduag             | 2003 | 210                  | 125          | 15 (7.1) 22 (10.5) 125 (59.5)           | (9) |
|               | Kolhapur             | 2003 | 209                  | 65           | 49 (23.3) 123 (60.0) 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  | NA  | (39) |
| Mizoram       | Aizwal               | 2003 | 210                  | 165          | 2 (1.0) 16 (7.6) 34 (17.2) 158 (75.2)   | (9) |
| Nagaland      | Mon                  | 2003 | 207                  | 120          | 5 (2.4) 37 (17.9) 116 (56.0)            | (9) |
| Orissa        | Cuttack              | 2003 | 210                  | 110          | 20 (9.5) 27 (12.9) 41 (19.5) 122 (58.1) | (9) |
| Sundargarh    | 2003                  | 2008 | 103                  | 25 (12.0)    | 27 (13.0) 50 (24.0) 106 (51.0)          | (9) |
| Puri          | 2004                  | 145   | 125.0                | 2 (1.4)      | 8 (4.5) 33 (18.8) 102 (50.0)           | (10) |
| Pondicherry   | Pondicherry          | 1998 | 187                  | 145.0        | 3 (1.6) 6 (3.2) 45 (24.1) 133 (71.1)   | (43) |
| Kerala        | Kariakal             | 2004 | 80                   | 150.0        | 0.0 (0.0) 3 (1.6) 9 (4.5) 68 (35.0)     | (10) |
|                | Yanam                | 2004 | 100                  | 200.0        | 0.0 (0.0) 0 (0.0) 15 (7.5) 85 (42.5)    | (10) |
| Nagaland      | Mahe                 | 2004 | 100                  | 65.0         | 5 (2.5) 27 (13.0) 34 (17.2) 34 (17.2)   | (10) |
| Punjab        | Gurudaspur           | 2003 | 202                  | 70           | 38 (18.8) 28 (13.9) 57 (28.2) 79 (39.1) | (9) |

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 |
| West Bengal            |                      |      |                      |               |       |           |           |
|                        | Darjeeling           | 2003 | 206                  | 11.0          | 10 (4.9) | 13 (6.3) | 67 (32.5) | 116 (56.3) |
|                        | Jalpaiguri           | 2003 | 208                  | 120 (10.1)    | 29 (9.1) | 34 (16.3) | 134 (64.4) |
|                        | South 24 Parganas    | 2005 | 520                  | 225           | NA     | NA       | NA       | NA     |
|                        | Dakshin Dinajpur     | 2005 | 2250                 | 16 (17.5)     | NA     | NA       | NA       | NA     |
|                        | North 24 Parganas    | 2006 | 363                  | 160           | NA     | NA       | 10 (6.0) | 150 (94.0) |
|                        | Purulia              | 2006 | 2400                 | 92.5          | 759 (31.6) | NA       | NA       | NA     |
|                        | Howrah               | 2008 | 200                  | 250           | NA     | NA       | NA       | NA     |
| Uttarakhand            | Udham Singh Nagar    | 2000 | 770                  | 98            | 23 (3) | 66 (8.6) | 231 (30) | (51)   |
|                        | Dehradun             | 2001 | 1617                 | 127           | NA     | NA       | NA       | NA     |
|                        | Nainital             | 2003 | 194                  | 110           | 15 (7.7) | 30 (15.5) | 43 (22.2) | 106 (54.6) |
|                        | Pauri                | 2004 | 100                  | 175.0         | 2 (2.0) | 2 (2.0) | 13 (13.0) | 83 (83.0) |
|                        | Pithoragarh          | 2004 | 154                  | 200.0         | 0 (0.0) | 2 (1.2) | 17 (11.4) | 135 (87.6) |
|                        | Uttar Kashi          | 2004 | 61                   | 200.0         | 6 (9.8) | 3 (3.2) | 7 (11.4) | 46 (75.4) |
| Tripura                | North Tripura        | 2002 | 1123                 | >100.0        | NA     | NA       | NA       | NA     |
|                        | Tripura              | 2004 | 133                  | 175.0         | 0 (0.0) | 19 (14.3) | 27 (20.3) | 87 (65.4) |
| Uttar Pradesh          | Lakhipura Kheri      | 2001 | 2003                 | 90            | NA     | NA       | NA       | NA     |
|                        | Badaun               | 2001 | 1978                 | 118           | NA     | NA       | NA       | NA     |
|                        | Mainpuri             | 2001 | 1050                 | 90            | NA     | NA       | NA       | NA     |
|                        | Shahjanpur           | 2003 | 182                  | 75            | 9 (4.9) | 21 (11.5) | 87 (47.8) | 65 (35.7) |
|                        | Shahranpur           | 2003 | 135                  | 75            | 5 (3.7) | 33 (24.4) | 48 (35.6) | 49 (36.3) |
|                        | Meerut               | 2004 | 710                  | 150.0         | 38 (5.4) | 21 (2.9) | 142 (20.2) | 509 (71.7) |
|                        | Saharanpur           | 2004 | 192                  | 200.0         | 0 (0.4) | 2 (1.2) | 17 (11.4) | 135 (87.6) |
|                        | Bareilly             | 2004 | 82                   | 102.0         | 11 (13.4) | 18 (21.9) | 10 (12.3) | 45 (52.4) |
|                        | Agra                 | 2004 | 92                   | 175.0         | 0 (0.0) | 0 (0.0) | 10 (10.8) | 82 (89.1) |
|                        | Kanpur               | 2004 | 72                   | 105.0         | 1 (1.4) | 2 (2.8) | 25 (34.7) | 44 (61.1) |
|                        | Lakhimpur            | 2004 | 128                  | 50.0          | 18 (14.1) | 18 (14.1) | 39 (30.4) | 53 (41.4) |
|                        | Lalitpur             | 2004 | 109                  | 135.0         | 0 (0.0) | 10 (9.3) | 28 (25.7) | 61 (55.9) |
|                        | Sidhharth Nagar      | 2004 | 148                  | 100.0         | 15 (10.1) | 13 (8.8) | 37 (25.0) | 83 (56.1) |
|                        | Padrona              | 2004 | 80                   | 200.0         | 0 (0.0) | 0 (0.0) | 5 (6.2) | 75 (93.8) |
|                        | Sultanpur            | 2004 | 103                  | 100.0         | 1 (1.0) | 13 (12.6) | 37 (35.9) | 52 (50.5) |
|                        | Gorakhpur            | 2004 | 147                  | 150.0         | 7 (4.8) | 3 (2.0) | 17 (11.6) | 120 (81.6) |
|                        | Varanasi             | 2004 | 107                  | 100.0         | 8 (16.8) | 0 (0.0) | 30 (28.0) | 59 (55.1) |
|                        | Meerut               | 2004 | 710                  | 150.0         | 8 (5.4) | 21 (2.9) | 142 (20.0) | 509 (71.7) |
|                        | Sidhharth Nagar      | 2009 | 240                  | 60.0          | 42 (17.5) | NA       | NA       | NA     |
|                        | Gonda                | 2010 | 1236                 | 100.0         | 99 (8.0) | 155 (12.5) | 337 (27.3) | 645 (52.2) |

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
| State               | Name of the district | Year | No. of salt samples | Iodine content of salt (ppm) | Ref |
|---------------------|----------------------|------|---------------------|-------------------------------|-----|
| 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      | Mehuboob 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) |
|                     | Mehuboob Nagar       | 2004 | 116                 | 103 (88.8) 13 (11.2)          | (11) |
|                     | Chittoor             | 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) |
|                     | Nalgonde             | 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) |
|                     | Annapur              | 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                | 765 (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              |     |
| Haryana                | Saurashtra          | 2010 | 840                 | 160 (19)                     | 680 (81) | 20 |
|                        | 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 |

Kapil: Iodine deficiency disorders in India
Table 2 (Contd...)

| Name of the district          | Year | No. of salt samples | Iodine content of salt (ppm) | Ref |
|------------------------------|------|---------------------|------------------------------|-----|
| 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) |
| Alappuzha                    | 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) |
| Ernakulam                    | 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) |
| Thiruvau-tha-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) |
| Sindhurd                     | 2003 | 240                 | 113 (47.1)                   | 127 (52.9) | (9) |

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) |
| 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) |
| Chhinetupui  |                      | 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) |
| Sundargarh   |                      | 2003 | 210                 | 163 (77.6)                  | 47   (22.4) | (9) |
|               |                      |      |                     |                             |     |
|               |                      |      |                     | 660 (55)                    | 540  (45) | (40) |
|               |                      |      |                     | 180 (49)                    | 188  (51) | (41) |
|               |                      |      |                     | 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       | Amritsar             | 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 | 206                 | 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) |
|               | Sangur               | 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...)
| 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                 | 156 (97.5)                  | 4 (2.5)   | (49) |
|               | Kancheepuram           | 2004 | 200                 | 169 (84.5)                  | 31 (15.9)  | (49) |
|               | Thiruvannamalai        | 2004 | 162                 | 157 (96.9)                  | 5 (3.1)   | (49) |
|               | Virudhunagar           | 2004 | 160                 | 156 (97.5)                  | 4 (2.5)   | (49) |
|               | Dharmapuri             | 2004 | 100                 | 154 (94.6)                  | 5 (3.3)   | (49) |
|               | Vellore                | 2004 | 130                 | 169 (87.0)                  | 20 (10.0)  | (49) |
|               | Tiruvallore            | 2004 | 170                 | 177 (97.8)                  | 2 (1.3)   | (49) |
| Tripura       | Tripura               | 2004 | 1123                | 375 (33.4)                  | 748 (66.6) | (50) |
| Uttar Pradesh | Lakhimpur Kheri        | 1998 | 255                 | 33 (13.0)                   | 222 (87.1) | (10) |
|               | Pauri                  | 1998 | 224                 | 22 (10.0)                   | 202 (90.1) | (10) |
|               | Pithoragarh            | 1998 | 244                 | 16 (16.4)                   | 204 (83.6) | (10) |
|               | Udham Singh Nagar      | 2000 | 376                 | 168 (22.8)                  | 568 (77.2) | (51) |
|               | Dehradun               | 2001 | 300                 | 58 (19.3)                   | 242 (80.7) | (8)  |
|               | Nainital               | 2003 | 210                 | 116 (55.2)                  | 44 (44.8)  | (9)  |
| Uttarakhand   | 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 | 376                 | 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)  |
|               | 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) |
|               | Meerpur                | 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 (96.0)                  | 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) |
|               | Shahjanpur             | 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          | 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 |
| Maharashtra    | 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 |

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 pouch                      |
| 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                     |
| Jharkhand         | 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 Antyodyaya families residing in the Scheduled Area of Udaipur, Banswara, Dungarpur, Sirohi, Chittorgarh districts and Sahara 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 IDD 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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Indian Journal of Community Medicine/Vol 35/Issue 4/October 2010

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